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An analysis of manual postal sorting and station design using electromyography.

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AN ANALYSIS OF MANUAL POSTAL SORTING AND STATION DESIGN USING ELECTROMYOGRAPHY

Chris Kourtis

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ABSTRACT

Twelve subjects sorted mail to discover if the mail sorting task or station design caused repetitive strain injury symptoms. Subjects performed the task at six different stations. Each station had two design components for study.

Electrodes were placed on the deltoid, trapezius and infraspinatus muscles to study localised muscle fatigue, which is known to be a contributing factor to repetitive strain injuries.

54% of the male and 33% of the female trials resulted in statistical indications of muscle fatigue. There was no indication that the occurrence of indicators was due to station design. Additional analysis was performed using subjective responses of the perceived exertion. There were gender differences but no differences due to station design.

The results indicate that the sorting task itself may be responsible for the occurrence of RSI symptoms. To eliminate RSI incidence, it would be necessary to redesign the task and equipment used.

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ABSTRACT

Twelve subjects, eight males and four females, sorted mail manually in an attempt to discover if the manual mail sorting task and/or station design was conducive to the occurrence of repetitive strain injuries. Each subject performed the task six times, for a two hour period, at different stations. Each station had two design components for study, namely, three different boards and two mail pickup points.

Electrodes were placed on the anterior deltoid, upper trapezius and infraspinatus muscles for the purpose of performing an electromyographic (EMG) study. It has been documented that an increase in the Root-Mean-Square (RMS) values of the EMG signal, coupled with a decrease, over time, of the Mean Power Frequency (MPF) is an indicator of localised muscle fatigue. Localised muscle fatigue is known to be a contributing factor to repetitive strain injuries.

It was found that 54% of the male and 33% of the female trials resulted in statistical indications of muscle fatigue. The occurrence rate between genders was not found to be statistically significant. Also, there was no indication that the high occurrence of fatigue indicators was due to station design.

Additional analysis was performed using subjective responses. Nine different parts of the body were considered. Subjects rated their perceived exertion rates using the Borg RPE scale. Aside from some minor gender differences, there were no indications of differences due to station design.

A linear regression model was developed based on fatigue indicators and the EMG signals. It indicated that the slope of the MPF values of the deltoid muscle, helped to predict the occurrence of statistical signs of fatigue.

These results tend to indicate that the actual mail sorting task may be responsible for the high incidence rates. In order to reduce the incidence rate, it will be necessary to redesign either the station or job. The key points to improving the station design include elimination of movements above the shoulder, allowing flexibility in seating arrangements, eliminating twisting of the body and placing the mail slots below the hands.

DEDICATION

This thesis is dedicated to my parents.

ACKNOWLEDGEMENTS

I would like to thank my supervisor, Dr. S.M. Taboun, and my committee members, Dr. S.P. Dutta and Dr. G.W. Marino, for their help and support during the life of this project. I also wish to thank our departmental secretary, Ms. Jacquie Mummery, and technician, Mr. Tom Williams for their help. Finally, I wish to thank Nancy Urban and Jim Muma for proof-reading this document.

I could not, would not, on a boat.

I will not, will not, with a goat.

I will not eat them in the rain.

I will not eat them on a train.

Not in the dark! Not in a tree!

Not in a car! You let me be!

I do not like them in a box.

I do not like them with a fox.

I will not eat them in a house.

I do not like them with a mouse.

I do not like them here or there.

I do not like them ANYWHERE!

I do not like green eggs and ham!

I do not like them, Sam-I-am.[1]

[1] from: Geisel, T.S., 1960, Green Eggs and Ham, by Dr. Seuss (pseud.), Beginner Books (Random House)

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1 INTRODUCTION

Traditionally, the sorting of letters in the post office has been a task performed by hand by individual operators. Even with the advent of automated postal sorting systems, which have become prevalent due to the technology available today, there is still a requirement for postal workers to sort mail by hand. In the United States, 11% of all letters require manual sorting (United States Postal Service, 1994). This is due to the fact that mail may be in irregular shapes that do not allow for automatic processing, where automatic processing is available, or that errors can be made. These errors may be mechanical or made by humans inside (sorting errors) or outside (addressing errors) the postal service. Regardless, manual mail sorters still place mail into pigeon-hole slots (United States Mail, 1978?).

The physical work task involved in sorting mail is fairly consistent and is repeated daily over a long period of time by the individual concerned. It involves a high number of repetitions of low force work. These repetitive motions, performed many times over a long period of time can result in musculoskeletal stress that may lead to temporary or permanent physical damage to the individual. Postal workers, due to the continual movements of their arms, are likely to be at risk of developing problems in the shoulder-neck areas of their bodies. These motions are, of course, dependent on the sorting station used by the worker. It was this sorting procedure along with the design of equipment that was evaluated.

In recent years, the temporary or permanent damage that may occur to a worker in industry has come to be known as a cumulative trauma disorder (CTD) or repetitive strain injury (RSI). CTDs are a great concern, not only for the damage they cause to individuals, but also due to the costs that may be incurred by individual companies as a result of these injuries.

The purpose of this study was to evaluate different manual postal sorting stations to determine which of the studied stations allows for the greatest number of letters to be sorted, coupled with a low possibility of CTD incidence. Three different 'boards' or 'layouts', used to sort mail, were considered. In each layout, the worker picked up mail from two different points, making a total of six different stations.

While performing the study, a count of the number of envelopes sorted by each worker at each station was taken. In addition, surface electrodes were attached to three different muscles for the purpose of recording electromyographic (EMG) signals to assess the performance of each muscle and to determine if any indications associated with muscle fatigue developed over the course of the experiment. After sorting the envelopes, each subject answered a subjective rating scale of the perceived exertion of the different parts of the body, which was used to assess the ease or difficulty in sorting mail at each station.

The primary goal of this study was an ergonomic evaluation of the various stations used to sort mail. Specifically, the repetition of the work performed and the analysis of the EMG signals of the muscles could allow this work to be used to determine the occurrence of CTDs. In this particular study, the interest was in determining if the sorting of mail, at various types of stations, predisposed individuals to develop symptoms of CTDs. The only characteristic being considered in this aspect of the study was localised muscle fatigue.

The concept of fatigue used in this study was not one where fatigue is considered to occur when a muscle is unable to perform or maintain a certain function. While a muscle is operating, indications of fatigue may be occurring at any time. An analogy would be a steel bridge that collapses at a certain point. What is observed in the collapse is the failure point, not fatigue. Closer investigation of the bridge, at any point prior to the collapse, would show various mechanical signs of fatigue (DeLuca, 1984).

Consideration was also given to evaluating each station for performance of the mail sorting task. In doing so, this study could be used as a template for other studies of light repetitive work. The results could be used for the specific design of manual mail sorting stations in post offices or company mailrooms or as a basis for further study of other styles of manual sorting stations in other fields.

This experiment received the approval of the Ethics Committee of the University of Windsor. Copies of the consent form used can be found in Appendix A.

2 LITERATURE REVIEW

2.1 Cumulative Trauma Disorders

Cumulative trauma disorders, or repetitive strain injuries, have been described as painful and limiting soft tissue failures that result from repeated or continuous application of slight to moderate physical stress over extended periods of time (Burnette and Ayoub, 1989a). Putz-Anderson (1988) defines CTDs as "A disorder of the muscular and/or tendinous and/or osseous and/or nervous system(s) caused, precipitated or aggravated by repeated exertions or movements of the body". The key phrase of any definition of CTDs is in the emphasis of the repetitive occurrence of similar motions over long periods of time, which would result in the symptoms of the specific trauma. CTDs usually affect the hand-wrist-forearm area or the shoulder-neck area and can cause damage to muscles, tendons, nerves and blood vessels. Occasionally, certain motions may cause damage to bones, such as vertebrae in the spinal column (Kroemer, 1992).

Causes of CTDs may be either occupational or non-occupational activities. Occupational causes include repetitive and forceful activities resulting in prolonged exertions, static muscle load, awkward body postures, direct pressure from work equipment, vibration from machinery and exposure to cold temperatures or airflows. Non-occupational causes include age, gender, chronic disease and hereditary causes (ie. pre-disposition to CTDs).

It is thought that activities that involve repetitive or forceful exertions, or a combination of both are the primary cause of CTDs, although there is no precise definition of what would constitute a high amount of repetition or excessive force (Kroemer, 1989). Such a definition could vary depending on the specific task under consideration. Some examples of CTDs are localised muscle fatigue, which was the primary focus of this paper, tendon-related disorders, nerve entrapment syndromes, carpal tunnel syndrome (CTS), which is discussed presently and hand-arm vibration syndrome (HAVS) (Rempel et al., 1992).

Ranney (1993) argues that the terms CTD and RSI should be regarded as "statements of causation", rather than as medical diagnoses of their own. Even though these types of injuries can be sustained through non-occupational activities, determining a generally accepted definition for CTD and RSI, one that may only refer to occupational causation, is important if only for legal reasons. More frequently, employers are being taken to court in an attempt to receive compensation by injured workers. Each case may provide its own unique set of circumstances and determination of causation may rely on analysis of the work and/or lifestyle routine of the individuals concerned.

2.2 Repetitive Work

The effects of fatigue due to repetitive work have been studied for a variety of different tasks. Kadefors et al. (1976) found signs of muscle fatigue in welders doing overhead work. Inexperienced welders showed general fatigue, whereas experienced welders only showed signs of fatigue in one muscle.

Hagberg (1981) found increases in heart rate and perceived exertion during a series of concentric and eccentric flexions in the shoulder over a period of one hour. Subjects had complaints with regard to the descending trapezius muscle twenty-four hours after the experiment.

Vezina et al. (1992) measured the forces exerted by sewing machine operators, during standard repetitive operations and provided reports of fatigue and discomfort. The work performed was considered to be light work, and was based on the fact that the government of Quebec uses energy expenditure as the only measure of physical work.

Sundelin and Hagberg (1992) found that fatigue occurred in the trapezius and infraspinatus muscles for light repetitive MTM paced arm motions over a period of one hour. The work involved reaching for and grasping a cylinder, moving it to a hole and releasing it.

Higgs et al. (1992) reported that in workers from meat-packing plants, jobs with the highest repetition and the smallest rest cycle had the highest upper extremity impairment. Workers who rotated from job-to-job were found to have less impairment than workers who performed only one job.

2.3 Carpal Tunnel Syndrome

Carpal tunnel syndrome affects the hand-arm area and is a result of the compression of the median nerve in the carpal tunnel of the wrist. This can affect the entire hand, since the median nerve extends into the fingers. Swelling of the tendons can reduce the opening of the carpal tunnel and can pinch the median nerve or blood vessels. This can cause pain, numbness or tingling in the hand

(Kroemer, 1989). While this occurs infrequently in the general population, it can have a high incidence in certain industries, such as assembly work, the butcher/meat packing industry and garment/sewing work (Rempel et al., 1992). Physicians have estimated that from 31 to 55 percent of all CTS cases are work related. In Canada, there were an estimated 27,500 incident cases of CTS in 1989. Of this number, 8,500 to 15,100 were thought to be work-related (Kraut, 1994).

Skandalakis et al. (1992a, 1992b, 1992c) provide a detailed discussion of CTS symptoms, anatomy of the wrist and treatments based on the dissection of 156 wrist cadavers.

2.4 Importance to Industry of CTDs

One of the reasons CTDs are of interest, aside from their medical considerations, is the cost that employers may bear for their occurrence. These costs can be direct or indirect costs and may occur from worker absence due to injury, high turnover, frequent rest breaks, compensation for injuries, reduced productivity or quality of workers, medical costs for treatments and legal fees (Carson, 1993).

Individual cases of CTDs can cost from $20,000 up to $100,000 (US) in lost time in addition to medical costs. In 1990 approximately 60% of all occupational injuries were attributed to CTDs. Estimates indicate that 35% of all workers will experience CTDs at one point in time and the actual numbers may rise dramatically since it is expected that half of all jobs may be affected by the year 2000 (Noaker, 1993).

Companies that ignore ergonomic procedures can pay a heavy price for doing so. Samsonite Corporation, of Denver, recently reached an agreement with the Occupational Safety and Health Administration (OSHA) to provide a comprehensive ergonomic management program to protect its workers, and paid a $495,000 penalty for not doing so earlier. Furthermore, OSHA has targeted meat-packing plants, for reduction of CTDs, since workers in this industry suffer from injuries at a rate that is twelve times greater than workers in industries which produce nondurable goods, such as in the textile industry (Stix, 1991). Punnett (1992) found that male workers in the retail meat industry reported occurrences of pain in the shoulder, elbow/arm and wrist/hand areas at rates from 1.7 to 2.2 times greater than workers performing similar tasks in other industries.

Franklin et al. (1991) report that the incidence of occupational CTS in

Washington state from 1984 to 1988 compared to that of non-occupational CTS is significantly different. Occupational CTS occurs in persons with a lower average age (37 for occupational CTS to 51 for non-occupational CTS) and with a significantly different female to male ratio (1.2:1 compared to 3:1), where males experience a smaller overall incidence rate, and a smaller rate still in non-occupational CTS. Industries that were found to have the highest CTS rates were food processing and packing, carpentry, manufacturing and wood product industries, such as sawmills and logging.

Some of the increases in the occurrence of CTDs can be attributed simply to a greater awareness of the problem. Previously, some workers may have attributed various injuries to arthritis or pulled muscles or to some other self-diagnosed injury. As workers become more aware of the role played by on-the-job conditions in the development of CTDs, there will be an increase in the reporting of the injuries (Kalogeridis, 1991). This increased awareness may account for the fact that reported cases rose 500% from 1979 to 1988 and 100% from 1987 to 1989. Even so, there are still problems in obtaining correct incidence numbers of CTDs since the injuries that occur may be referred to by many different names. Depending on the source, CTDs may account for anywhere from 30 to over 50 percent of all workplace injuries (Schwartz, 1992; Sommerich et al., 1993).

The automotive industry and other heavy engineering occupations are prone to occurrences due to the wide variety of tasks performed. Studies have been published on the use of scissors (Tannen et al., 1986), sewing machine operators (Stetson et al., 1986) and electricians (Hunting et al., 1994). Occurrences of CTDs were studied within five different types of automotive plants (Nelson et al., 1992). Incidence rates were found to be higher in specific types of plants, namely the assembly and foundry plants, but within the divisions of the assembly plant, rates differed greatly according to exposure group. Fransson-Hall et al. (1992) found gender differences in exposure to physical load within divisions.

Carpal tunnel syndrome is also recognized as a problem in the computer industry and can occur in office workers who use keyboards for an excessive period of time, such as journalists and data-entry clerks (Sauter et al., 1987; Buckle, 1991; Harvey, 1991; Bernard et al., 1992; Buckle, 1992; Silverstein, 1992). However, a British court, in a controversial decision, recently rejected the idea that RSI may be considered as a medical condition in a ruling on a case involving a journalist, even though British courts have previously awarded judgements of £20,000 to an electronics worker and £21,000 to six turkey factory workers. (O'Brien, 1993; Reuters, 1993).

CTDs can also affect workers outside of heavy industries. Studies have been conducted on fishermen (Törner et al., 1988), secretaries and office workers (Kamwendo and Linton, 1991; Kamwendo et al., 1991, Franzblau et al. 1993), sign language interpreters (Feuerstein and Fitzgerald, 1992; Stedt, 1992), musicians (Grieco et al., 1989; Lederman, 1993) and checkout workers in grocery stores and supermarkets (Ryan, 1989; Harber et al., 1992; Orgel et al., 1992; Harber et al., 1993a; Harber et al., 1993b; Osorio et al., 1994).

2.5 Reducing CTDs in Industry

Often, by redesigning equipment and/or the tasks individuals must perform, CTDs can be eliminated or reduced, and in the process the company can reap financial benefits from doing so.

Westgaard and Aarås (1985) report on the effects of ergonomic improvement efforts at a Norwegian factory that were made during the late 1970's. The productivity in the factory was, on average, higher after implementation of the improvements than before. They report a reduction in long-term sick leave (Aarås and Westgaard, 1987), primarily due to musculoskeletal problems being reduced.

Galt (1993) reports on the example of Cuddy Foods of London, Ontario, which, in the late 1980's had as many as 44 workers per month being disabled from a work-force of 750 people. After a one million dollar investment to redesign equipment and work stations and the development of a system to monitor workers for signs of CTDs, they managed to reduce the injured worker count to zero, and estimated that they received a return of six to one on the original investment.

Noaker (1993) reports on Updyke Stamping of Oxford, Michigan. Updyke analysed two welding operations that required the operator to make three 90° bends to lift stock from a container. After redesigning the worksite, in under eleven implementation hours, the productivity at the two welding operations had increased by 45% and 29%, respectively. Including this redesign and others over the previous two years, the cost of 95% of the ergonomic improvements undertaken was less than $300.

There are also situations where some solutions may be prohibitively expensive for companies to initiate changes. Special ergonomic keyboards currently sell in the $600 to $800 range, compared to $20 for conventional keyboards. However, if companies buy new equipment, such as chairs, they should attempt to buy adjustable equipment that can fit a majority of workers (Marley, 1994).

2.6 Prevention and Management of CTDs

In order to avoid CTDs it is necessary to design jobs so that the tasks that must be performed are suitable for the worker rather than finding workers who are suitable to perform any particular task. Kroemer (1992) lists seven conditions that should be avoided. They are: high numbers of repetitions, excessive exertion of force, unusual body positions or contortions, direct pressure from work equipment on the body, vibration, cold temperature or airflows and static body positions. The occurrence of any of these situations are indicators of potential CTDs.

Effective prevention of CTDs requires a coordinated approach in companies between management and employees. Redesigning equipment in hindsight is an approach that will cost the company money, since losses will have already occurred. Roughton (1993) describes the elements that must go into a task force, that is charged with eliminating problems before they occur.

The task force must be composed of different elements of the company such as management, who will provide the resources for and accountability of the program. Supervisory groups are required, since they have the understanding of what is required to complete any task; the employees must be present to provide for communication channels to make all workers aware of the program goals; engineering departments are required for their understanding of the equipment and processes involved; maintenance groups are required since it is they who carry out the installation and maintenance of the equipment; and finally, ergonomists are required in order to evaluate any potential risks in the workplace.

Training must be provided and should include elements of how to control risk factors, methods of prevention, how early symptoms can be detected along with emphasis on early reporting of these symptoms and instruction on appropriate work practices. Job hazard analysis is required to identify activities that may contribute to CTDs, collect and analyse historical data, review all jobs and review and eliminate hazardous steps. Medical management is required to manage and treat injured and recovering workers, so that they can be assigned duties that will not place them at further risk. The task force must look into the proper design of tools, considering aspects such as proper weight, shape, vibration, noise, grips, pressure and posture required to use the tool. The workplace design must also be analysed for various physical and environmental factors. Finally, any program to prevent CTDs must have an Evaluation System to determine if it is meeting its objectives.

Mahone (1993) advocates a six-stage design process, that could be used to remove the trial-and-error aspect of system design. Usually, little attention is paid to the design of small systems, until something goes wrong. Kittusamy et al. (1992) provided a checklist for a questionnaire, that can be used in the design process.

2.7 Risk Assessment

In order to minimize the occurrence of CTDs, various attempts at predicting, rather than diagnosing, occurrences have been made. These attempts generally involve methods of quantifying work done by an individual, or performing specific physical tests to increase the ability to detect CTDs.

Baleshta and Fraser (1986) developed a symbolic notation to indicate various motions made by the arm during work. The notation was designed to be computerised for analysis by machine. Armstrong et al. (1986) used drawing-board manikins to help determine the best layout and location for a given task. Burnette and Ayoub (1989b) have proposed a computerized model to rate various tasks according to their risk. The rating is based on a series of inputs regarding anthropometric and job-based parameters.

Moore et al. (1991) developed a mathematical model to predict the various loads that occur in the wrist and hand, to better predict CTS. The mathematical model developed includes reference to the geometry of the task, tendon pressure on tissue, tendon forces, tendon excursion and friction. This allows the study of the combined effects of the force, posture and repetition for each individual. White and Kaczmar (1992) have attempted to predict a relationship between muscle stress and wrist movement as related to CTS symptoms, using computerized cinematography and electromyography. Wygant et al. (1993) have developed a system of measuring human work based on time modules, in order to analyse tasks at the design stage. It is based on three classes of motions. They are: movement class, involving movement of the finger, hand, arm, shoulder and trunk; terminal class, which categorises activities at the end of a movement; and the auxiliary class, which refers to activities performed by other parts of the body. Wells et al. (1994) reported on an approach to assessing the risk factors of various types of work. The method involves analysis of video images of the worker and of simultaneous display of qualitative EMG information of various muscles on the screen.

Keyserling et al. (1993) developed a two-page checklist, designed to identify various ergonomic risk factors associated with CTDs. It was found that the results of the checklist tended to correspond to results of analysis done by ergonomic professionals. It also appeared to be more likely to identify risk factors associated with various jobs. Five major categories of exposure to CTDs were used. They were repetitiveness, local mechanical contact stress, forceful manual exertions, awkward upper extremity posture and hand tool usage.

Bird and Hill (1992) report on a study of twelve women who developed repetitive strain injuries. It was found that analysis of the particular tasks allowed a localised prediction to be made as to where symptoms would occur. Grant et al. (1992), in an attempt to diagnose CTS cases, tested devices that measured motor nerve conduction time and tactile sensitivity, but currently, have found them to be of only limited use.

Pelmear et al. (1992) discuss six different tests that can be done to identify the existence and severity of Hand-Arm Vibration Syndrome (HAVS), so that it is not incorrectly treated as CTS. Confusion between CTS and HAVS may exist, since HAVS has been defined as having symptoms which include circulatory disturbances, sensory and motor disturbances and musculoskeletal disturbances (Pelmear and Taylor, 1991). Hagberg (1992) indicated that there is an association between CTS and HAVS which is dependent on repetitive forceful gripping and/or extreme position of the wrist. Meanwhile, Taylor (1992) argued that standardized tests are not currently in existence that can conclusively distinguish HAVS from CTS. A basic discussion of HAVS can be found in Pelmear and Taylor (1994).

2.8 Electromyography and Muscle Fatigue

Merletti et al. (1991) describe muscle fatigue as a "failure point" at which the muscle is not able to sustain a desired force level. This "point" is determined by an amount and/or rate of change of the measurement of the electrical potential that exists in the motor units of the muscle during contraction. This is the EMG signal which is a representation of the muscle activity over time (Chaffin and Anderson, 1991).

Electromyography has been used to conduct studies of various activities, including uphill walking (Arendt-Nielsen and Sinkjær, 1991), wheelchair propulsion (Veeger et al., 1991) and Methods-Time Measurement (MTM) paced work with and without shoulder pauses (Sundelin, 1993). Electromyography has four main applications in ergonomic studies, namely muscle coordination studies, quantitative EMG (the study of relative load on each muscle), localised muscle fatigue studies and qualitative EMG (effects of static loading) (Jonsson, 1991).

Postal sorting, which is considered to be light repetitive work, has also been an area of study. Jørgensen et al. (1989) conducted a study on mail sorters during normal daily sorting activities of irregular length (20 to 40 minutes). Of six subjects, muscle fatigue was indicated in the trapezius muscles in two subjects and one subject recorded fatigue in the infraspinatus muscle. There was no fatigue recorded in the deltoid muscle. DeGroot (1987) found that the top row or rows used in sorting mail into pigeon-holes required greater muscular activity than for lower rows. This was particularly true for rows above shoulder height.

When attempting to measure fatigue in light work, the use of subjective signs of fatigue and measurable signs of fatigue provide an opportunity to follow the conditions under which fatigue may develop. EMG measurements are also considered to be a better form of measurement than the measurement of other physiological factors. Fatigue can usually be detected by an increase in the EMG signal amplitude and a shift of the Mean Power Frequency (MPF) to lower frequencies. (Basmajian and DeLuca, 1985; Nakata et al., 1992). Waly et al. (1986) studied muscle behaviour in a static task until the occurrence of muscle fatigue. They found that indicators of fatigue include increases in Root-Mean-Square (RMS) values and a shift towards a lower frequency content. A definition of MPF is given in Winter et al. (1979).

Basmajian and DeLuca (1985), in performing analysis of EMG signals, recommend the use of the RMS value, which is a value dependent on the amplitude, above all other measures. In controlled laboratory experiments, it is usually easier to detect EMG signs of fatigue than during regular work tasks, due to the technical difficulties in making correct measurements in a non-laboratory setting (Jonsson, 1991). Even so, in some laboratory experiments involving light repetitive work, use of a subjective scale for fatigue is sometimes a better indicator of fatigue (Nakata et al., 1991). Hammarskjöld and Harms-Ringdahl (1992) have measured the fatigue of manual performances of carpenters using only the mean EMG amplitude, in addition to subjective ratings.

2.9 Work Station Design

Jørgensen et al. (1998), in their study of Danish mail sorters, did not design a particular sorting station, but used the standard sorting station available. There were a total of 32 pigeon holes, with four holes in each row and eight columns. The total station height was 174.5 cm (69"), where the height to the bottom of the top-most row was 165 cm (65"). The bottom row was at a height of 93 cm (37"). The mail to be sorted was placed on a desk at a height of 73 cm (29"). The mail was sorted from a standing position.

When designing work stations, there are certain considerations that must be made to allow for the proper use of any equipment by workers. Konz (1990) has given several guidelines to follow in designing stations. They include avoiding static loads and fixed work postures, designing to reduce CTDs and setting work height at 50 mm below the elbow. Other considerations applicable to this study include designing for use by the preferred hand and to design stations such that they are within normal reach areas for as wide a segment of the population as possible. Similar discussions can also be found in Grandjean (1988), Pulat (1992) and Sanders and McCormick (1993).

Design considerations are not always given with respect to ergonomics considerations in classical Industrial Engineering methodology. Barnes (1980) related a number of principles of motion economy for use of the human body and design of work places. The development of a preferred work method was summarized by eliminating all unnecessary work, combining operations or elements to eliminate unnecessary movements and changing or simplifying sequences of operations. In order to make these determinations, a process analysis of the task at hand should be performed.

3 EXPERIMENTAL METHOD

3.1 Postal Equipment

For the purpose of this study, a station was considered to consist of a combination of one layout and one mail pickup point. There were a total of three different layouts and two mail pick up points used. They totalled six different stations.

The first station layout (Layout 1), and the one on which the other two were based, was a flat and straight board 71" (180 cm) wide by 51" (130 cm) high. There were one hundred pigeon-hole slots on the board, each one of which was six inches wide by four inches (15.2 cm x 10.2 cm) high. A one inch (2.54 cm) margin was left between each slot in each direction. The height was 74" (188 cm) in order to accommodate the reach of a 5th percentile female. The height to the bottom of the slots in the top-most row was 69" (176 cm). This was based on Marras and Kim (1993), who give the total of shoulder height, upper arm length and lower arm length as being approximately 77" (196.7 cm) for 5th percentile females. This board was placed in front of a mail collection station that allowed mail to be sorted into the slots and be collected at the back. It was placed eight inches (20.3 cm) from the edge of the table to allow mail to be placed there for pick-up during sorting (this was the first of the two mail pick-up points).

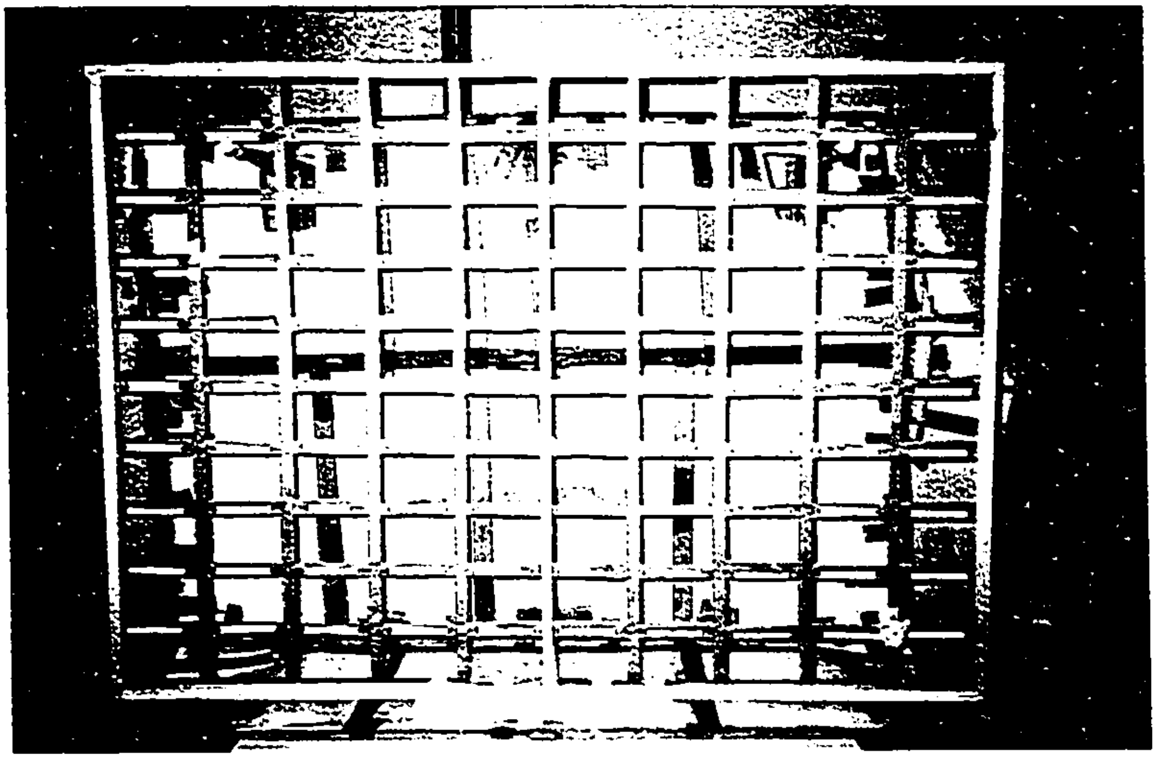

Figure 1 Photograph of Straight Layout

This layout was modified in two ways to produce the remaining layouts. The second layout was a "V-shaped" orientation. From the perspective of the worker, the sorting station "surrounds" the worker, who stood in the middle. The board had been cut in the middle, so that there were two boards, 51" (130 cm) high and 35½" (90 cm) wide. The two boards were joined together in the middle at an angle of 157°. This allowed the middle of the joined boards to be placed back an additional seven inches

(17.8 cm) for a total depth of fifteen inches (38 cm). This was done to accommodate the available equipment and allow approximately six inches (15.2 cm) behind the board, at the centre, for the collection of the envelopes. Because of the orientation, the outer most edges of the "V" layout were now four inches (10.2 cm) from the edge of the table.

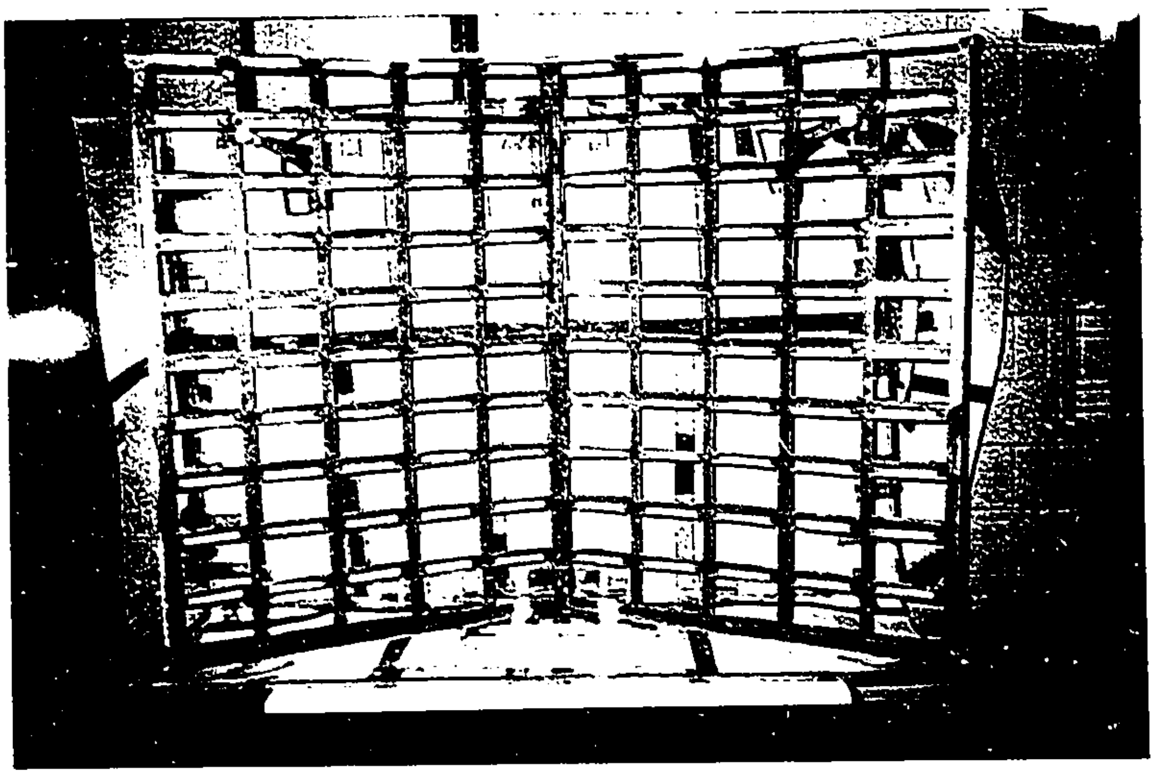

Figure 2 Photograph of "V-Shaped" Layout

The third layout involved "bending" or inclining the flat board near the middle to partially incline the bottom part of the board in the workers' direction. This compressed the height of the station by four inches (10.2 cm) to 70" (178 cm) (65" (165 cm) to bottom of top-most mail slots). The bottom four rows (two-fifths of the board) was folded forward 36°. The top entire board was still flat and straight, except that the bottom portion was now inclined upwards towards the worker.

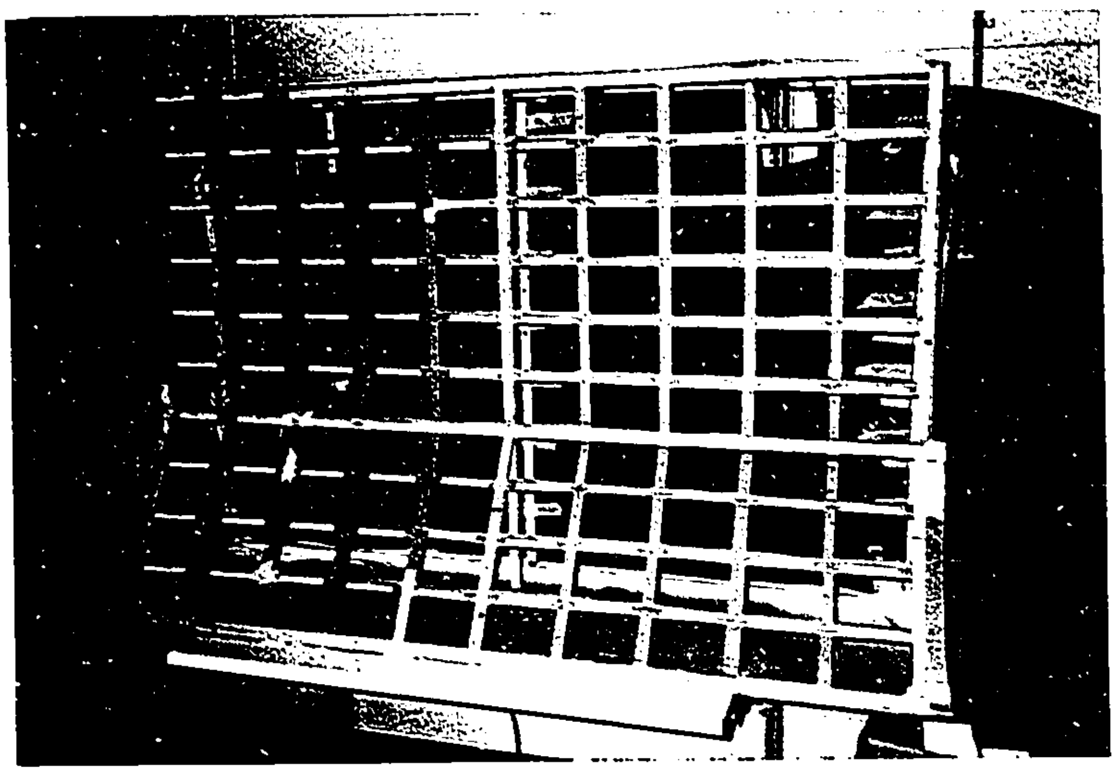

Figure 3 Photograph of Inclined Layout

Diagrams of each of the three layouts are presented in Appendix B.

In each layout there were two different locations from which the mail was picked up. The mail was placed in the centre of the table (in front of the board) or to the side opposite of the workers handedness. That is, left-handers would pick up mail from their right side and right-handers from the left side. When the mail was to be picked up from the opposite side, it was placed on a platform 23" (58 cm) high, which corresponded to the height of the table.

3.2 Postal Sorting Task

Subjects were asked to sort mail from a standing position and place envelopes into a slot, in the station layout, corresponding to the address on the front of the envelope.

Each layout had one hundred different slots into which mail could be placed. The one hundred mail slots consisted of thirty different Windsor area addresses (sixteen postal codes, five post offices, three rural routes and six institutions), sixty different Ontario cities or towns and ten out-of-province destinations. In order to facilitate the sorting process, the three left-most columns contained only Windsor addresses, the next six columns contained the Ontario cities, listed in alphabetical order, and the right-most column was used for out-of-province destinations.

In total, there were three thousand different envelopes available to be sorted. There were an equal number of envelopes available to be placed in any one slot, which was a total of thirty envelopes per slot. The envelopes used were standard No. 10 size (4 1/8" x 9 1/2", 10.5 cm x 24.1 cm). Each envelope was sealed and had one standard sheet of 8 1/2" x 11" (21.6 cm x 28 cm) paper folded inside to simulate regular first class mail. At the time of the experiment, first class mail consisted of letters which weighed less than 30 grams.

The subject had to determine from the address printed on the envelope how to sort each envelope. The addresses on each envelope had fictional names and street addresses, which were randomly generated, but the cities and towns indicated were real. In addition, the first letter of the postal code (first three in the case of Windsor addresses) were correct.

Each subject sorted letters for two hours. A total of seven sessions were conducted, the first being a training session. The station used for the training session was randomly selected. Verbal and written instruction was given to each subject before the training session. The written instruction given to each subject is shown in Appendix C. Each subject was required to be able to sort approximately 12-13 envelopes per minute by the end of the training sessions. This would correspond to a minimum of 1500 envelopes being sorted during the full two hour period. The two hour time period was selected since it is usually the maximum amount of time that would be worked, before a regular rest break would occur.

The following six sessions were then randomly selected from the six different stations. The stations, with the notation used to represent them in this paper, are: straight layout (Layout 1) with mail pick-up in the centre (Sc); straight layout (Layout 1) with mail pick-up on the opposite side (So); "V-shaped" layout (Layout 2) with mail pick-up from the centre (Vc); "V-shaped" layout (Layout 2) with mail pick-up from the opposite side (Vo); inclined layout (Layout 3) with mail pick-up from the centre (Ic); inclined layout (Layout 3) with mail pick-up from the opposite side (Io). During each trial, a light source was immediately above the sorting station. The experiments were conducted at a room temperature of approximately 20° C. The order in which the subjects performed the experiments are shown in Appendix D.

3.3 EMG Measurements

In order to measure muscle fatigue in the worker, bipolar surface electrodes were attached to three muscles. The muscles were the anterior deltoid, the upper trapezius and infraspinatus muscles. Subjects were asked to sort mail with only one hand, and the electrodes were attached to this side of the body. The electrodes used were 'Gold Disk Electrodes' (heavy gold plate over pure solid silver), type E5GH made by the Grass Instrument Company of Quincy, Massachusetts. These electrodes were approximately 10 mm in diameter. The separation of the electrodes was approximately 2.5 cm (1"), and they were located on the muscles according to Dalagi et al. (1975) and Goodgold (1974). The electrodes were held in place with medical tape, due to the fact that collars were not available for the model used.

Diagrams for electrode placement are provided in Appendix E.

The EMG signals from the electrodes were amplified through a Grass Instruments High Performance AC Preamplifier (Model P511). The settings for the Preamplifier can be found in Appendix F. The amplified signals were then read by a 486-based Personal Computer using the available data collection software, Viewdac, Release 2.10, by Keithley Data Acquisition Division, of Taunton, Massachusetts.

Subjects that participated in the study completed one sorting session per day. In order to minimise problems associated with effects of training, the sessions were completed over a fixed time frame. Male subjects completed the seven sessions (one training plus six measured sessions) in seven to nine days. Female subjects completed the study in a period of two to three weeks (fourteen to twenty days).

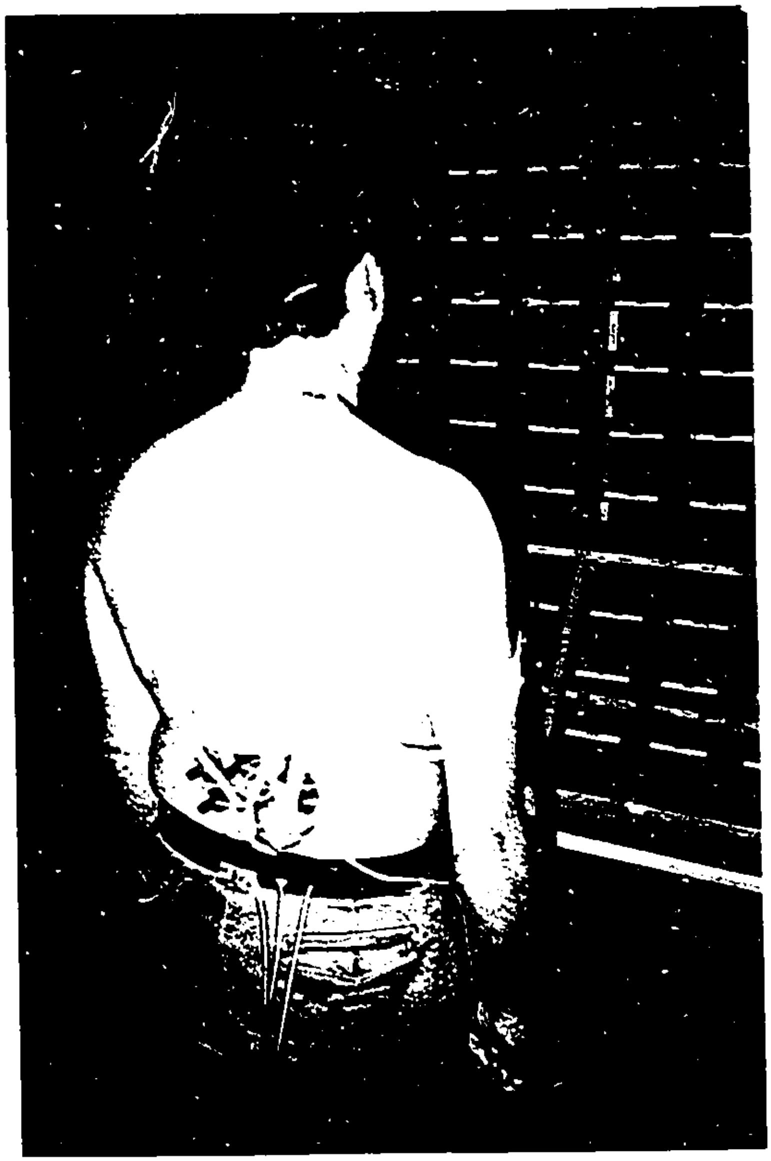

Figure 4 Photograph of Subject Showing Electrode Placement

Since the study was conducted over a period of time, this meant that the surface electrodes had to be placed on the subject every time. In situations such as this, the results obtained from surface electrodes are considered reliable. Giroux and Lamontagne (1990) found that results of surface electrodes are considered to be statistically similar, both in same day and day-to-day use. The results should be consistent over the temperature range (Holewijn and Heus, 1992) and there should be little variability across subjects for the same muscles (Preece et al., 1994).

3.4 Data Collection

Viewdac uses an Analog-to-Digital conversion routine to sample the information transmitted from the amplifier. With three channels being received, one channel for each muscle, the software was able to make 45 readings per second per channel (2700 per minute). Data were collected at fixed intervals during the two hour session. The session was broken into twelve equal periods of ten minutes, where the sampling was done during the last three of the ten minutes. In effect, this means readings were taken during the following 36 minutes of the session: 8, 9, 10, 18, 19, 20, 28, 29, 30, 38, 39, 40, 48, 49, 50, 58, 59, 60, 68, 69, 70, 78, 79, 80, 88, 89, 90, 98, 99, 100, 108, 109, 110, 118, 119 and 120. The voltage received was converted to a value between -5 and 5 volts. The Viewdac procedures, that were used to collect this information, are shown in Appendix G.

The voltage values can be analysed to determine the RMS and MPF values. Information on calculating these is provided in Appendix H.

At times during the experiment, the electrodes would come loose. Readings obtained when this happened were ignored. A total of 7776 minutes (12 subjects x 6 sessions x 3 muscles x 36 minutes per session) worth of data was collected. A total of 91 minutes of data was deemed inadequate and was not included in calculations. This represents a loss of 1.2% of the total data collected.

Two other sets of data were collected for each experiment. The number of envelopes that were sorted by each individual for each station was recorded. Also, at the end of the experiment, each subject was required to provide subjective responses to a questionnaire to rate the perceived exertion in nine different body parts. This questionnaire used Borg's RPE (Rating of Perceived Exertion) scale as a discomfort scale (Gamberale, 1972; Borg, 1990).

The body parts that were considered were the neck, shoulders, upper back, elbows, lower back, wrists/hands, hips/thighs, knees and ankles/feet. These divisions of the body were taken from definitions in the Nordic questionnaire for the analysis of musculoskeletal symptoms (Kuorinka et al., 1987). It is reproduced in Appendix I.

3.5 Subjects

A total of twelve subjects, eight males and four females, completed the experiment. In this paper, the eight male subjects were referred to numerically, as subjects 1 to 8. The four female subjects were referred to with letters, as subjects A to D.

The average age of the males that participated was 26.5 years, with a range of 21 to 36, and a standard deviation of 5.5 years. Of the females, the average age was 21.3 with a standard deviation of 2.6 years. The range of the ages of the females was 19 to 25. Overall, the average age of all twelve subjects was 24.8 years. The standard deviation was 5.3 years. The difference of the ages and the difference in variance of these ages were not statistically significant at a 5% level.

The average height of the males was 177.9 cm, with a standard deviation of 6.7 cm and for the females it was 176.8 cm, with a standard deviation of 7.6 cm. The range of heights of the males was 168 cm to 186 cm. The range of heights of the females was 169 cm to 187 cm. Considering all twelve subjects together, the average height was 177.5 cm. The standard deviation was 6.7 cm.

The average shoulder height was 147.0 cm for the males, with a standard deviation of 6.0 cm. The average shoulder height of the females was 146.0 cm, with a standard deviation of 6.7 cm. Overall, the average shoulder height was 146.7 cm and the standard deviation was 6.0 cm. The ranges of the shoulder height by gender were 136 to 154 cm (males) and 139 to 155 cm (females).

An analysis of the differences of the heights and shoulder heights between genders, and of the differences of the variance of these measures, was not found to be statistically significant at a 5% level.

Subject-by-subject information is given in Appendix J.

3.6 Experimental Design

In this study, the experimental unit, or block, was the individual performing the experiment. In order to control the variability of the individuals concerned, each subject performed the experiment for each combination of factors. This is a "within-subject" or repeated measures experimental design. Repeated measures designs are characterised by the fact that a number of measurements or results are obtained from an individual performing an experiment. (Norman and Streiner, 1994)

For any response variable y, the model for the response variable was:

$$y_{ijk} = \mu + g_i + b_j + p_k + \epsilon_{ijk},$$

where y_{ijk} was the (ijk)th observation, μ was the overall mean, g_i was the parameter based on the (i)th gender, b_j was the parameter based on the (j)th board, p_k was the parameter based on the (k)th pickup point and ϵ_{ijk} was the error component. Of the subscripts, i was the gender and was one of {m,f}; j was the board and was one of {s,v,i}; and k was the pickup point and was one of {c,o}. The various responses are summarised in Table 1.

Table 1 Summary for Results of any Response Variable

Gender	Pickup Point	Board Layout		
		Straight	V-Shaped	Inclined
Male	Centre	Y_{msc}	Y_{mvc}	Y_{mic}
Male	Opposite	Y_{mso}	Y_{mvo}	Y_{mio}
Female	Centre	Y_{fsc}	Y_{fvc}	Y_{fic}
Female	Opposite	Y_{fso}	Y_{fvo}	Y_{fio}

Statistical analysis of the results obtained was performed using Statgraphics Plus 7.0, by Manugistics, Inc. of Rockville, Maryland.

The experiment may be described as a "Factorial Design", since the controlled variables have different levels. Multifactor analysis of variance (ANOVA) tests were performed on the "fatigue scores", count of envelopes, subjective ratings and the RMS values. If the analysis of variance was found to be significant at 5 percent, a multiple range analysis was performed using Duncan's Multiple Range Test to determine if there were significant differences of means among the significant factor. Duncan's test was chosen because of its conservative nature in detecting differences of means only when they really exist (Montgomery, 1991). In situations where there was a significant two-way interaction between factors, a graph is included.

The ANOVA table was calculated with three factors. One factor had three levels (board) and two had two levels (pickup point and gender). In the analysis of the ANOVA table, the response variable (one of fatigue score, envelope count, subjective ratings or RMS values) was the dependent variable. The board, pickup point and gender were the independent variables. In advance of the testing, no assumption was made that males and females would perform the experiment in a similar manner. As such, gender was used as a factor in these experiments.

In order to simplify the analysis of the data, if a three-way analysis found that gender was a significant factor, testing was then done within each gender. This had the effect of making the experiment a two-factor test. If gender was significant, then males and females were treated separately. When gender was not significant, consideration could be given to the two remaining factors. This allowed a focus, in the analysis, on the design aspects of the station.

3.7 Calculation of "Fatigue Score"

Mathematical analysis, to determine if various experimental factors were likely to induce signs of muscle fatigue, were done using the "fatigue score" for each experimental trial.

In order to determine if statistical signs of fatigue existed, the RMS (Root-Mean-Square) and MPF (Mean Power Frequency) values were calculated from the EMG signal. If, over time, there was found to be a positive slope for the RMS values coupled with a negative slope of the MPF values, then statistical signs of fatigue were considered to exist. In this experiment, trials that yielded such indications were given a "fatigue score" of one, indicating that there were signs of fatigue. Trials that did not have results indicating fatigue were given a score of zero.

4 TABULATION OF RESULTS

4.1 Statistical Indicators of Muscle Fatigue

For each of the 36 different minutes in each trial that the EMG signal was recorded, the RMS (Root-Mean-Square) and MPF (Mean Power Frequency) values have been calculated. The results of the calculations for the RMS and MPF values are shown in Appendix K.

Regression analysis has been done for the RMS and MPF values with RMS and MPF as variables dependent on time (in minutes). Testing was done for each of the three muscles for each station. Interval testing of the slope was performed at 95 and 99 percent confidence levels. The confidence intervals of the RMS and MPF slopes, for each trial and muscle studied, are printed in Appendix L. The actual slopes are printed in Appendix M. The methodology for linear regression can be found in any standard engineering statistics text (eg. Miller et al., 1990; Scheaffer and McClave, 1990). A fatigue score of one was assigned to a station if any one of the three muscles that were being studied showed statistical indications of fatigue.

Statistical signs of fatigue may have occurred at a point before the full two hour period was over. Additionally, if an individual was working and feeling "fatigued", they may have changed their work pattern at various points in time. If this occurred, there may not have been statistical signs of muscle fatigue after two hours, but there may have been at an earlier point in time.

In order to determine if signs of muscle fatigue existed at any point during the experiment, analysis was performed on the RMS and MPF values from the beginning of the experiment to all recorded time points from 30 to 120 minutes. In doing so, it was possible to determine at what point statistical signs of fatigue first occurred.

Table 2 Time to First Occurrence of Statistical Muscle Fatigue, based on Regression Analysis of RMS and MPF Values, showing Station worked on, muscle that first showed statistical signs of fatigue (D=Deltoid, T=Trapezius, I=Infraspinatus), time, in minutes, to the first statistical occurrence of muscle fatigue indication and best confidence level and interval for the slope.

Station & Muscle			Time	RMS Slope * 10^3 Confidence	RMS Slope * 10^3 Interval	MPF Slope Confidence	MPF Slope Interval
1	So	D	108	99	(0.0035, 0.0052)	95	(-0.0126,-0.0014)
1	Vc	I	118	95	(0.0007, 0.0080)	95	(-0.0738,-0.0085)
1	Io	D	50	99	(0.1874, 0.2521)	95	(-0.0405,-0.0006)
2	Vo	I	30	99	(0.1119, 0.1431)	95	(-0.0591,-0.0011)
3	Vo	I	39	99	(0.0126, 0.0715)	95	(-0.7160,-0.1012)
3	Vc	D	90	99	(0.0894, 0.1244)	95	(-0.2993,-0.0067)
3	Ic	D	40	99	(0.0614, 0.1709)	95	(-1.7595,-0.0796)

4	So	I	100	99	(0.0005, 0.0061)	95	(-0.0657,-0.0014)
4	Io	D	89	99	(0.1201, 0.1455)	95	(-0.0393,-0.0034)
5	So	T	30	99	(0.0384, 0.1927)	95	(-1.0223,-0.1663)
5	Vo	I	60	99	(0.0524, 0.1008)	95	(-0.5786,-0.0485)
5	Vc	I	39	99	(0.0799, 0.1977)	95	(-0.9966,-0.0583)
6	So	D	49	99	(0.0229, 0.2276)	95	(-3.3648,-0.0308)
6	Vo	D	69	99	(0.0479, 0.1393)	95	(-1.3571,-0.0253)
6	Vc	D	38	95	(0.0053, 0.1519)	95	(-2.8944,-0.0755)
6	Ic	I	78	99	(0.0012, 0.0105)	95	(-0.1252,-0.0039)
7	So	I	30	99	(0.0444, 0.1929)	95	(-3.8828,-0.6077)
7	Sc	I	40	95	(0.0001, 0.0735)	99	(-3.6965,-0.0858)
7	Vo	I	78	95	(0.0051, 0.0781)	95	(-2.3601,-0.1334)
7	Vc	D	30	99	(0.0849, 0.2477)	95	(-5.7651,-0.4987)
7	Io	D	68	99	(0.1511, 0.1745)	95	(-0.2072,-0.0026)
7	Ic	D	49	95	(0.0138, 0.1911)	95	(-5.0235,-0.0474)
8	So	D	48	95	(0.0311, 0.2315)	99	(-16.0912,-2.9150)
8	Sc	D	58	99	(0.0497, 0.3508)	95	(-8.0274,-1.0437)
8	Vc	D	60	95	(0.0118, 0.2150)	99	(-9.3047,-0.4687)
8	Ic	D	38	99	(0.0007, 0.3237)	95	(-8.8319,-1.0025)
A	So	I	88	95	(0.0001, 0.0066)	99	(-0.1642,-0.0159)
A	Ic	D	30	99	(0.2360, 0.3112)	95	(-0.1267,-0.0102)
B	So	I	59	95	(0.0011, 0.0596)	99	(-8.4066,-1.1889)
B	Sc	D	108	95	(0.0023, 0.0937)	99	(-6.9030,-3.2781)
B	Vc	I	68	99	(0.0117, 0.9054)	95	(-1.5431,-0.1815)
B	Io	D	30	99	(0.1460, 0.4771)	95	(-30.7353,-4.2552)
C	Ic	I	60	99	(0.0388, 0.0476)	95	(-0.0458,-0.0026)
D	Vo	D	108	95	(0.0026, 0.0253)	99	(-0.5243,-0.0145)

Of the 72 total trials, 34 trials showed results consistent with statistical signs

of muscle fatigue (47%). Of the 48 total trials performed by males, indications of muscle fatigue occurred in 26 instances (54%). There were eight instances of statistical indicators of muscle fatigue in 24 total trials performed by females (33%).

Table 3 Occurrence Rates of Indications of Muscle Fatigue

Pickup Point	Board			
	Straight	V-Shaped	Inclined	Total
Opposite	8	6	4	18
Centre	3	7	6	16
Total	11	13	10	34

There were additional cases where more than one muscle showed statistical signs of muscle fatigue during a trial. There were seven additional occurrences by the deltoid muscle for a total of 26 of 72 trials. There were two additional occurrences by the trapezius muscle for a total of three of 72 trials. Finally, there were seven additional occurrences by the infraspinatus muscle for a total of 21 of 72 occurrences. These additional occurrences were not considered further, since a statistical sign of fatigue was considered to occur if any muscle showed signs. The additional occurrences are tabled below.

Table 4 Additional Occurrences of Fatigue by Muscle (D=Deltoid, T=Trapezius, I=Infraspinatus)

Subject	Station	Muscle(s)
2	Vo	D
5	So	D, I
	Vc	D
6	So	I
	Vo	I
7	So	D
	Sc	D
	Vo	D
	Vc	T
	Io	T, I
8	Ic	I
A	Ic	I
B	So	D
	Io	I

In order to analyse if any particular factor was more likely to induce signs of muscle fatigue, the "fatigue score" was analysed. No specific factor was found to have any statistically significant effect on the occurrence of muscle fatigue indicators at a 5% level. Graphs showing 95% confidence intervals of the fatigue score by gender, board and pickup point, are shown in Figures 5, 6 and 7. The ANOVA table relevant to this analysis can be found in Appendix N.

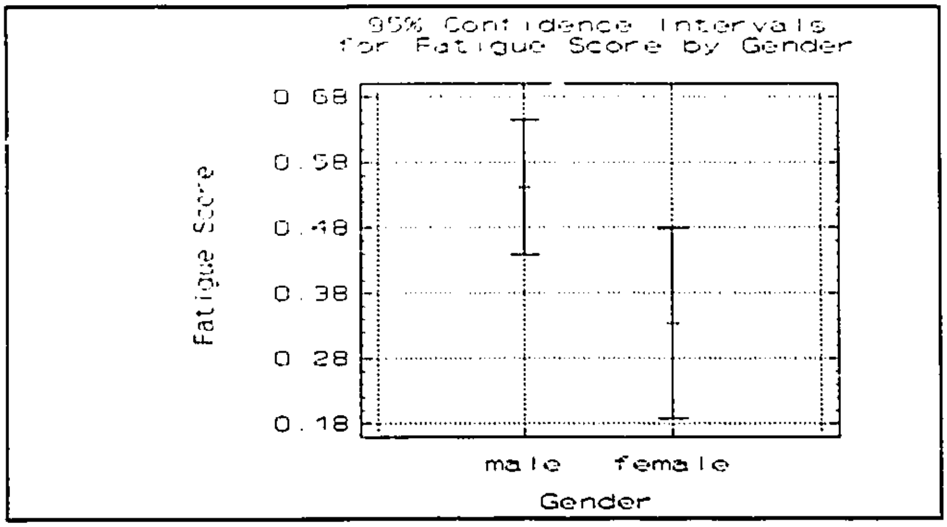

Figure 5 Intervals of Means of Fatigue Score by Gender

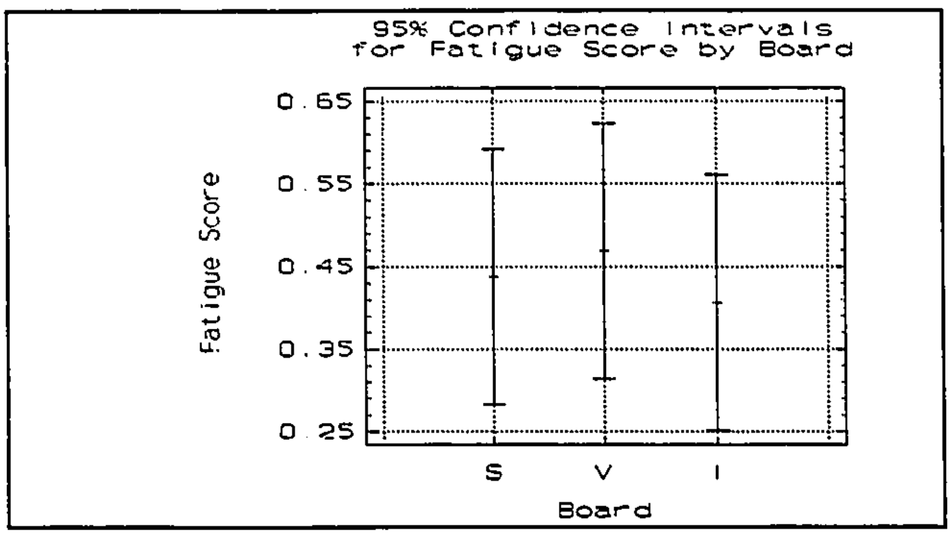

Figure 6 Intervals of Means of Fatigue Score by Board

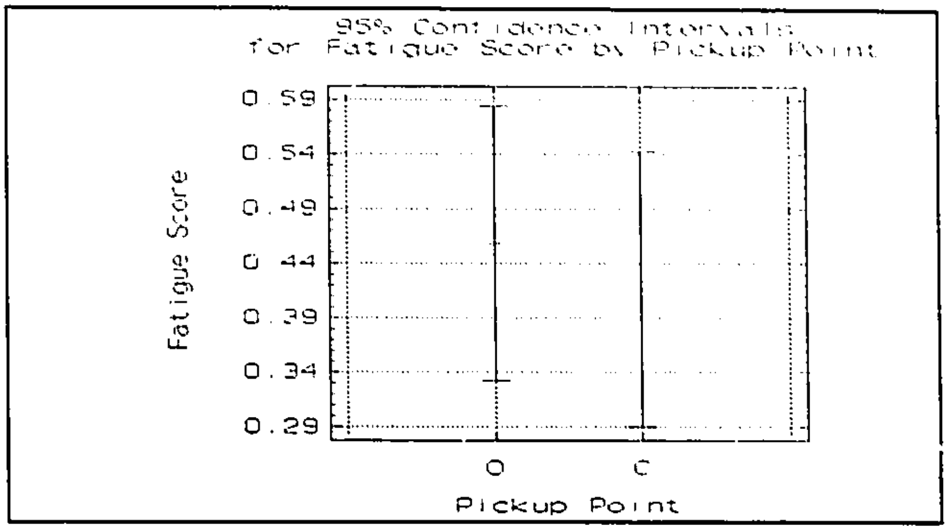

Figure 7 Intervals of Means of Fatigue Score by Pickup Point

For reference, Appendix O contains printouts of the EMG signal and RMS/MPF plots for a muscle that was found to have signs of fatigue during the experiment. The plots are for the deltoid muscle for Subject 7 (Station: So). Appendix P contains printouts of the EMG signal and RMS/MPF plots for a muscle that was not found to have fatigue occur during the experiment. The plots are for trapezius muscle for Subject 7 (Station: So).

For each muscle, the EMG signal has been printed for the first collection of data during the experiment (minutes 8, 9 and 10), the mid-point of the experiment (minutes 58, 59 and 60) and the end of the experiment (minutes 118, 119 and 120). The RMS and MPF plots appear on the same graph, for comparison purposes.

4.2 Envelope Count and Pickup

The most direct way to measure the performance at the different stations was to count the number of envelopes that were sorted at each station. The results are presented in Table 5.

Table 5 Count of Envelopes

	Station					
Subject	So	Sc	Vo	Vc	Io	Ic
1	1908	2160	2313	2071	2265	2065
2	2150	2107	2115	2172	1944	1989
3	2803	2499	2697	2633	2241	2828
4	1797	2385	2227	2153	1558	2354
5	1708	2100	1899	1880	1587	2106
6	1856	1668	1806	1751	1895	2026
7	2647	2738	2809	2242	2809	2946
8	1654	1748	2131	1964	2001	1530
A	2377	2575	2500	2491	2425	2512
B	2515	2390	2185	2421	2483	1911
C	1872	2063	2052	1991	2192	1649
D	1924	1608	1770	1718	1873	1689

Analysis was carried out on the envelope count to ascertain if subjects sorted different amounts of mail at any stations. No significant results were obtained at a 5% level.

There appeared to be some significant differences in the ranges of the number of envelopes each subject sorted. The intervals of the variance at a 95% confidence level were calculated for each subject. The only difference of variability between subjects was found between subjects 4 and A. This was likely due to the fact that subject 4 required a longer learning curve to come up to "normal" sorting speed, while subject A was at a "normal" level much faster. There were no other significant differences recorded among the subjects. The values are presented below.

Table 6 Variance of Envelope Count

Subject	Range
1	(92, 363)
2	(57, 225)
3	(137, 539)
4	(207, 812)
5	(130, 509)
6	(77, 303)
7	(152, 599)
8	(144, 565)
A	(43, 171)
B	(144, 565)
C	(118, 462)
D	(74, 289)

While performing the task, subjects were required to pickup mail from a designated position. The number of times that this was done during the two-hour period may have effected the rate at which the work was performed. However, during the trials, it was not possible to make observations during the experiment without being overly intrusive. In order to attempt some measure of the number of envelopes that each subject grabbed from the pickup point, five trials were conducted after the final sorting session, for each of the two pickup points. Analysis of the ANOVA table did not indicate that subjects picked up significantly different amounts of mail due to gender or pickup point.

The analysis for this section is found in Appendix Q.

4.3 Subjective Ratings

Subjective ratings of perceived exertion were provided by each subject after each experiment. The rating was based on Borg's RPE scale and it ranges from six (for very, very light exertion) to 20 (for very, very hard exertion). Ratings were provided for nine parts of the body, namely: neck, shoulders, upper back, elbows, lower back, wrists/hands, hips/thighs, knees and ankles/feet. The results are printed in Appendix R.

For each of the nine body parts, the ratings were tested to determine if any of the three factors had a significant effect on the ratings provided. It was found that for six of the nine body parts rated, females provided significantly lower scores than males. This occurred for the upper back, elbows, lower back, hips/thighs, knees and ankle/feet. There was no significant difference for the neck, shoulders and wrists/hands. No other factor was found to have a significant effect. Graphs showing the differences of means due to gender, for the six body parts with such differences, are displayed in Figures 8 to 13.

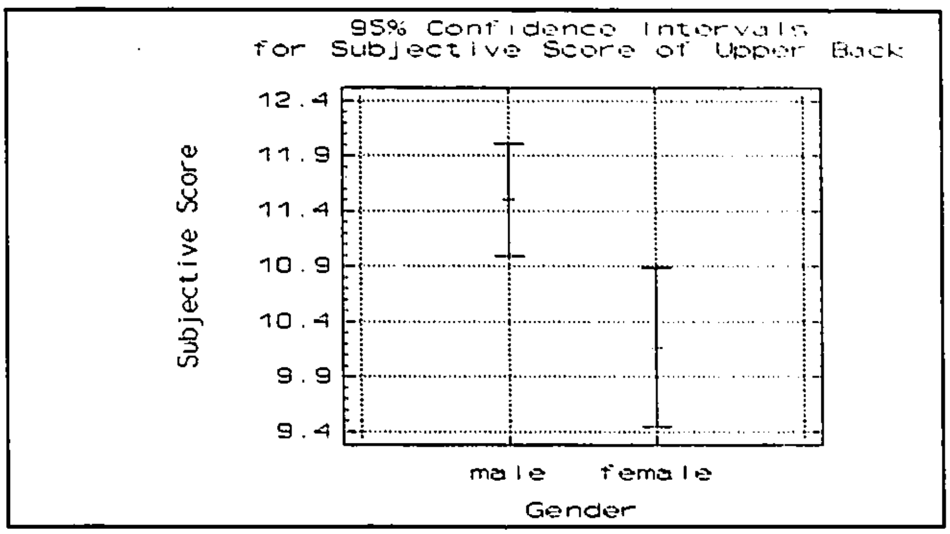

Figure 8 Intervals of Means of Subjective Scores: Upper Back by Gender

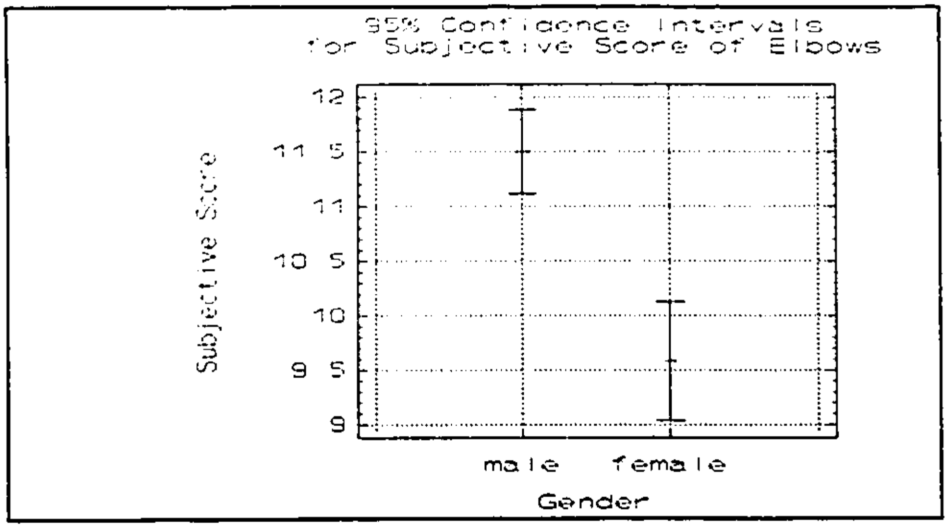

Figure 9 Intervals of Means of Subjective Scores: Elbows by Gender

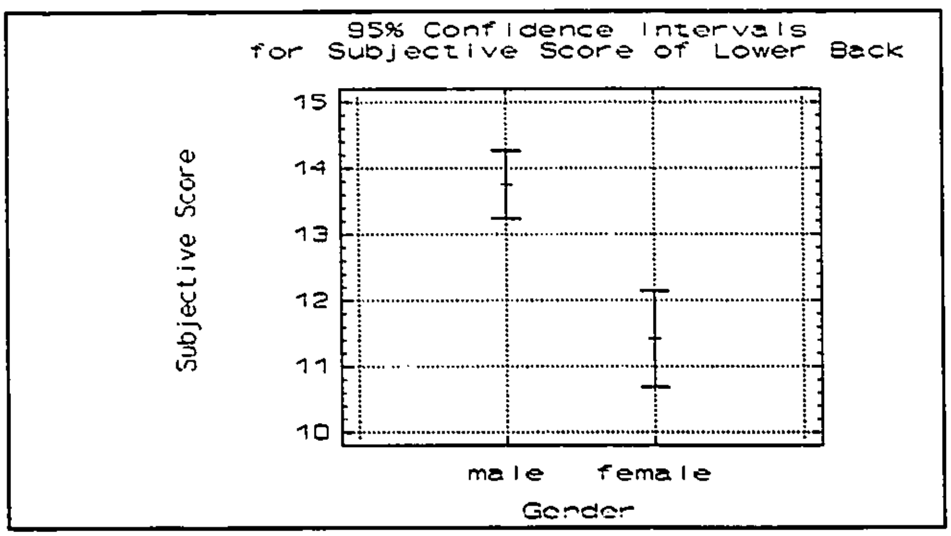

Figure 10 Intervals of Means of Subjective Scores:Lower Back by Gender

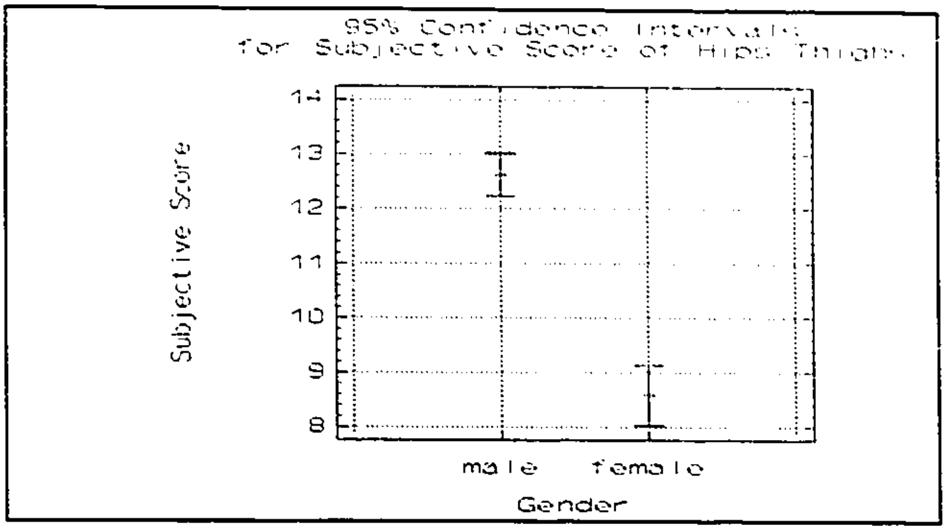

Figure 11 Intervals of Means of Subjective Scores: Hips/Thigh by Gender

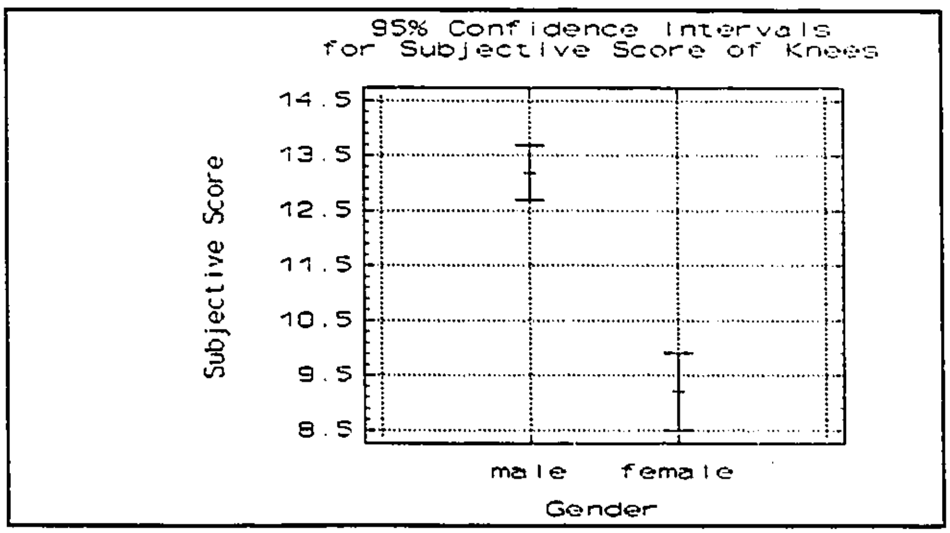

Figure 12 Intervals of Means of Subjective Scores: Knees by Gender

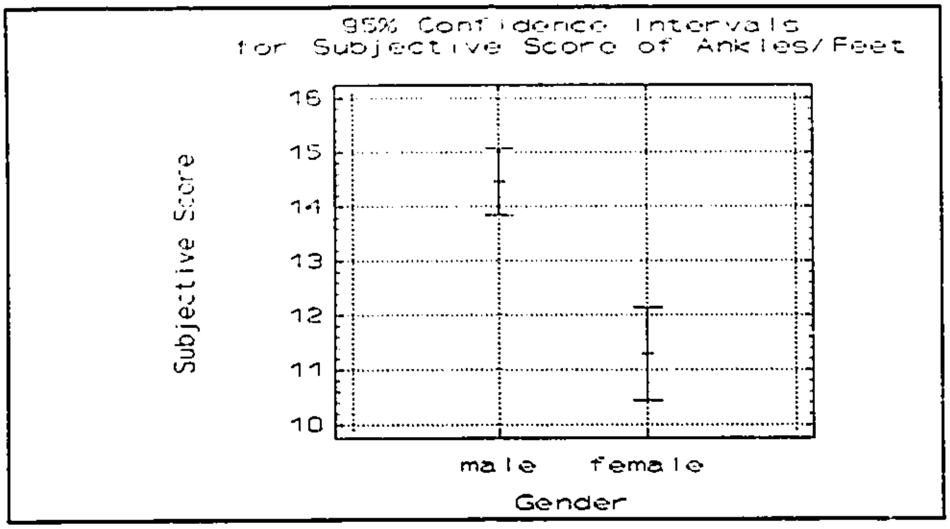

Figure 13 Intervals of Means of Subjective Scores: Ankles by Gender

Since the population sizes were unequal, a comparison was done on the variance for the six body parts that showed significant differences in the mean score, due to the gender. Four body parts, namely the upper back, hips/thighs, knees and ankles/feet were not found to have statistically different variances at a 5% level. The variances for the lower back and elbows, however, were found to have statistical differences. In both of these cases, the variance for the responses provided by the females were greater than those provided by the males.

In order to determine if the ratings provided were due to the station design or inherent to the task, ANOVA tables were calculated with gender and body part as factors. It was found that gender and body part were significant factors in the subjective score provided. Consequently, the subjective scores were tested within each gender, with the body part as the only factor, to determine if there were differences in how each part of the body was scored. Differences were found in how each gender provided the subjective ratings.

The male scores provided the clearest divisions. Specifically, males scored the neck lowest. They next scored the wrist/hands, elbows, shoulders and upper back as a homogenous group. It should be noted that these five body parts are all part of the upper body. The lower body parts were scored at the upper end of the scale. The hips/thighs score was significantly lower than that of the lower back and ankles/feet. Also, the knees were significantly lower than the ankles/feet. In general, the ratings ascribed to the 'upper' half of the body (neck, shoulders, upper back, elbows, wrists/hands) were found to be significantly lower than the ratings given to the 'lower' parts of the body (lower back, hips/thighs, knees, ankles/feet). These results are displayed in Figure 14.

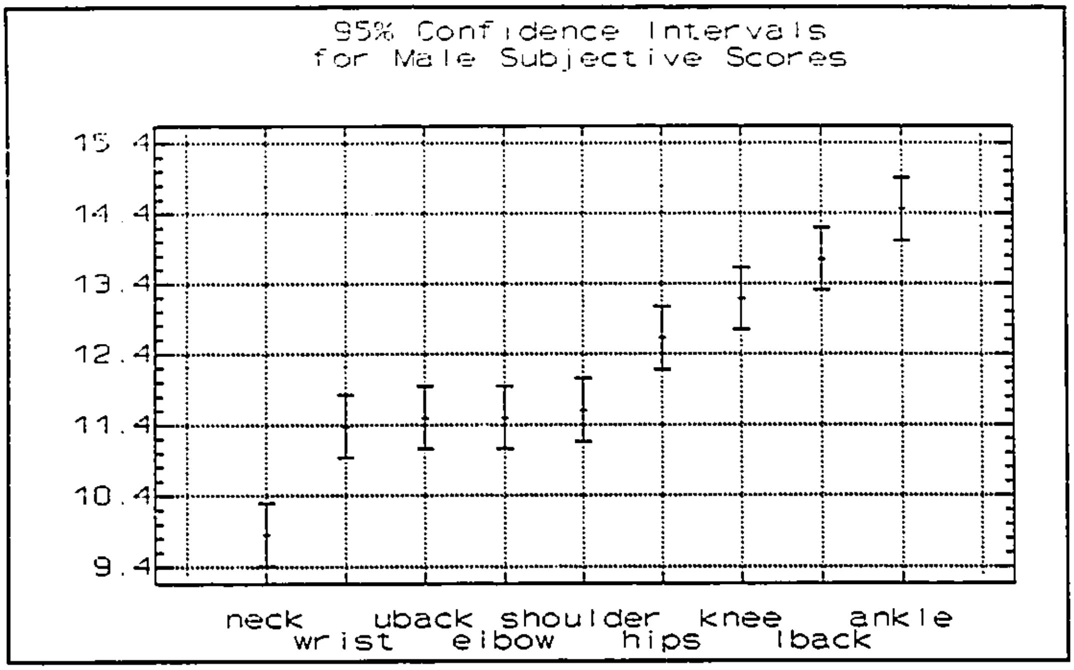

Figure 14 Intervals of Means of Male Subjective Scores by Body Part

The females did not provide as many clear cut divisions in their scoring. Significant differences were found as follows: hips/thighs lower than neck, shoulders, lower back and ankles/feet; knees lower than shoulders, lower back and ankles/feet; and, elbows lower than shoulders. The results are displayed in Figure 15.

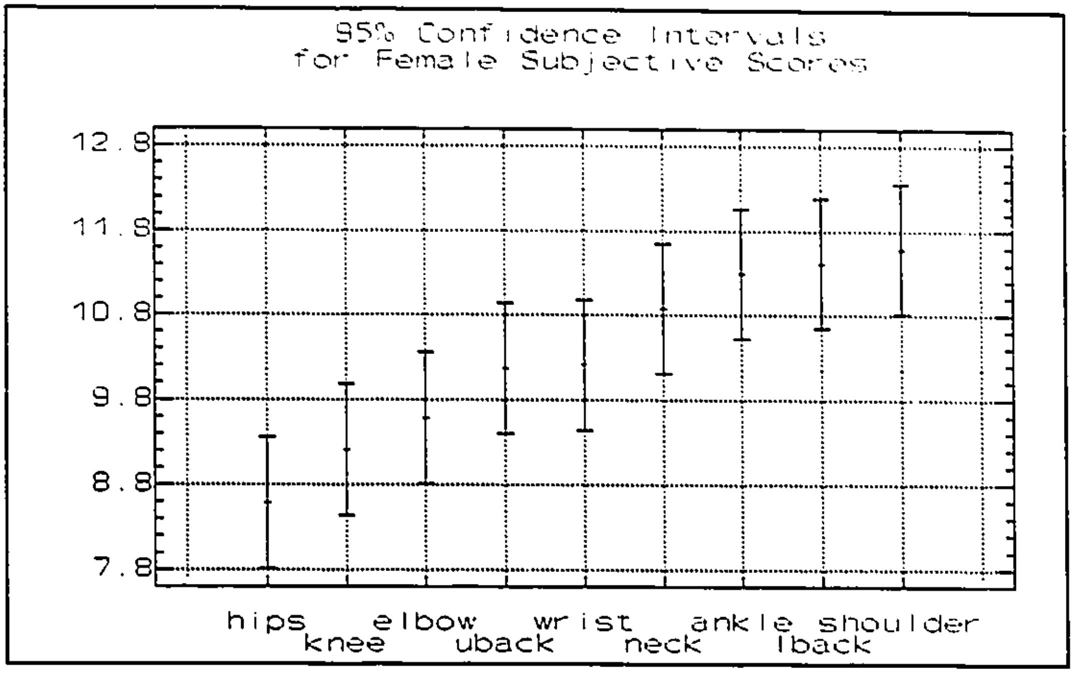

Figure 15 Intervals of Means of Female Subjective Scores by Body Part

The results for analysis of subjective ratings, within gender, by body part is printed in Appendix S.

In order to see if the subjective ratings provided had a relationship with the occurrence of statistical signs of fatigue or the number of envelopes counted, Spearman's Correlation Coefficients were calculated for the subjective rating, fatigue score and envelope count using Statgraphics. The testing was done within gender and for each of the nine body parts. The results are printed in Appendix T.

It was found that females had a negative correlation between the number of envelopes sorted and the scores provided for the shoulders, lower back and ankles/feet. A positive correlation was found between fatigue score and the subjective ratings for the wrist/hand and hips/thighs. Males were found to have a positive correlation between the fatigue score and three body parts. They were the neck, shoulders and upper back. Males were not found to have any correlation between envelope count and subjective ratings.

4.4 Analysis of RMS Values

When fatigue in a muscle occurs, the amplitude of the EMG signal, from surface electrodes, increases (Winter, 1990) and the frequency spectrum shifts to lower frequencies (Basmajian and DeLuca, 1985). In looking specifically at the meaning of the RMS value, it has been established that the amplitude (ie. RMS) of the EMG signal can be used as a proportional measure of the force required by the muscle to perform a task (Wells and Patla, 1985).

In attempting to determine which, if any, of the particular designs used were most suitable for a human operator, the actual RMS values were studied. The purpose for the study of the RMS values was to determine if certain stations required a greater force from the muscles involved. If so, conclusions could be made that the greater force requirement could, in time, more readily lead to muscle fatigue.

Table 7 Analysis of RMS Values (based on required force)

Gender	Muscle	Board	Pickup Point
Female	Deltoid	I < V < S	C < O
Male	Deltoid	(VS) < I	C < O
Female	Trapezius	S < (VI)	No Differences
Male	Trapezius	No Differences	No Differences
Both	Infraspinatus	I < S < V	O < C

Analysis indicates that there were gender differences for the deltoid and trapezius muscles. The infraspinatus muscle showed no such differences. Data for the deltoid and trapezius muscles was further analysed by gender to determine significant differences.

Analysis of the RMS values of the deltoid muscles for the females indicated that the RMS values were significantly different for each board. The boards, from highest required force to lowest force were: straight board, V-shaped and inclined. The pickup points were also different, with a greater force required from the deltoid muscle when dealing with pickups from the opposite side. These are illustrated below in Figures 16 and 17.

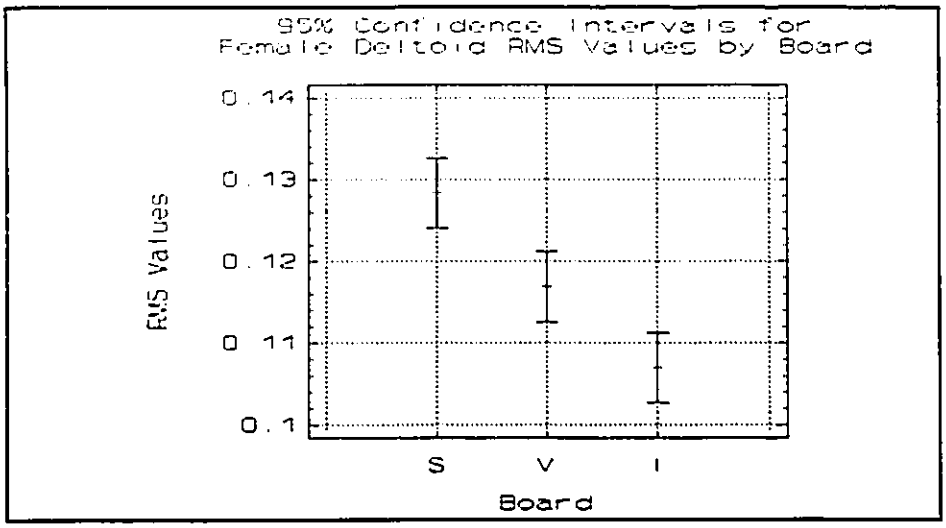

Figure 16 Intervals of Means of Female Deltoid RMS Values by Board

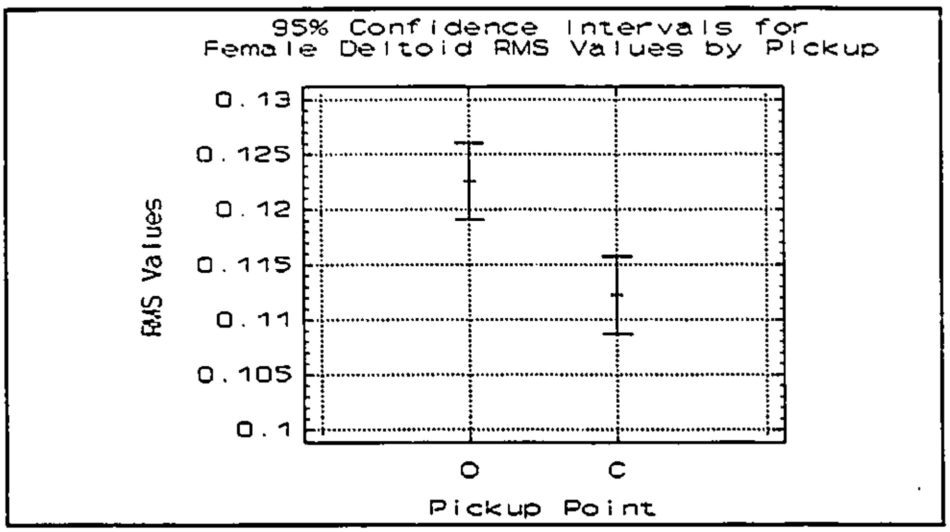

Figure 17 Intervals of Means of Female Deltoid RMS Values by Pickup

The analysis of the RMS values of the deltoid muscles for the males indicated that a greater amount of force was required when using the inclined board and when picking up mail from the opposite side pickup point. These results are illustrated in Figures 18 and 19.

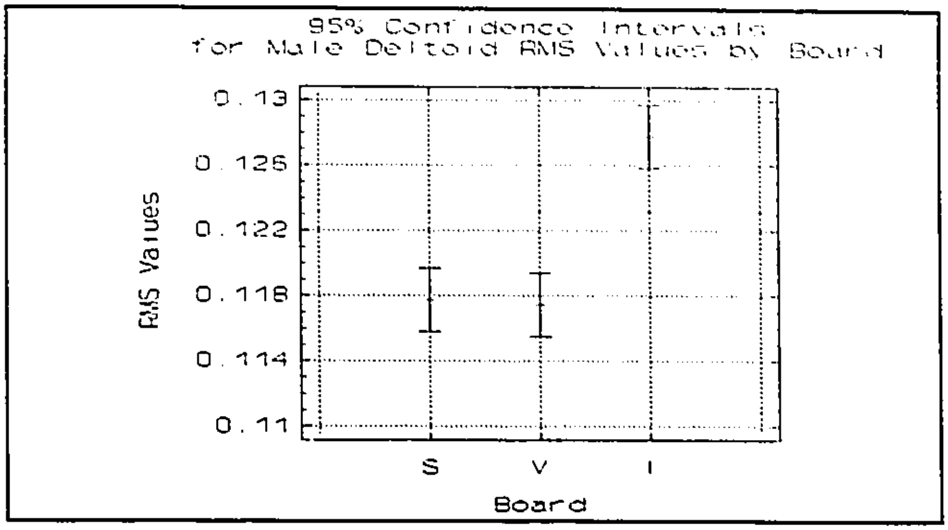

Figure 18 Intervals of Means of Male Deltoid RMS Values by Board

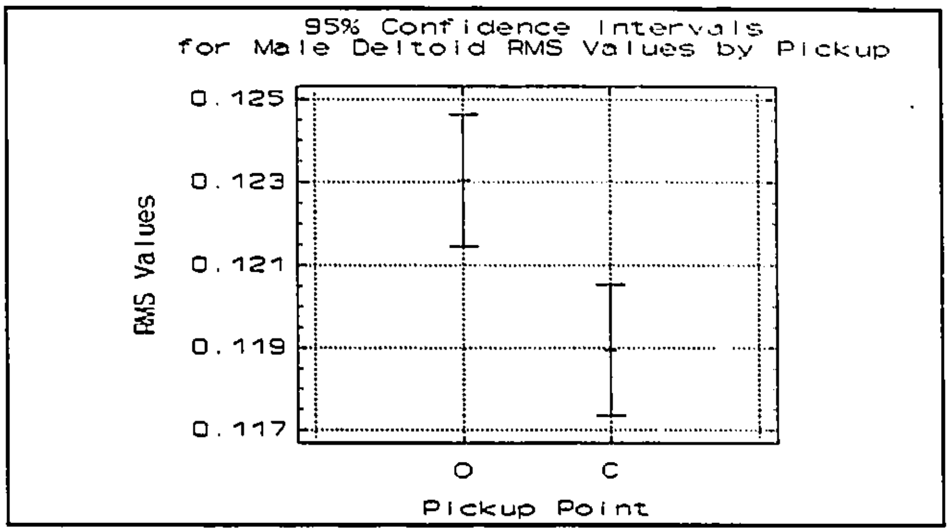

Figure 19 Intervals of Means of Male Deltoid RMS Values by Pickup

Analysis by gender, of the RMS values for the trapezius muscle, showed no significant differences among the males. Among females, the only significant difference that was found was due to the board used. The trapezius muscle required less force when using the straight board than for either of the other two boards. The results are summarised in Figure 20.

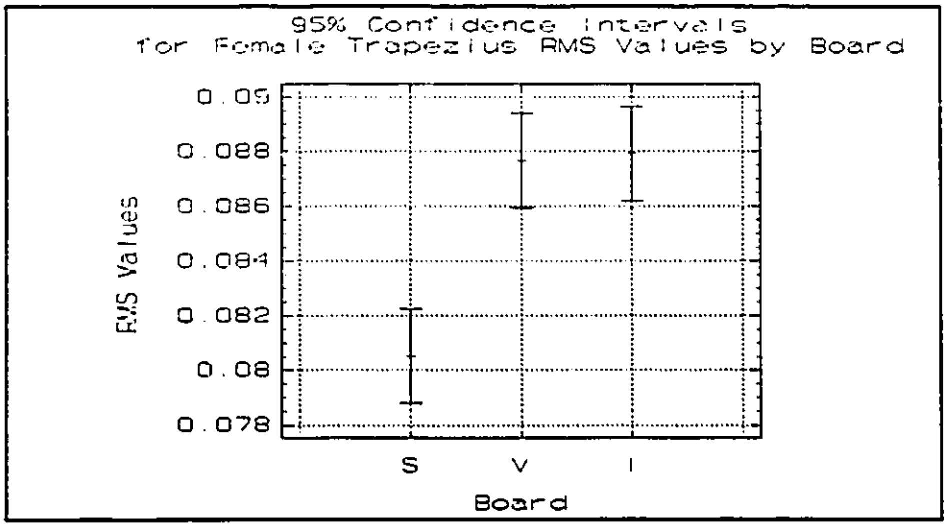

Figure 20 Intervals of Means of Female Trapezius RMS Values by Board

Analysis of the infraspinatus muscle showed no differences due to gender, but did show differences based on the board used and the pickup point. The board with the lowest force required was the inclined board. The straight board was next and the V-shaped board required the greatest force. When considering the pickup point, the stations with opposite pickups produced a lower RMS value. Graphical representation of these points are illustrated in Figures 21 and 22.

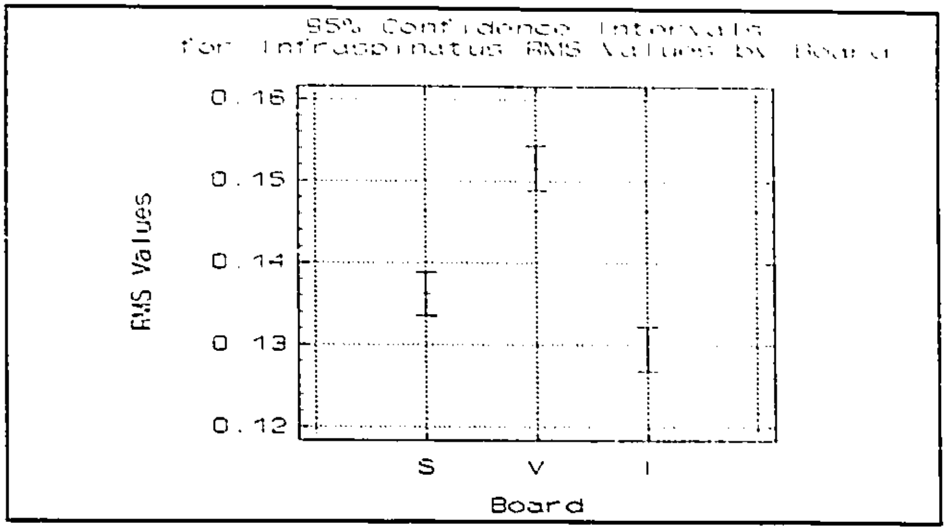

Figure 21 Intervals of Means of Infraspinatus RMS Values by Board

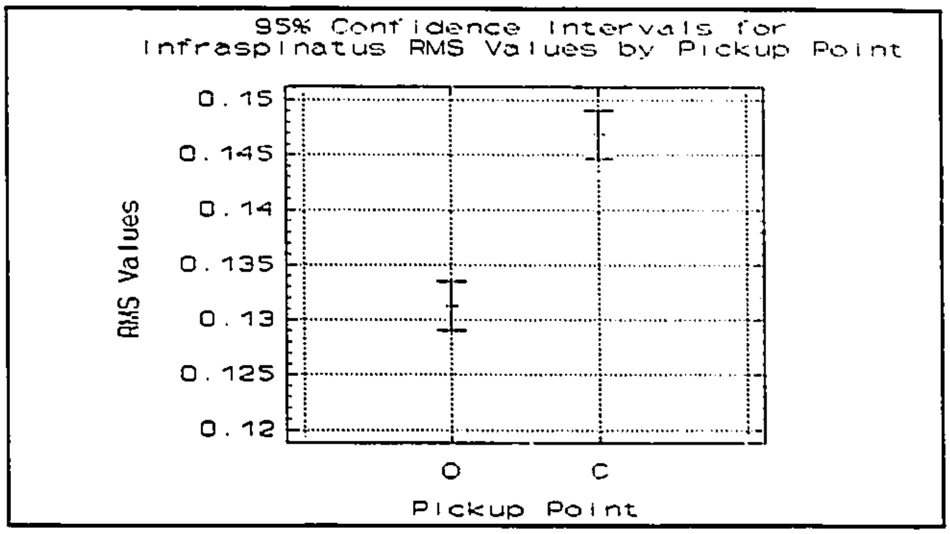

Figure 22 Intervals of Means of Infraspinatus RMS Values by Pickup

If the ANOVA table displayed any significant effects due to interaction of the board and pickup, a check was done of the confidence intervals of the mean, for the interaction. Statgraphics calculates the interval at a 95% confidence level using the Least Significant Difference (LSD) method. A discussion of the LSD methodology can be found in Montgomery (1991). The results are tabulated in Table 8.

Table 8 Differences in Stations Based on RMS Interactions

Gender	Muscle	Force Required
Female	Deltoid	All Others < So
Male	Deltoid	All Others < Io
Female	Trapezius	none
Male	Trapezius	none
Both	Infraspinatus	All Others < Vc

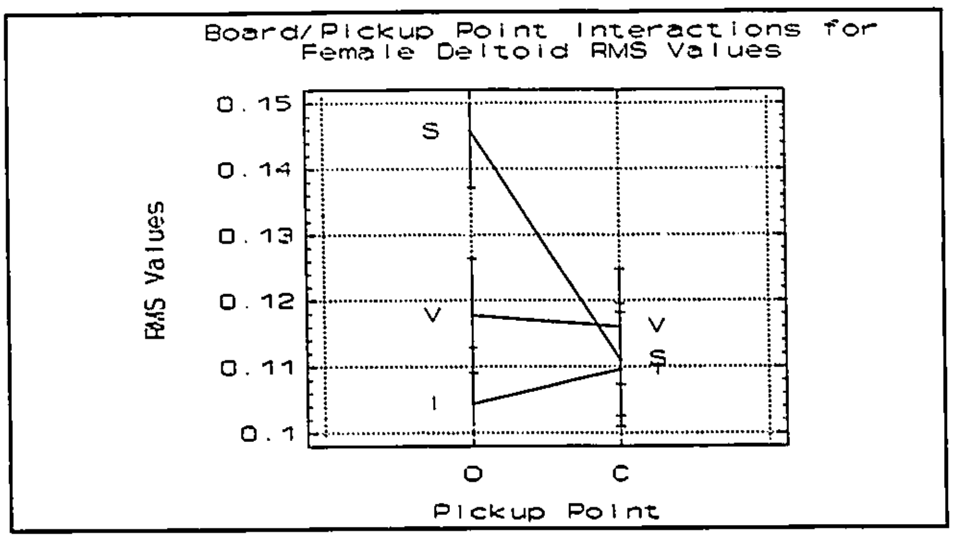

Figure 23 Board/Pickup Interaction for Female Deltoid RMS Values

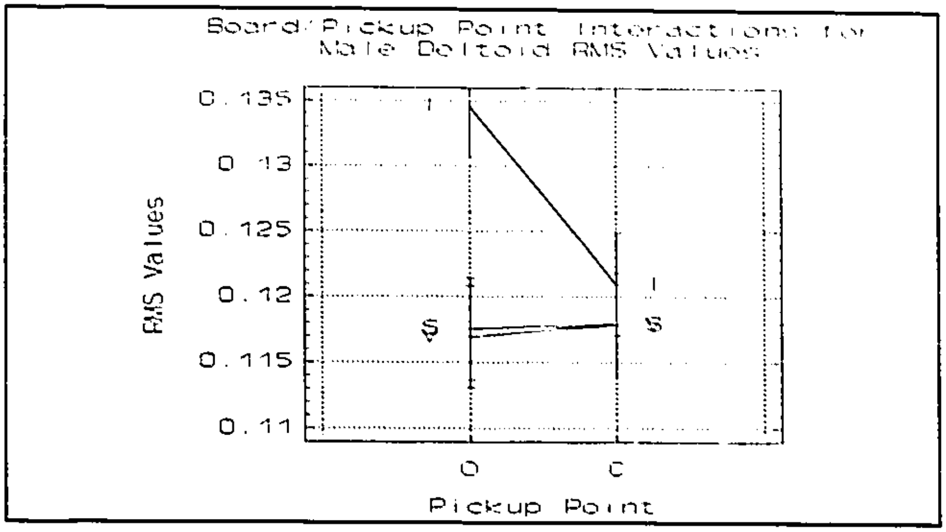

Figure 24 Board/Pickup Interaction for Male Deltoid RMS Values

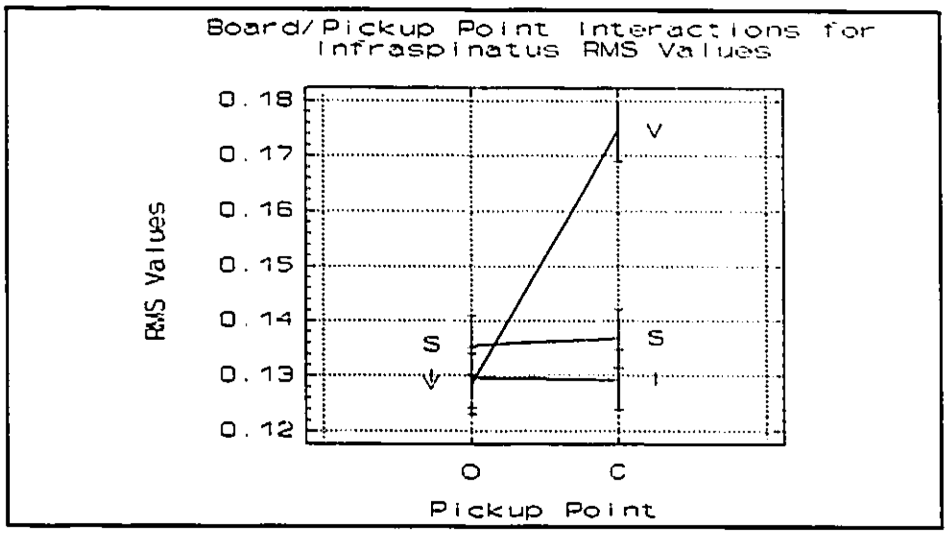

Figure 25 Board/Pickup Interaction for Infraspinatus RMS Values

Figures 23, 24 and 25 show the significant interactions between board and pickup point. Using these results, it was possible to identify some stations that could be avoided, due the increased force required. Specifically, both genders would avoid using station Vc, due to the requirements of the infraspinatus muscle. Also, for consideration of the effects on the deltoid muscle, females be kept away from station So and males from station Io.

The analysis for this section can be found in Appendix U.

4.5 Analysis of MPF Values

The raw MPF values were not analysed in a manner similar to the RMS values. However, it should be noted that they were all roughly in the 200 to 500 range. This corresponded to measurements by Genaidy et al. (1991), where frequency measurements were made of muscles during a static task, with varying loads. With a load of zero, the mean power frequencies ranged from approximately 280 to 350 over the twenty second duration of the experiment and had a standard deviation of up to 330. When a load was introduced, the frequencies fell below 100. Thus, with the MPF values calculated during the mail sorting task, it could be argued that the task was a "light" task, as it was roughly analogous to the static task of holding one's arm motionless for twenty seconds with no load.

Attempts to determine a linear regression model for the occurrence of statistical signs of fatigue yielded one significant model. It was for a simple regression model of the form $y = a + bx$, with the fatigue score as the dependent variable (y) and the MPF slope of the deltoid muscle as the independent variable (x). The calculated model provided the equation $y = 0.43 - 0.075x$.

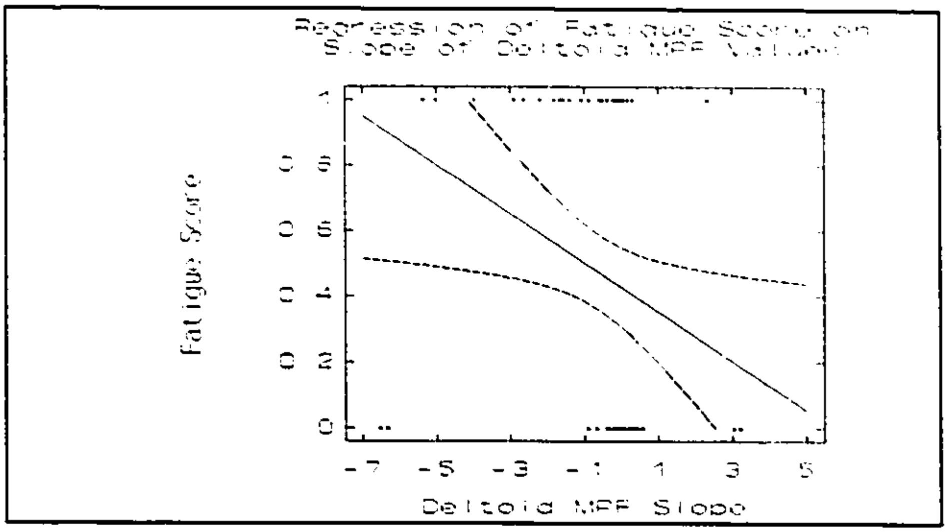

Figure 26 Linear Regression Model for Statistical Indications of Fatigue

The analysis for this section can be found in Appendix V.

4.6 Reliability

In trying to determine when or how often statistical signs of fatigue will occur, an analogy can be drawn to reliability testing. If the occurrence of signs of fatigue is considered to be a "failure", it would be possible to predict the mean time to its statistical occurrence and the occurrence rate over a eight hour working day.

The exponential distribution is frequently employed in reliability testing. The equations used are presented in Appendix W. The results for the "mean time to failure" for each station are listed in Table 9, along with 95% confidence intervals for the mean.

Table 9 Mean Time to Signs of Statistical Fatigue (all times in minutes)

Station	Mean	Interval
So	124.0	(68.8,287.2)
Sc	428.7	(178.0,2079.2)
Vo	154.1	(82.6,383.4)
Vc	183.8	(94.5,500.9)
Io	299.3	(136.5,1098.2)
Ic	179.3	(92.2,488.6)

Over an eight hour period, the reliability of station Sc would be the best. It would have a 33% reliability. This means that 67% of all individuals working at this station could be expected to develop signs of muscle fatigue. This did not take into account rest cycles, but was still a very high rate.

5 DISCUSSION

5.1 Fatigue Indicators

The primary point of this study was to analyse the sorting task and station design as they relate to the possible onset of CTDs. Analysis of the RMS and MPF values, as indicators of localised muscle fatigue, indicated a high incidence rate. However, there was no evidence that any of the differences in station designs used in this study contributed directly to the occurrence of fatigue.

The analysis of the envelope count indicated that the number of envelopes sorted during the experiment was not affected by gender, board used or the mail pickup point. These three factors did not appear to play a role in the occurrence of signs of muscle fatigue. Also, the occurrence of statistical signs of muscle fatigue did not appear to be dependant on any of these factors. Furthermore, analysis of how many envelopes the workers picked up from the pickup points did not show any differences in how the mail was handled. Together, these factors would tend to indicate that the occurrence of muscle fatigue indicators was not due to the rate at which the work was performed, how many times workers reached for additional mail or to any differences in the designs used in the experiment. Since this was the case, the occurrence of fatigue may be a result of the actual mail sorting task or it may be due to common properties of the station designs that were used. It was possible that the different stations used were not different enough in size and shape to evoke statistically significant result.

A look at the low reliability rates shows that if workers are repeatedly exposed to working at stations of this design, they will be exposed to signs of fatigue on a regular basis. Over time, they will likely develop symptoms of CTDs. It is very likely that all workers could be affected and that this could lead to permanent injuries to workers. In addition, the employer would suffer, due to high medical costs and reduced productivity that would ensue.

5.2 Subjective Ratings

The score of the subjective ratings were not significantly different for differences in station design. There were some differences between gender for six of the nine body parts considered. Analysis of the variance, of the six body parts that did show differences due to gender, indicated that the variance of four of these body parts were not statistically different. The two remaining body parts indicated a greater variance in the female scores. This is likely due to the fact that fewer females participated in the study. However, the fact that four of the variances were statistically similar indicates, that even with the unequal sample sizes, the differences do appear to be true gender differences.

The three body parts that did not have significantly different scores between genders were the neck, shoulders and the wrists/hand (Figures 27, 28 and 29). It was notable that these three parts of the body were the ones most utilised in the sorting task, as they were continually in motion during the task. In addition, the muscles that were selected for analysis were all in the neck/shoulder region of the body, since they were the muscles most utilised in the sorting task.

This fact may indicate that the single greatest factor in rating the perceived exertion of the various parts of the body was the direct relationship between the physical task in question and the utilisation, for the task, of the various parts of the body. This would have a greater effect on the perceived rating than any effect due to gender. In this instance, since the neck, shoulder and wrist/hands were the parts of the body most directly related to the sorting task, any inherent gender differences were downplayed in favour of a response due to the actual perceived exertion of the task. The remaining scores, for body parts not directly related to the task, may be scored more due to gender differences than any other factor.

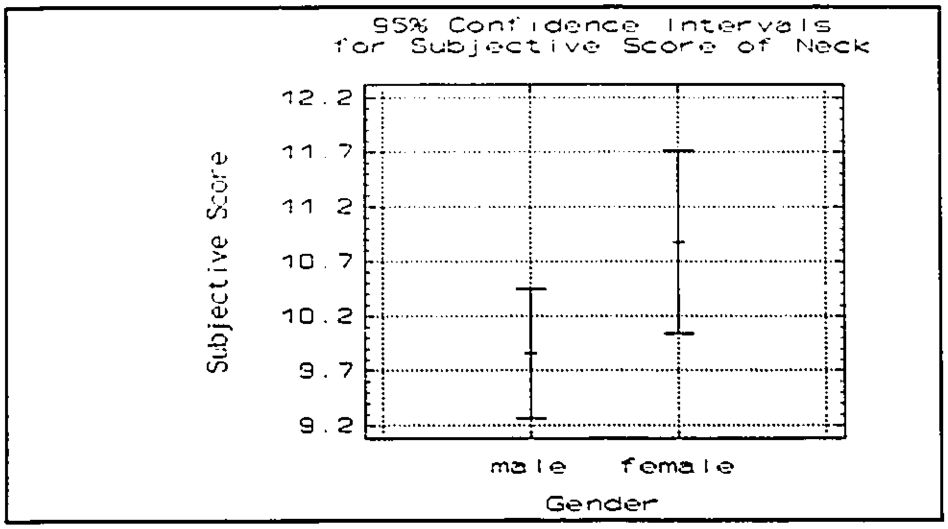

Figure 27 Intervals of Means of Subjective Scores: Neck by Gender

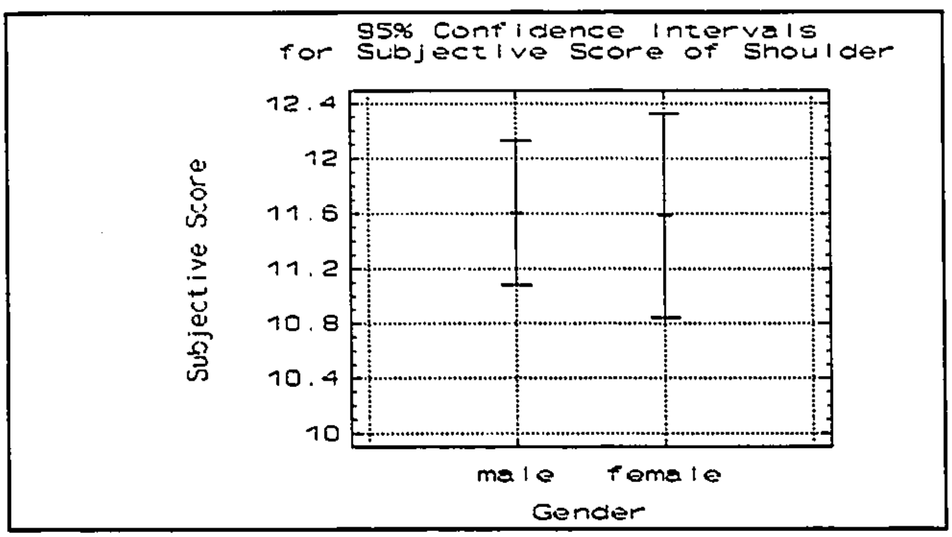

Figure 28 Intervals of Means of Subjective Scores: Shoulder by Gender

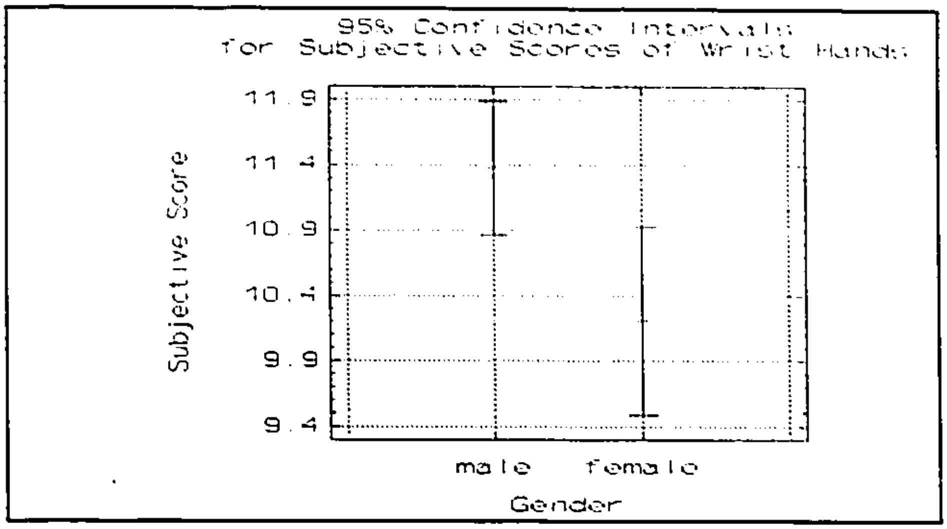

Figure 29 Intervals of Means of Subjective Scores: Wrist/Hand by Gender

When comparing the subjective scores only within genders, it was found that there were no significant differences recorded due to station design. There were differences in some results due to the part of the body being rated. The males tended to score the upper half of the body higher than the lower half, while the females recorded significant differences only for certain joints.

Males scored the upper part of the lower than the lower half of the body. Specifically, the neck was the lowest score. The wrist/hands, upper back, elbow and shoulders formed a homogeneous group, and were rated higher than the neck. The four lower parts of the body did not form a homogeneous group, but were all rated higher than the previously mentioned body parts. This may tend to indicate that the ratings were a result of some common element of the experiment, likely the fact that the experiment was performed while standing up. Even though mail was sorted continuously throughout the experiment, the standing and walking from side-to-side seemed to require a greater exertion on the lower half of the body than the sorting of mail requires of the upper half.

The scores of the females did not form any readily apparent groups. The three lowest scores were of the hips/thighs, elbows and knees. The only comment that can be made at this time, is that all three of these are major joints of the body.

The results of the correlation testing indicate that, for males, the higher the subjective score for the neck, shoulders or upper back, the more likely that there would have been indications of fatigue. This is likely due to the fact that the muscles being studied are in the neck/shoulder and upper back area. If these parts of the body were experiencing signs of fatigue, it is reasonable to assume that the males would have provided a higher score for these areas. The coefficients for the neck, shoulders and upper back, were, respectively, 0.46, 0.38 and 0.35. This indicated a fairly significant relationship between fatigue score and the subjective ratings.

The results of correlation testing for females displayed different results. The positive correlation between fatigue score and subjective scores for the wrist/hands and hips/thighs indicated that statistical signs of fatigue were more likely to occur when these two scores were higher. This was possibility a result of using the wrist and hands to sort the mail, continuously, over the two-hour period. The result for the hips and thighs may have been a result of using bending the body more to lean into the board while sorting. This was probably done while turning the body, to the appropriate mail slot, using the hips and thighs to direct themselves to the slots. The negative correlation between envelope count and the scores for the shoulders, lower back and ankles/feet, indicate that as fewer envelopes would be sorted as the perceived exertion increased. A possible explanation for this, is that as the discomfort increased in these areas of the body, the females would not be able to sort as many envelopes. This would have been particularly true for the shoulders, as they are in motion throughout the experiment, and for the lower back and ankles/feet, since the subject was standing for the entire two-hour period.

5.3 RMS Values

The analysis of the RMS values yielded statistically significant results. It was found that, for the deltoid muscle, the best board for use by females was the inclined board and that the worst choice for males was the same inclined board. This was likely due to the adoption of different strategies by the genders in sorting the mail. The inclined board tends to follow the work envelope of the arm more closely than the other boards. As such, the deltoid muscle, which is doing most of the work in the sorting task would have had less force required to complete the task. if the operator tended to always face the board directly. If the operator adopted a strategy of walking back and forth in front of the board, the advantage of following the work envelope would be lost if the operator was often at an angle to the board.

In analysis of the trapezius muscle, males showed no differences in the RMS values. In the sorting task, the greatest effort of the trapezius muscle would have come from moving the head and neck to identify the appropriate slot for sorting or from excessive rotation of the shoulder. Since males did not have any significant differences, they would have moved the head and neck in a similar manner, regardless of the board. The females, however, required less force from the trapezius muscle for the straight board. This indicated that they could see the board better and that they did not have to move their neck as often to see the slots or that due to the regularity of the board, it did not require excessive shoulder rotation to find the appropriate slot for sorting.

The infraspinatus muscle, because of its position in the back, was least affected by gender differences. It would primarily have been affected by the arm reaching across the body to sort letters. Both genders showed a smaller force requirement for the inclined board. Again, this is likely due to the fact that the inclined board most closely follows the arm's work envelope.

5.4 Linear Regression Model

The linear regression model that was determined, with the fatigue score dependent on the slope of the MPF value of the deltoid muscle indicated that as the slope of the MPF tended farther towards a negative slope, the chance of an occurrence of statistical signs of muscle fatigue increased.

It is already known that a negative slope of the MPF values is an indicator of fatigue. In this study, the deltoid and infraspinatus muscles had the highest rates of occurrence of signs of muscle fatigue. Therefore, one would expect that the MPF slope of the infraspinatus muscle would also be an statistically significant indicator of muscle fatigue in a linear regression model. However, this was not the case. The deltoid muscle may have been the only significant muscle in this case because it did the bulk of the work in the sorting task.

Further study would be required to determine if there is a significant difference between muscles that show high rates of statistical indicators of muscle fatigue and those that are also significant predictors in linear regression models.

5.5 Selection of Station

In using this study to determine a preferred station for sorting, one can look at the high incidence rates of muscle fatigue indicators, and would be unable to recommend any of the station designs. The reliability figures indicate that approximately two-thirds of all workers would show statistical signs of muscle fatigue, on a daily basis. Analysis of design factors, using statistical indicators of fatigue and subjective ratings, did not reach any particular conclusion. Next, it was possible to look at using the RMS values, since they are roughly proportional to force, to determine which of the stations was most suitable for use. After the three stations that appeared to require a higher amount of force (So, Io, Vc) were eliminated, there then remained three choices of stations, namely Sc, Ic and Vo. If it was absolutely necessary to select stations for use based on the available results, one of these three stations could have been selected. However, selection of a station from RMS values alone may not be a reliable method. RMS values are proportional to force but the relationship of force to amplitude signals can be affected by other factors (Wells and Patla, 1985).

What is needed is to redesign the type of station that will be used. By following certain design principles, the effort required in the task can be reduced. Improvements that can be made would include elimination of awkward reaching and allowing for improved postures. Currently, subjects must reach above shoulder level to sort the envelopes, which is an action that should be eliminated. The highest row to sort mail should be at or slightly lower than shoulder level. Secondly, without a seat, subjects were on their feet for a long duration and tended to adopt individual, sometimes awkward, postures while sorting. The station needs to be redesigned so that the worker can carry out the required task while in a seated or standing position. This would allow the worker the ability to sit or stand (or lean against an object) at leisure, without being required to stand for a prolonged period of time or being forced to adopt a static seated position.

If the idea of placing the top of the sorting station below shoulder level is taken a step further, the station would be placed even lower so that the operator could be "above" the station. Ideally, the slots would be located below the operator's shoulder such that the operator could drop envelopes into the appropriate slots.

Currently, the operator must push or "flick" the envelopes into slots, which requires a greater effort from the wrist. If the effects of gravity were considered in such a design, then a station with slots that are vertical rather than horizontal could be employed.

5.6 Decision Making

One aspect of this study, which has not been addressed, involves the fact that some decision making was required by the subjects. The subjects must process the information that they received from reading the letter and correctly determine the slot in which to place the letter. The subjects were required to correctly determine the city for which the letter was being sent, and for Windsor addresses in this study, which postal code or other sub-division the address belonged to.

The stages of word recognition involve proceeding from the stimulus to feature analysis (ie. straight or curved lines, etc.) to letter analysis and finally word recognition. Errors in sorting, which were not monitored in this experiment, can be made. Categories of errors that could occur in mail sorting include mistakes (failing to form the right intention), slips (incorrectly carrying out the right intention) and lapses (failure to carry out an action) (Wickens, 1992). Examples of how these errors could occur include identifying the city on the envelope incorrectly and placing the mail into the slot for the incorrect city (mistake), placing the envelope into the incorrect slot after identifying the correct city on the envelope (slip) and not sorting the envelope at all because it was dropped and left on the floor (lapse). It should be noted in this study, that no consideration was given to the effects of decision making or vigilance.

5.7 Rest Cycles

The use of rest cycles may play a role in the reduction of CTDs. Reliability calculations have been made to project the effects of mail sorting over a standard eight hour workday. However, these figures do not take into account the effect of rest cycles.

The main purpose of rest cycles, in a task such as mail sorting, is to make allowances for fatigue and to allow the muscles sufficient time to recover from the effects of work, so as to avoid any impairment to the muscle. Konz (1990) discussed four different methodologies for calculating work allowances. The main considerations include the dynamic load, cycle time, posture and clothing. There was also consideration given for allowances due to mental fatigue.

While the effects of rest cycles were not measured in this study, what is of most interest is the effect of the rest period on the EMG signal. Baidya and Stevenson (1988) measured the effects on the mean frequency, for five and ten minute rest periods, for a simple repetitive task. They found no significant difference with regard to the length of the break. Furthermore, the MPF slopes showed a general downward trend, a characteristic consistent with signs of fatigue in the muscles. However, Sundelin (1993) found that MTM-paced work, with 10 minute rest intervals each hour, were able to reduce the slopes of both RMS and MPF measures. While rest cycles may not necessarily stem the occurrence of muscle fatigue indicators, they do appear to inhibit its occurrence somewhat.

In order to draw any reasonable conclusions on the effect of rest cycles vis-a-vis characteristics of the EMG signals received, further testing would need to be done.

5.8 Sources of Error

In this experiment, it was not possible to measure the accuracy of the individuals sorting the mail. The mail was placed into pigeon-hole slots which had no backing and was allowed to accumulate behind the station. It is inconceivable that each subject placed each letter in the correct slot every time. If the slots involved were in rows at the top or bottom of the board or towards the far left or right hand columns, the work would be slightly more or less difficult and would show a corresponding difference in the EMG signal.

A second source of error was that of inter-subject variability. This would be due to the fact that subjects may perform differently on different days. Subjects were allowed to select the time of day that best suited their personal preferences and schedules. Days that were particularly busy for subjects were skipped and rescheduled.

5.9 Recommendations for Future Work

The main consideration in studying human work is to design operations and/or workstations that allow the work to be completed as quickly as possible, with little risk to the operator. The risk, if this is not done adequately, is that workers will begin to develop signs of CTDs.

The basic process of this occurrence is that the worker will perform some repetitive task. At some point the stress will become excessive and the muscle will experience localised fatigue. If this occurs often enough, the muscle could experience either temporary or permanent damage.

What will often happen is that CTDs will first occur and then attempts will be made to rectify the problem. What is needed to prevent CTDs is a proactive, rather than reactive, approach to the problem. To some extent, a proactive approach is possible with the use of various design principles, ergonomic checklists and other subjective measures that are available to measure various aspects of a station/job design.

What is not available is a quantitative method for determining when or how certain work methods will become dangerous to a muscle. There are certain methods to measure the performance of a muscle, which include EMG signals. From this, it may be possible to develop indexes describing the performance level required (ie. difficulty) and the effects of repetition. Since a combination of these factors could lead to CTDs, the goal would be to determine at what point, statistically, CTDs may occur.

This study, for example, was a situation where a task was analysed to determine the occurrence of statistical indicators of fatigue. The question raised from the results would be to determine at what point these statistical indicators will lead to CTDs. Factors that could be used to measure CTD risk, would include differences due to individual variability and specific task elements. These elements of the task can be quantified in various ways and could include both subjective measurements (eg. questionnaires) and direct measures of performance (eg. EMG signals), number of days working at these tasks (ie. time) and aspects due to the length of work cycles, repetition of tasks and rest cycles.

One avenue for doing this could lie in further investigation of the results of Genaidy et al. (1991). The MPF was measured for a simple task with different loads. The results indicate that the MPF deceases as the load increases. A possible use of this could be to study fatigue and CTDs in simple tasks and then extrapolate the results to more complicated work patterns. For example, if a particular work task was found to have an MPF value roughly equivalent to holding a 10 kg weight, an investigation could be carried out of the latter task, as it would be easier to control under laboratory conditions. However, problems could occur if different muscles do not react to events in a consistent manner. Also, the method of extrapolating results may not be sufficiently accurate to ensure proper results.

6 CONCLUSIONS

The current design used for manual postal sorting is inappropriate. The designs that were tested in this study were meant to mimic actual stations used in industry. It was found that use of these stations will lead to a high incidence rate of statistical indicators of localised muscle fatigue. Since localised muscle fatigue can lead to repetitive strain injures, methods should be taken to reduce its occurrence.

The analysis based on the EMG signals of the subjects did not determine if any particular layout or pickup point was preferable for mail sorting. Analysis of the RMS and MPF values indicated statistical signs of fatigue on a number of occasions, but the occurrence was apparently not a result of any aspect of the station design. As such, it can be considered to be inherent to the task of mail sorting at the stations used. Two of the layouts used in this study were derived from the first layout (ie. Straight Board), and perhaps, were not sufficiently different to produce discernable differences.

Analysis of the raw RMS values did produce some statistically significant differences with regard to station design. However, since there were no significant results due to station design for statistical occurrence of fatigue, it was not possible to draw any conclusions from this evidence. This was so, because, while the RMS value if roughly proportional to force required, it is not an exact measure. As such, it was not possible to determine if the force required by certain muscles was excessive without additional proof.

The use of subjective ratings by the subjects was not able to distinguish design aspects of the stations from one another. Of nine different divisions of the body that were used, there were significant differences only due to gender, six times. The gender differences appeared to be true gender differences. Also, it was significant to note that the three body divisions that did not have gender differences were parts of the body most directly related to the actual task performed by the individuals. If the gender differences were true differences, then subjective ratings may only be useful for body parts directly involved in a particular task.

None of the stations that were tested was considered to be suitable for postal sorting. A redesign of the station is necessary, in order to eliminate the occurrence of statistical signs of fatigue. Using standard ergonomic principles, some guidelines for a new sorting station can be developed. The key points are to allow the operator flexibility in posture with seated and standing positions, to ensure that the operator need never raise the hands above shoulder level, to eliminate the requirement for the body to turn from side-to-side and to allow the operator to drop, rather than place, envelopes into slots.

It is also important to note, that this study was an example of a reactive, rather than proactive, method of ergonomic analysis. In order to conduct the study, it was necessary to go through a complete and time consuming study and analyse recorded data to make a determination of incidence rates. The analysis done was very much specific to the task. It is necessary to do this because there is no coherent method for an engineer to determine a risk factor of CTD occurrence from the analysis of EMG signals.

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APPENDICES

A Consent Forms

CONSENT FORM

I, ____________________________, am participating in this study of my own free will. The decision to participate is completely voluntary on my part. No one has coerced or intimidated me to participate.

The Investigator has answered any and all questions I have asked about this study, my participation, and the procedures involved, which are described in the attachment to this consent form, which I have initialled.

I understand that the Investigator or his Supervisor will be available to answer any questions concerning procedures throughout this study. I understand that if significant new findings develop during the course of this research which may relate to my decision to continue participation, I will be informed. I further understand that I may withdraw consent at any time and discontinue further participation at my discretion. I understand that the Investigator or the Supervisor or any medical consultant may terminate my participation in this study if it is felt to be in my best interest.

I do not have any disorders of my cardiovascular system, my spinal column, within my wrists, arms, shoulders or neck or any other disorders or deficiencies that make it inadvisable for me to participate as a subject in this experiment.

I understand that the results of my efforts will be will be recorded but that no photographic record will be made of the experiment. I consent to the use of the recorded information for scientific or training purposes and understand that any records of my participation in this study may be disclosed only according to federal and provincial law and that no one will be able to identify myself as a participant in this study from the reporting of any results or conclusions reached by the Investigator. I also understand that personal information will not be released to an unauthorized third party without my permission.

I understand that I will be compensated at the minimum wage rate as set out by law. This money will be paid to me at the conclusion of my participation in this study. I understand that I will not be paid if I do not complete the study, unless I have a medical or other valid reason for not completing the study and documentation to support this fact.

I FULLY UNDERSTAND THAT I AM MAKING A DECISION WHETHER OR NOT TO PARTICIPATE IN THE STUDY. MY SIGNATURE INDICATES THAT I HAVE DECIDED TO PARTICIPATE UNDER THE CONDITIONS DESCRIBED ABOVE.

____

Volunteer Signature Date

____

Signature of Witness Date

This study has been cleared by the Ethics Committee of the University of Windsor. Any questions or comments concerning research ethics can be addressed to the Office of Research Services at (519) 253-4232, Ext. 3916. Any other questions or comments concerning study procedures may be addressed to the Department of Industrial Engineering at (519) 253-4232, Ext. 2607.

ATTACHMENT TO CONSENT FORM

You are invited to participate as a subject in an experiment to measure stress and fatigue in the shoulder-neck area in the performance of a postal sorting task. The data gathered in this study will be used to study the relative merits of several different designs of sorting stations. In addition, a normal strength exertion test will be conducted.

The postal sorting task encompasses approximately twelve different designs with two hours of work required to complete testing on each design. The times to conduct the experiment will be scheduled at mutually convenient times. If more than one design is to be tested at one sitting a rest period of one-half hour will be permitted between testing of designs in order to simulate a real-life work situation. In performing the task, you will be required to work at a "normal" pace, suitable to your own abilities.

In measuring your performance, three surface electrodes will be attached to your skin in the shoulder-neck area to monitor muscle activity. In agreeing to participate in this study you acknowledge that you have no objection, medical or otherwise, to being monitored in this manner. It is possible that you will experience temporary muscle soreness or fatigue as a result of participation in this experiment.

The results of your participation will be recorded and analyzed. Only overall results of all subjects who participate in this study will be reported. There will be no reporting of results in a manner that would allow anyone to specifically identify your specific results.

Before your use as a test subject, you must inform the Investigator or Supervisor of any change to your physical status. This information will include any medication taken or medical care or conditions that will directly or indirectly affect the experiment.

If you have any questions you can reach the Investigator (Chris Kourtis) or Supervisor (Dr. S. Taboun) via the Department of Industrial Engineering at the University of Windsor at (519) 253-8132, extension 2607, during normal business hours.

Subject's Initials: ______________________________

B Diagrams of Layouts Used in Experiment

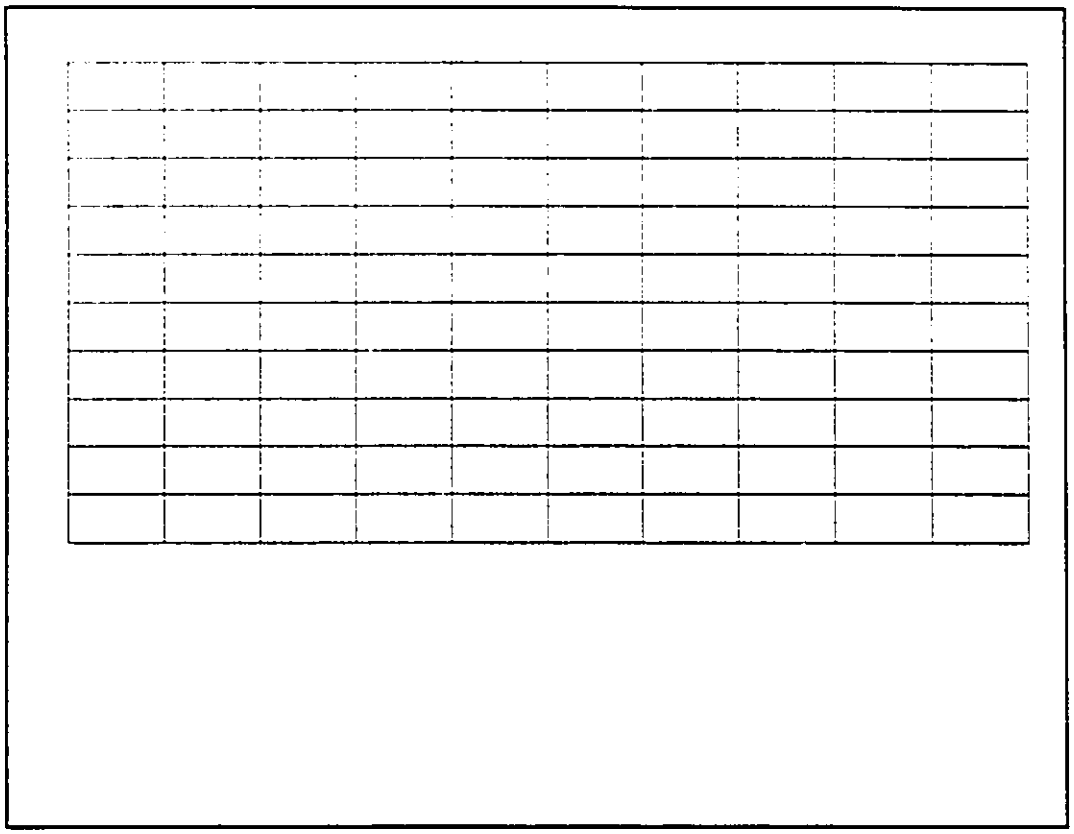


Diagram of Layout A (Straight board)

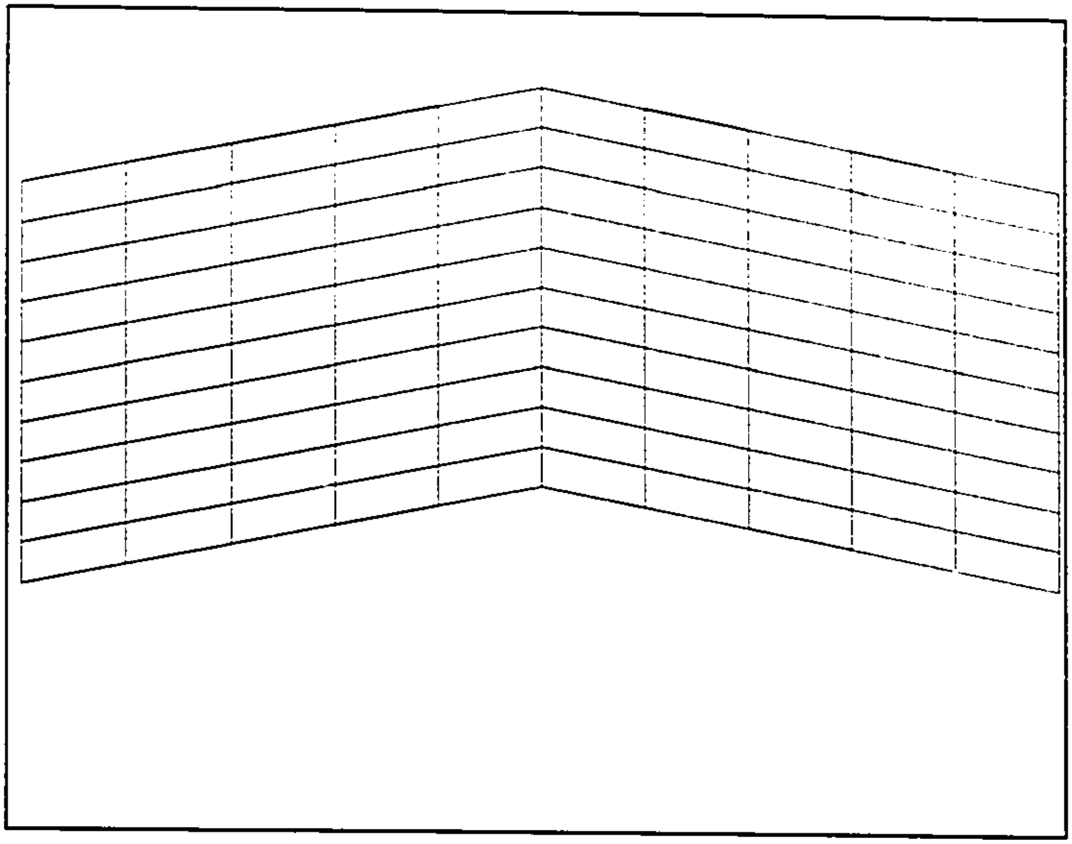


Diagram of Layout B (V-shaped board)

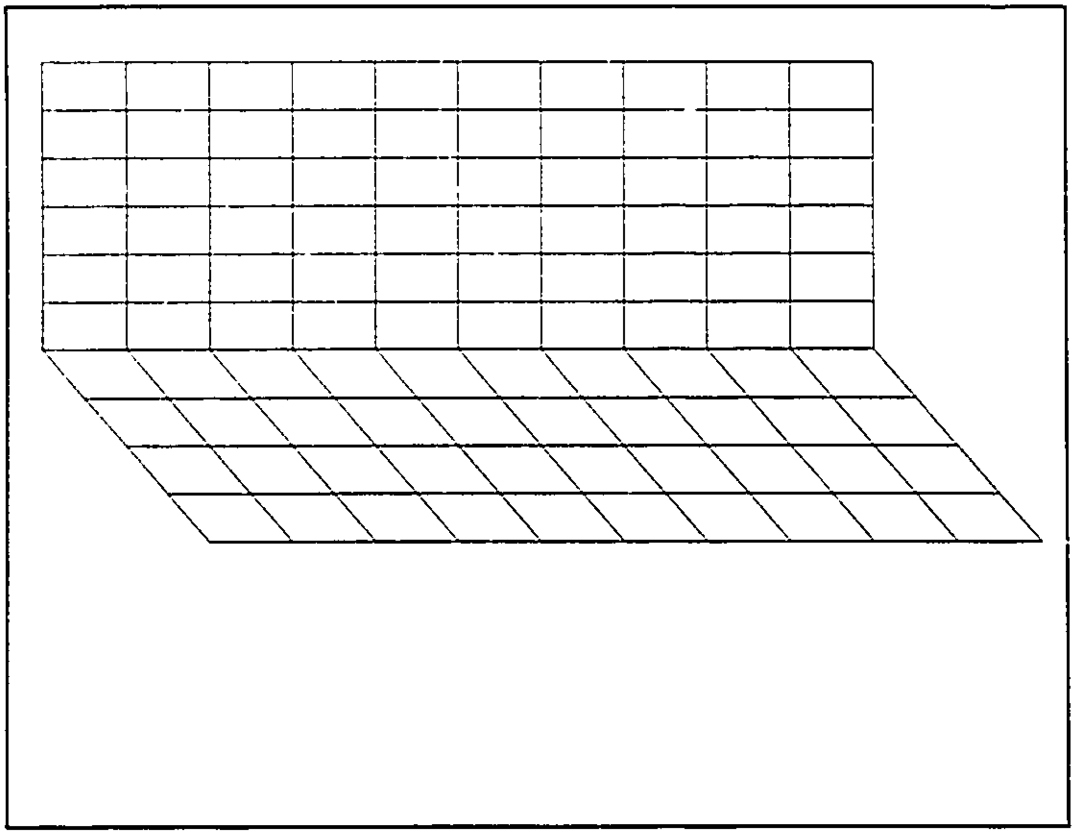


Diagram of Layout C (Inclined board)
(Top six rows straight, bottom four rows angled towards subject)

C Written Instructions Given to Subjects

EXPERIMENTAL INSTRUCTIONS

You are being asked to participate in a study which involves the manual sorting of mail. You will be required to handle envelopes and place them in appropriate slots corresponding to the address on the envelope. There are 100 different slots for mail to be placed in. They are presented to you in the sorting station in 10 columns with 10 slots in each column, for a total of 10 rows.

The columns are arranged as follows:

The three left-most columns are all for mail with a Windsor address. From top to bottom the left-most column contains nine slots for mail addressed to postal codes beginning with N8 (eg. N8Y) arranged in alphabetical order, followed by a slot specifically for mail addressed to the City of Windsor. The next column contains seven slots for mail addressed to postal codes beginning with N9 (eg. N9A), followed by slots for mail specifically addressed to Chrysler, Ford and General Motors. The third column has five slots for mail addressed to different post office boxes (ie. Postal Station A and stations in LaSalle, Sandwich, Tecumseh and Walkerville), three slots for mail addressed to rural routes (RR1, RR2 and RR3) and two slots for mail addressed specifically to St. Clair College and the University of Windsor.

Please note that postal codes for mail addressed to a post office box or a rural route do not begin with N8 or N9, while mail addressed to the six specific organizations will begin with N8 or N9.

The next six columns contain the names or sixty Ontario cities or towns. They are arranged in alphabetical order top to bottom and then left to right. The right-most column contains nine slots for the other nine provinces arranged in alphabetical order, with a slot for mail addressed to the United States at the bottom.

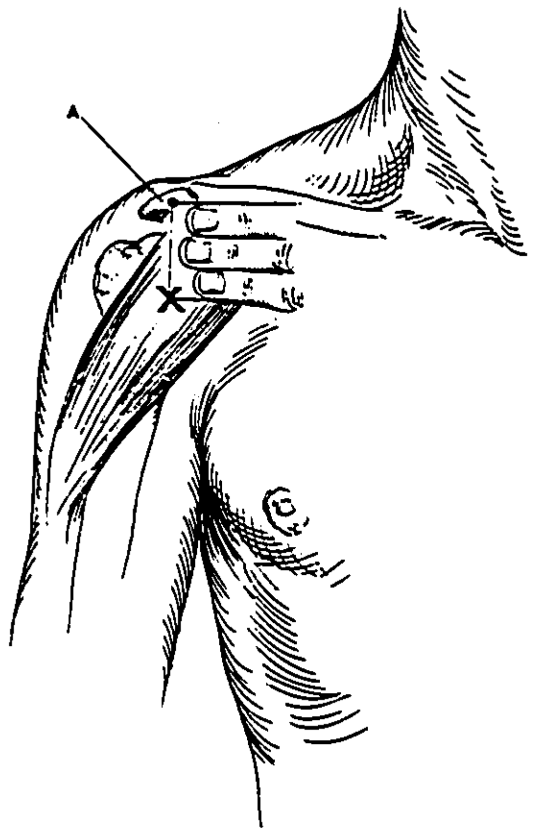
Your task is to sort the mail that is given to you into the correct slots. You should work at a normal pace, one that is neither too fast, nor too slow.

D Experimental Order

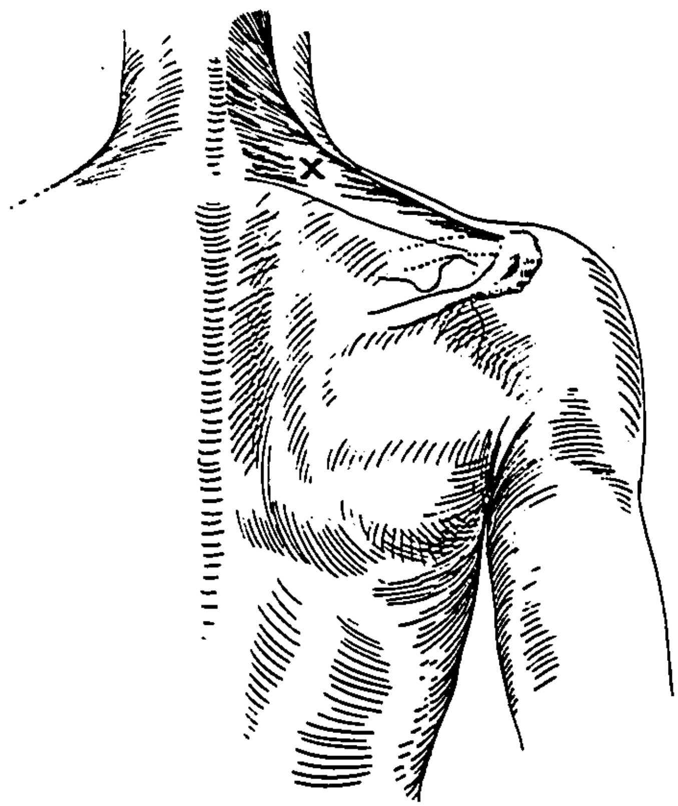
Subject	Sessions					
	1	2	3	4	5	6
1	So	Vc	Vo	Ic	Sc	Io
2	Io	Ic	Sc	So	Vo	Vc
3	Io	Sc	Vo	Vc	So	Ic
4	Io	So	Vc	Vo	Ic	Sc
5	Io	So	Vc	Vo	Sc	Ic
6	Sc	Ic	Io	Vo	Vc	So
7	Vc	So	Sc	Io	Vo	Ic
8	Ic	Sc	So	Io	Vc	Vo
A	Io	So	Vc	Vo	Ic	Sc
B	Ic	Vo	Sc	So	Io	Vc
C	Ic	So	Vc	Sc	Vo	Io
D	Sc	Ic	Vc	Vo	So	Io

E Electrode Placement

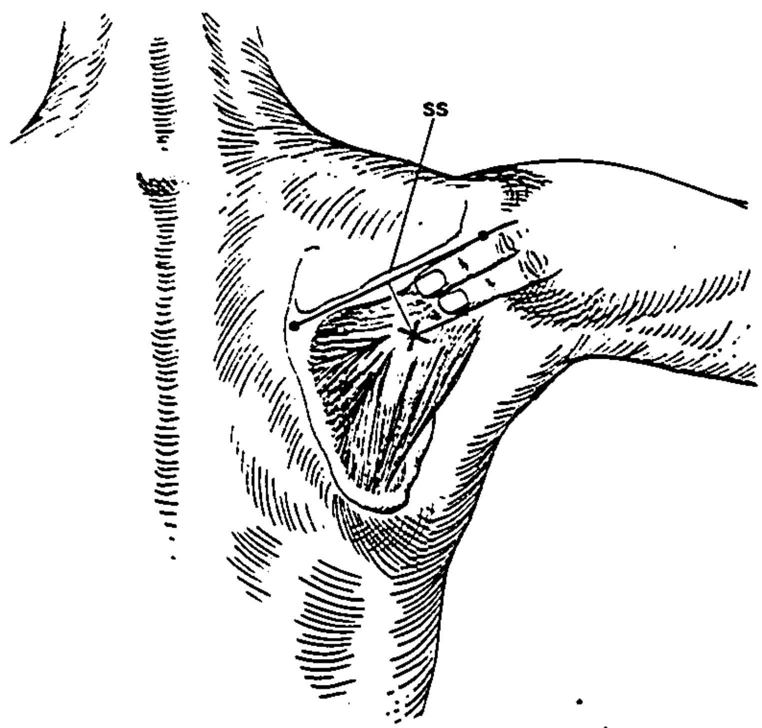
The following diagrams are used to aid in the placement of the electrodes.
They are reproduced from Dalagi et al. (1975).



Placement of Electrodes for Anterior Deltoid



Placement of Electrodes for Upper Trapezius

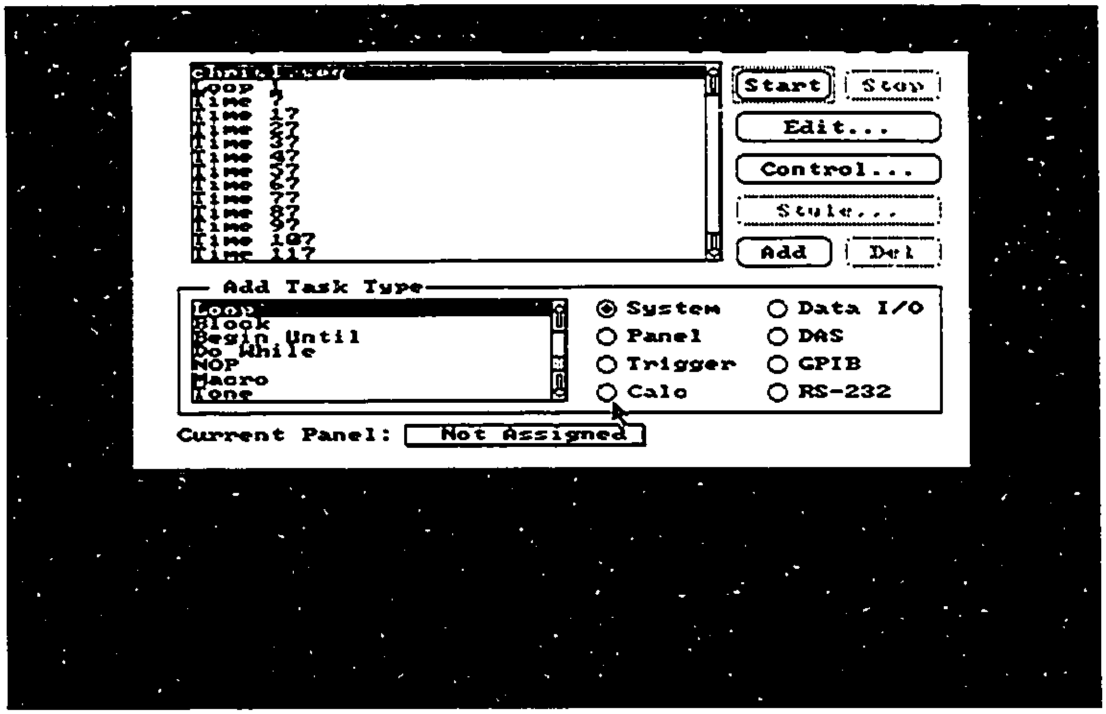


Placement of Electrodes for Infraspinatus

F Preamplifier Settings

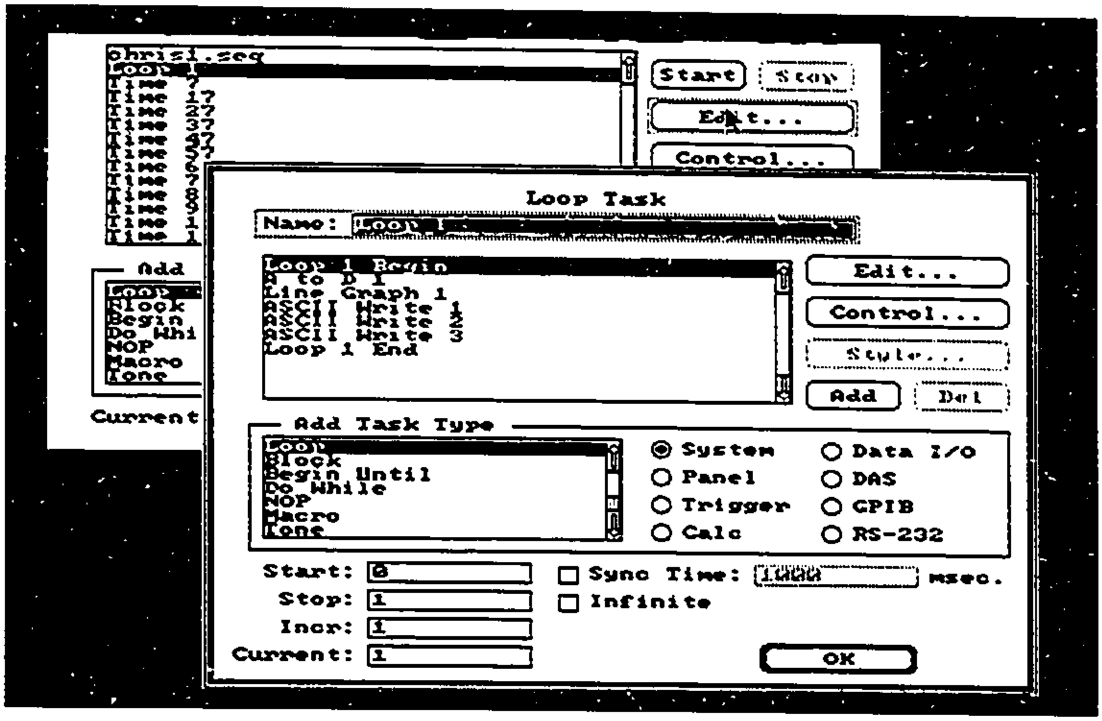
Calibration	1 MV
Input - Use-Cal	Use
- A/C - D/C	D/C
1/2 Amp. Lo Freq.	1 Hz
Amplification	2000 (10 x 200)
Amplification Calibration	Manual Adjustment
1/2 Amp. Hi Freq.	30 Khz
60 Hz Filter	Out

G Viewdac Screens



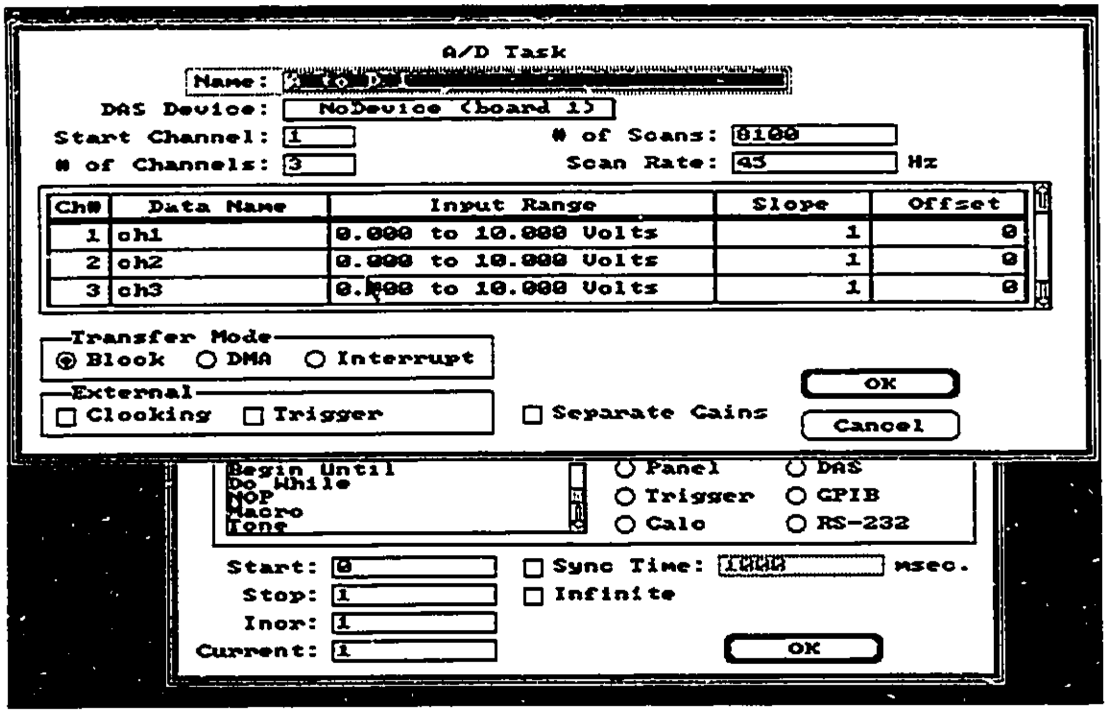
Main Viewdac Screen

This and the following pages contains screen captures of routines in Viewdac used to collect data. This is the main screen.



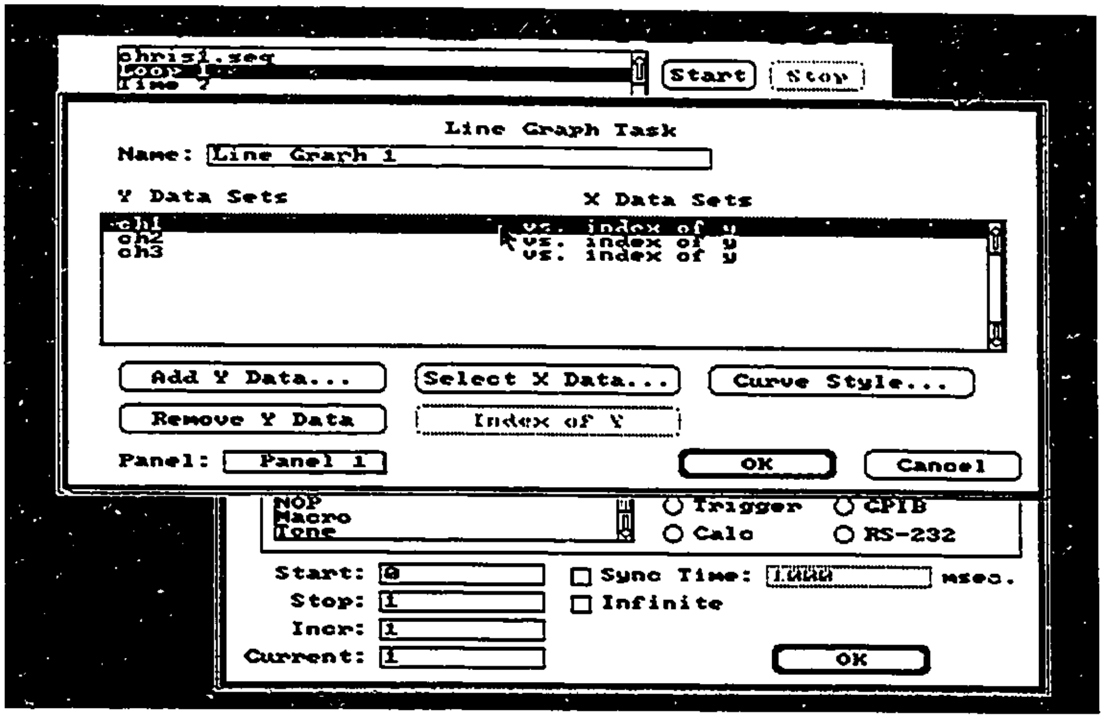
Loop 1

"Loop 1" is the main routine which collects data for three minutes, graphs the data at the end of the three minutes on-screen and prints out data to a DOS file.



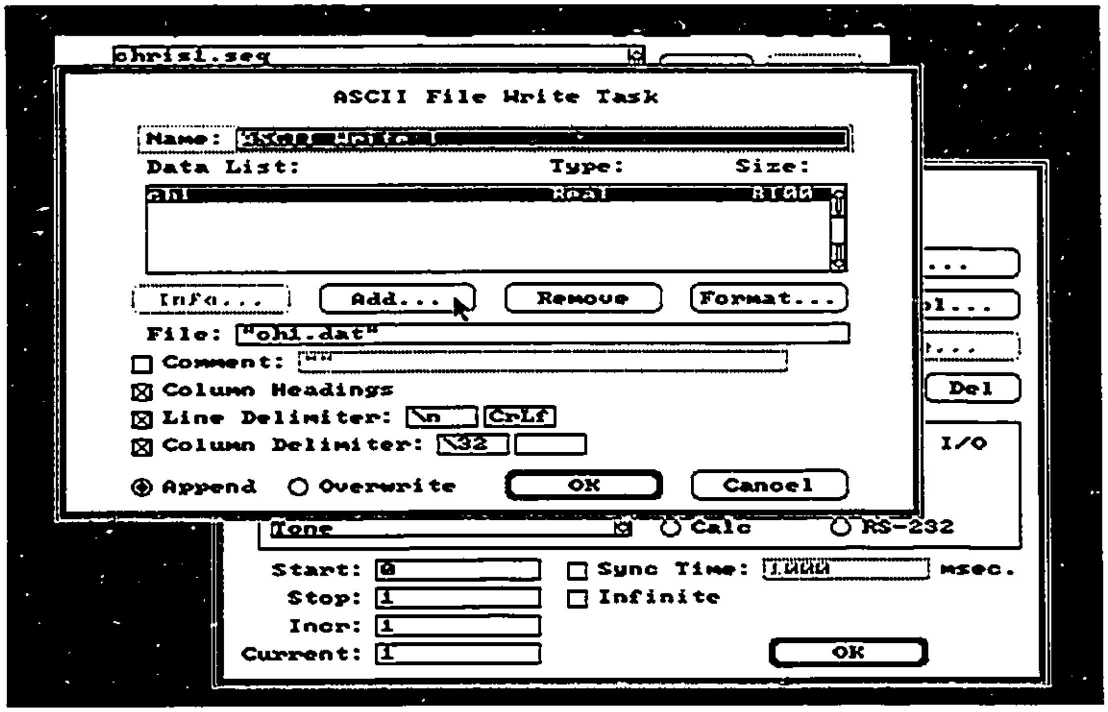
A to D 1

"A to D 1" is the task that collects data for three minutes from each of the three channels at a rate of 45 readings per second.



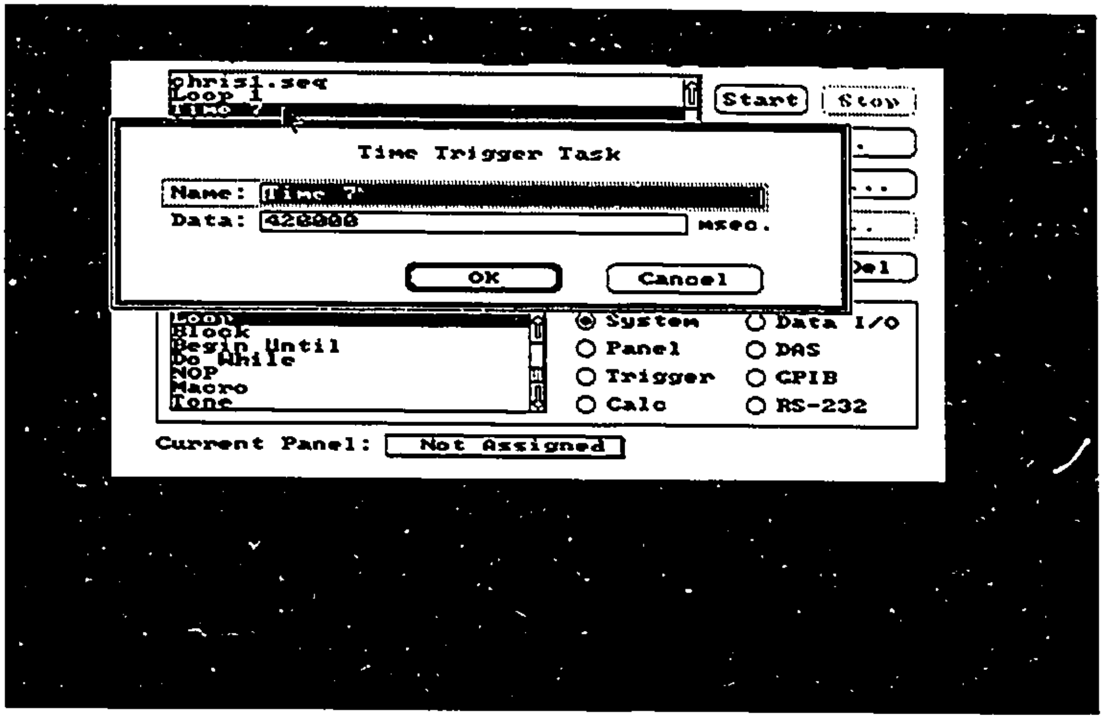
Line Graph 1

"Line Graph 1" prints the collected data to the screen immediately after the three minutes are up.



ASCII Write 1

"ASCII Write 1" appends the data to a DOS file.



Time 7

"Time 7" is a trigger that begins the three minute collection process, in this case beginning at the end of seven minutes.

H RMS and MPF Information

The RMS (Root-Mean-Square) is calculated from the raw EMG values. It is the square root of the mean square value. The mean square value, in turn, is the average of the squared values of each individual EMG signal. The reader is directed to Thomson (1988) for more information.

The MPF (Mean Power Frequency) is computed by first calculating the FFT (Fast Fourier Transform) of the EMG values. This transfers the EMG signal from the time to frequency domain[2]. An algorithm for calculating the FFT, adapted from Chapra and Canale (1988) is given below. Note that it is a two-step process, and that x and y are variables of dimension n. The variable y, which is the complex component, is dropped from the second part of the algorithm. It is not required for the MPF calculation, but is necessary for the process.

```
n2 = n
for k = 1 to m
        n1 = n2
        n2 = n2 / 2
        angle = 0
        argument = 2π / n1
        for j = 0 to (n2 - 1)
                c = cos(angle)
                s = -sin(angle)
                for i = j to (n - 1) step n1
                        l = i + n2
                        xtemp = x(i) - x(l)
                        x(i) = x(i) + x(l)
                        ytemp = y(i) - y(l)
                        y(i) = y(i) + y(l)
                        x(l) = (xtemp * c) - (y(t) * s)
                        y(l) = (ytemp * c) + (x(t) * s)
                next i
                angle = (j + 1) * argument
        next j
next k
j = 0
```

[2] If graphed, the time domain would have the EMG signal as the y-axis and the x-axis would be time. When mapping to the frequency domain, via the FFT, the x-axis becomes the frequency and the y-axis remains unchanged.

```
for i = 0 to (n - 2)
        if (i < j) then
                xtemp = x(j)
                x(j) = x(i)
                x(i) = xtemp
        end if
        k = n / 2
        while (k < (j + 1))
                j = j - k
                k = k / 2
        end while
        j = j + k
next i
for i = 0 to (n - 1)
        x(i) = x(i) / n
next i
```

The FFT produces a number of data points that are of an order of 2. In this experiment, 2700 data points are collected per minute. Since this is not a power of two, zero values are added until there are 4096 points. The squared value of the FFT (ie. x) is the power spectrum. To calculate the MPF, the power spectrum is multiplied by the frequency, since we are now in the frequency rather than time domain, and integrated over all frequencies. This value is divided by the integral of the power spectrum over all frequencies. The resulting value is the MPF. More information regarding EMG reporting units can be found in Winter et al. (1979). The equation for the Mean Power Frequency is given below.

$$MPF = \frac{\int_{f1}^{f2} f G(f)\,df}{\int_{f1}^{f2} G(f)\,df},$$

where f is the frequency and G(f) is the Power Spectrum.

Additional information on the Fast Fourier Transform can also be found in Kreyszig (1993) or Hsu (1984). General information on signals and the FFT can be found in Hewlett-Packard (1991).

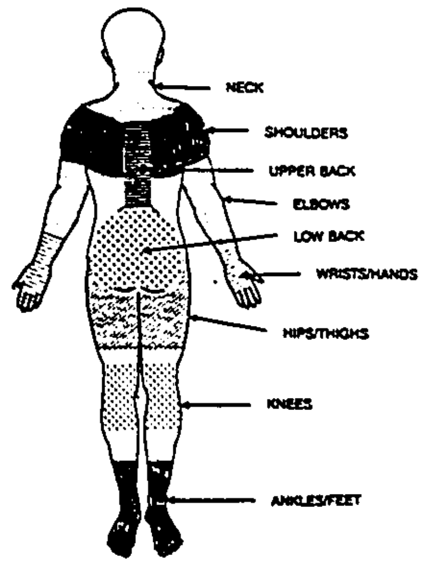
I Questionnaire

QUESTIONNAIRE

For each part of your body, as indicated on the accompanying diagram on the right, please indicate your perceived exertion during this postal sorting procedure, using the scale below on the left.

Scale:

6	
7	Very, very light
8	
9	Very light
10	
11	Fairly light
12	
13	Somewhat hard
14	
15	Hard
16	
17	Very hard
18	
19	Very, very hard
20	



Neck: _______ Elbows: _______ Hips/Thighs: _______

Shoulders: _______ Lower Back: _______ Knees: _______

Upper Back: _______ Wrists/Hands: _______ Ankles/Feet: _______

Subject: ______________________________

Conditions: ______________________________

J Subjects

Ages, Heights and Shoulder Heights of Subjects

Subject	Age	Height	Shoulder Height
1	22	186	151
2	33	178	148
3	24	176	149
4	23	168	136
5	21	182	151
6	29	179	147
7	24	185	154
8	36	169	140
A	25	177	146
B	19	169	139
C	20	187	155
D	21	174	144

All heights are in cm.

K Experimental RMS and MPF Values

This appendix contains the calculated RMS and MPF values for each trial. They are listed sequentially by minute and contain values for all three muscles. Where information was lost during the experiment, a blank space is left.

The abbreviation "Min" represents the minute of the trial.

Subject: 1 Board: Straight Pickup: Opposite

Min	----Deltoid----- RMS	MPF	---Trapezius---- RMS	MPF	-Infraspinatus-- RMS	MPF
8	0.1447	240.19	0.1089	239.87	0.1627	239.87
9	0.1446	239.18	0.1089	238.83	0.1627	239.94
10	0.1446	240.98	0.1088	239.62	0.1626	239.16
18	0.1445	239.55	0.1089	240.63	0.1627	239.69
19	0.1446	240.36	0.1088	241.41	0.1627	240.15
20	0.1446	239.54	0.1088	239.25	0.1626	240.00
28	0.1447	239.26	0.1088	240.08	0.1627	239.38
29	0.1445	239.35	0.1088	239.60	0.1627	239.46
30	0.1446	240.44	0.1088	239.84	0.1627	239.70
38	0.1447	240.09	0.1089	239.85	0.1628	239.81
39	0.1447	239.35	0.1089	239.48	0.1627	239.34
40	0.1446	239.85	0.1089	240.37	0.1628	240.13
48	0.1446	240.26	0.1089	239.14	0.1628	240.14
49	0.1447	239.60	0.1089	240.45	0.1628	239.98
50	0.1447	240.10	0.1090	239.91	0.1627	239.21
58	0.1448	240.05	0.1090	239.78	0.1628	239.76
59	0.1447	239.75	0.1090	239.84	0.1629	239.63
60	0.1448	240.42	0.1089	239.14	0.1628	240.03
68	0.1448	239.18	0.1092	242.78	0.1629	239.61
69	0.1448	238.60	0.1090	239.77	0.1628	239.85
70	0.1448	239.73	0.1090	239.59	0.1628	239.73
78	0.1447	239.41	0.1090	239.74	0.1628	239.76
79	0.1448	239.18	0.1091	239.84	0.1628	239.55
80	0.1448	239.64	0.1090	240.53	0.1628	239.59
88	0.1449	240.05	0.1092	239.55	0.1630	239.37
89	0.1449	239.57	0.1091	240.15	0.1629	239.47
90	0.1449	239.30	0.1091	239.68	0.1629	239.63
98	0.1450	239.64	0.1091	239.52	0.1630	240.06
99	0.1450	239.32	0.1092	240.17	0.1630	239.01
100	0.1449	239.41	0.1091	240.31	0.1629	238.47
108	0.1449	238.91	0.1091	239.69	0.1630	240.37
109	0.1450	239.11	0.1092	239.27	0.1631	239.62
110	0.1450	239.29	0.1092	239.66	0.1630	240.00
118	0.1451	239.45	0.1092	238.75	0.1631	240.20
119	0.1451	239.51	0.1092	239.21	0.1632	239.30
120	0.1451	240.04	0.1093	239.22	0.1632	238.96

Subject: 1 Board: Straight Pickup: Centre

Min	----Deltoid-----		---Trapezius----		-Infraspinatus--	
	RMS	MPF	RMS	MPF	RMS	MPF
8	0.1277	258.40	0.1072	304.80	0.1518	258.79
9	0.1282	261.01	0.1089	328.88	0.1519	258.05
10	0.1287	262.97	0.1146	467.71	0.1527	257.04
18	0.1300	265.49	0.1096	347.67	0.1527	257.21
19	0.1316	301.65	0.1099	373.82	0.1543	276.38
20	0.1311	287.70	0.1087	336.86	0.1530	253.11
28	0.1321	278.96	0.1055	254.72	0.1536	261.40
29	0.1318	271.61	0.1051	255.92	0.1534	252.24
30	0.1319	271.78	0.1050	250.98	0.1542	260.60
38	0.1337	283.61	0.1059	262.36	0.1544	265.06
39	0.1343	304.19	0.1063	276.02	0.1551	264.69
40	0.1340	287.33	0.1056	251.17	0.1547	262.79
48	0.1353	295.61	0.1060	266.78	0.1552	265.19
49	0.1347	279.97	0.1058	263.50	0.1556	263.23
50	0.1350	285.17	0.1055	265.35	0.1547	255.47
58	0.1358	285.06	0.1047	252.00	0.1553	256.29
59	0.1357	275.88	0.1053	257.38	0.1552	251.64
60	0.1363	282.60	0.1059	263.84	0.1554	264.11
68	0.1360	275.20	0.1055	260.38	0.1561	251.02
69	0.1383	305.61	0.1059	263.11	0.1563	258.45
70	0.1370	284.65	0.1057	267.95	0.1558	256.70
78	0.1381	298.88	0.1052	265.92	0.1564	257.29
79	0.1367	277.34	0.1053	256.95	0.1565	252.39
80	0.1370	277.53	0.1054	254.80	0.1563	251.11
88	0.1395	309.86	0.1062	275.25	0.1565	260.52
89	0.1377	281.32	0.1059	253.14	0.1566	253.62
90	0.1388	293.72	0.1053	252.95	0.1566	257.52
98	0.1393	292.26	0.1060	265.61	0.1570	262.74
99	0.1389	299.32	0.1058	275.00	0.1574	261.88
100	0.1392	291.81	0.1056	261.42	0.1572	268.95
108	0.1403	301.11	0.1059	265.84	0.1578	263.35
109	0.1393	285.79	0.1054	260.76	0.1572	262.52
110	0.1398	289.19	0.1058	258.42	0.1574	254.78
118	0.1398	291.66	0.1060	270.35	0.1578	257.14
119	0.1398	293.67	0.1064	272.96	0.1576	269.63
120	0.1403	296.70	0.1064	270.15	0.1575	264.60

Subject: 1 Board: V-Shaped Pickup: Opposite

Min	----Deltoid-----		---Trapezius----		-Infraspinatus--	
	RMS	MPF	RMS	MPF	RMS	MPF
8	0.1440	246.70	0.1104	240.09	0.1627	239.27
9	0.1439	247.47	0.1104	239.33	0.1627	239.42
10	0.1441	250.58	0.1103	239.78	0.1628	239.32
18	0.1446	259.24	0.1103	239.93	0.1627	239.29
19	0.1447	255.53	0.1104	239.51	0.1627	239.75
20	0.1448	260.76	0.1103	240.14	0.1627	239.26
28	0.1456	268.44	0.1103	241.15	0.1627	239.59
29	0.1448	266.26	0.1103	240.94	0.1626	239.37
30	0.1447	263.70	0.1104	241.83	0.1628	239.91
38	0.1466	302.92	0.1105	242.75	0.1628	239.40
39	0.1464	296.34	0.1107	245.15	0.1626	239.50
40	0.1471	309.63	0.1107	243.86	0.1628	238.86
48	0.1471	302.17	0.1107	248.84	0.1627	239.81
49	0.1483	330.80	0.1106	249.66	0.1627	239.80
50	0.1476	313.04	0.1106	247.05	0.1626	240.58
58	0.1492	342.59	0.1106	244.80	0.1627	240.27
59	0.1522	378.59	0.1108	255.53	0.1626	240.57
60	0.1512	367.71	0.1108	251.95	0.1627	240.43
68	0.1565	450.80	0.1108	256.49	0.1627	240.17
69	0.1542	409.45	0.1105	253.50	0.1628	241.98
70	0.1550	422.89	0.1108	252.85	0.1627	240.10
78	0.1575	481.33	0.1110	263.31	0.1627	243.99
79	0.1534	420.73	0.1114	266.39	0.1628	244.18
80	0.1543	427.37	0.1112	268.51	0.1629	243.58
88	0.1551	432.80	0.1109	274.23	0.1634	251.88
89	0.1609	500.02	0.1117	293.09	0.1644	262.39
90	0.1625	537.80	0.1108	250.07	0.1649	279.22
98	0.1553	433.37	0.1108	257.60	0.1647	268.75
99	0.1575	466.42	0.1108	268.24	0.1669	310.37
100	0.1586	472.87	0.1106	266.20	0.1670	320.18
108	0.1619	538.71	0.1126	284.97		
109	0.1641	552.84	0.1123	293.88		
110	0.1632	559.62	0.1127	305.36		
118	0.1627	538.89	0.1112	277.34		
119	0.1619	530.08	0.1107	257.25		
120	0.1742	716.05	0.1111	266.60		

Subject: 1 Board: V-Shaped Pickup: Centre

Min	----Deltoid-----		---Trapezius----		-Infraspinatus--	
	RMS	MPF	RMS	MPF	RMS	MPF
8			0.1120	265.32		
9			0.1125	269.23		
10			0.1120	255.99		
18	0.1432	264.57	0.1114	249.36		
19	0.1434	257.47	0.1120	255.54		
20	0.1443	269.53	0.1122	271.26		
28	0.1435	258.22	0.1121	271.02	0.1637	253.83
29	0.1434	255.01	0.1119	256.03	0.1633	248.47
30	0.1431	254.32	0.1121	253.55	0.1627	245.70
38	0.1439	260.18	0.1114	259.13	0.1632	245.04
39	0.1442	265.29	0.1121	262.92	0.1631	247.37
40	0.1434	258.67	0.1116	265.57	0.1629	245.80
48	0.1455	274.64	0.1136	298.41	0.1626	247.17
49	0.1447	270.11	0.1127	293.68	0.1631	244.22
50	0.1445	280.50	0.1128	289.75	0.1633	246.92
58	0.1443	260.44	0.1125	294.95	0.1633	243.94
59	0.1442	271.61	0.1120	282.11	0.1631	250.09
60	0.1447	258.30	0.1116	261.16	0.1627	241.41
68	0.1447	265.25	0.1114	255.37	0.1633	244.45
69	0.1449	260.70	0.1122	278.76	0.1634	245.74
70	0.1447	271.64	0.1123	292.03	0.1633	245.12
78	0.1446	261.22	0.1127	280.95	0.1632	246.95
79	0.1443	255.58	0.1117	265.32	0.1631	240.88
80	0.1438	254.81	0.1115	259.59	0.1634	245.41
88	0.1443	250.94	0.1114	261.90	0.1633	244.14
89	0.1448	259.14	0.1124	275.43	0.1629	245.16
90	0.1447	260.81	0.1119	269.73	0.1632	244.74
98	0.1441	256.03	0.1122	269.70	0.1634	244.09
99	0.1447	251.74	0.1113	255.00	0.1634	244.84
100	0.1454	267.39	0.1121	261.99	0.1634	246.32
108	0.1447	257.18	0.1118	277.97	0.1633	245.73
109	0.1451	263.83	0.1125	285.90	0.1636	245.97
110	0.1463	275.99	0.1121	279.36	0.1636	243.73
118	0.1454	266.80	0.1123	285.62	0.1636	242.97
119	0.1450	270.80	0.1117	270.50	0.1633	242.75
120	0.1449	254.48	0.1109	256.06	0.1634	246.20

Subject: 1 Board: Inclined Pickup: Opposite

Min	----Deltoid----- RMS	MPF	---Trapezius---- RMS	MPF	-Infraspinatus-- RMS	MPF
8	0.1236	241.22	0.0988	250.29	0.1457	240.47
9	0.1240	240.67	0.0992	252.33	0.1460	240.27
10	0.1245	241.09	0.0992	255.13	0.1463	239.89
18	0.1271	239.67	0.0995	249.44	0.1479	238.91
19	0.1274	239.58	0.0998	256.01	0.1480	239.59
20	0.1277	240.92	0.0999	267.37	0.1482	240.04
28	0.1296	240.19	0.0995	253.72	0.1492	239.83
29	0.1298	240.91	0.0999	258.32	0.1493	239.33
30	0.1300	240.20	0.1000	259.73	0.1493	239.38
38	0.1313	239.91	0.1002	252.54	0.1501	240.19
39	0.1315	240.62	0.1003	261.34	0.1502	239.84
40	0.1317	239.51	0.0997	246.96	0.1503	239.59
48	0.1328	239.90	0.0995	247.94	0.1508	239.57
49	0.1330	240.34	0.0998	252.32	0.1509	240.43
50	0.1331	239.69	0.0997	251.90	0.1511	240.04
58	0.1342	240.30	0.0999	263.80	0.1516	240.10
59	0.1343	239.64	0.1001	260.25	0.1515	240.11
60	0.1344	239.82	0.0999	259.23	0.1516	239.72
68	0.1353	240.11	0.1002	258.98	0.1520	238.74
69	0.1354	240.35	0.0999	261.96	0.1521	239.29
70	0.1355	240.10	0.1002	260.50	0.1522	240.11
78	0.1363	239.63	0.1001	253.02	0.1526	239.70
79	0.1363	240.12	0.0997	260.68	0.1525	239.76
80	0.1364	239.96	0.1002	257.73	0.1526	239.56
88	0.1371	240.74	0.0998	255.13	0.1530	239.63
89	0.1372	241.10	0.1003	264.60	0.1531	240.17
90	0.1373	240.16	0.1000	261.61	0.1531	239.59
98	0.1378	239.25	0.1004	258.54	0.1534	239.86
99	0.1384	249.66	0.1005	271.89	0.1534	239.21
100	0.1380	240.71	0.1011	272.29	0.1535	239.27
108	0.1384	240.37	0.1008	272.65	0.1537	240.37
109	0.1384	240.11	0.1000	265.70	0.1538	239.90
110	0.1386	240.77	0.1006	279.47	0.1538	239.93
118	0.1390	239.38	0.1001	262.92	0.1540	240.06
119	0.1390	239.75	0.1006	269.18	0.1540	239.29
120	0.1390	240.15	0.1009	289.12	0.1541	240.22

Subject: 1 Board: Inclined Pickup: Centre

	----Deltoid-----		---Trapezius----		-Infraspinatus--	
Min	RMS	MPF	RMS	MPF	RMS	MPF
8	0.1309	322.43	0.1038	240.95	0.1501	239.50
9	0.1288	309.19	0.1038	240.52	0.1502	239.53
10	0.1286	250.25	0.1039	241.02	0.1502	239.68
18	0.1315	279.50	0.1039	240.64	0.1509	239.32
19	0.1303	308.85	0.1037	239.52	0.1510	239.15
20	0.1308	224.70	0.1040	239.98	0.1511	240.39
28	0.1290	309.75	0.1039	240.73	0.1517	238.92
29	0.1311	302.23	0.1039	241.20	0.1518	239.93
30	0.1341	293.07	0.1039	241.06	0.1518	239.22
38	0.1331	266.71	0.1037	241.48	0.1524	239.51
39	0.1332	287.96	0.1038	242.18	0.1525	239.98
40	0.1327	269.83	0.1041	247.02	0.1525	239.63
48	0.1319	288.53	0.1039	245.01	0.1530	239.75
49	0.1347	276.85	0.1038	246.99	0.1531	239.65
50	0.1342	283.03	0.1041	243.22	0.1533	239.07
58	0.1391	279.30	0.1045	253.47	0.1537	240.24
59	0.1361	260.16	0.1044	258.70	0.1536	239.56
60	0.1359	279.30	0.1045	253.07	0.1538	240.52
68	0.1385	279.89	0.1043	250.18	0.1541	239.56
69	0.1384	315.82	0.1044	264.27	0.1541	239.85
70	0.1377	286.69	0.1042	252.24	0.1541	239.99
78	0.1364	283.12	0.1045	251.87	0.1545	242.41
79	0.1319	288.68	0.1044	251.93	0.1546	240.57
80	0.1375	298.71	0.1040	245.48	0.1546	239.34
88	0.1429	313.67	0.1045	256.25	0.1552	242.47
89	0.1369	332.99	0.1048	259.12	0.1550	241.13
90	0.1382	310.98	0.1052	265.25	0.1549	241.76
98	0.1406	315.48	0.1045	254.95	0.1556	244.07
99	0.1402	329.55	0.1049	258.77	0.1554	243.06
100	0.1398	323.44	0.1058	276.82	0.1559	244.95
108	0.1428	344.67	0.1044	251.12	0.1556	245.09
109	0.1440	335.56	0.1053	271.96	0.1561	246.86
110	0.1442	311.75	0.1048	254.58	0.1560	242.46
118	0.1418	330.66	0.1047	256.04	0.1562	246.44
119	0.1402	364.35	0.1048	271.73	0.1563	247.80
120	0.1442	358.48	0.1045	257.81	0.1563	248.62

Subject: 2 Board: Straight Pickup: Opposite

Min	----Deltoid-----		---Trapezius----		-Infraspinatus--	
	RMS	MPF	RMS	MPF	RMS	MPF
8	0.1421	262.40	0.1031	239.65	0.1571	239.80
9	0.1424	265.65	0.1030	240.18	0.1571	239.76
10	0.1422	261.98	0.1030	239.33	0.1570	239.05
18	0.1433	276.87	0.1031	238.83	0.1571	239.90
19	0.1426	273.50	0.1032	239.91	0.1571	240.23
20	0.1427	269.69	0.1031	239.38	0.1570	239.90
28	0.1424	258.77	0.1031	240.63	0.1572	239.58
29	0.1420	258.39	0.1031	240.02	0.1572	239.85
30	0.1426	270.09	0.1031	239.47	0.1572	239.74
38	0.1426	264.06	0.1033	239.38	0.1573	239.62
39	0.1423	260.75	0.1032	239.71	0.1573	239.25
40	0.1427	265.70	0.1032	240.53	0.1573	239.65
48	0.1424	256.89	0.1032	240.40	0.1574	240.60
49	0.1434	262.87	0.1033	239.47	0.1574	240.86
50	0.1424	255.85	0.1033	239.32	0.1574	240.06
58	0.1426	264.67	0.1033	239.99	0.1575	240.04
59	0.1429	268.55	0.1034	239.82	0.1575	239.79
60	0.1432	268.85	0.1033	240.42	0.1575	240.56
68	0.1431	264.77	0.1036	238.99	0.1577	241.23
69	0.1431	262.31	0.1034	239.81	0.1575	240.50
70	0.1431	261.64	0.1035	238.96	0.1577	240.25
78	0.1433	270.72	0.1034	240.05	0.1576	240.44
79	0.1438	271.73	0.1034	240.62	0.1578	240.39
80	0.1432	265.76	0.1035	240.19	0.1577	240.52
88	0.1433	264.04	0.1035	240.78	0.1580	242.41
89	0.1436	264.26	0.1036	240.71	0.1579	241.70
90	0.1440	267.44	0.1036	240.76	0.1579	241.75
98	0.1435	260.17	0.1035	240.74	0.1580	240.13
99	0.1433	257.39	0.1036	239.99		
100	0.1439	271.12	0.1036	241.14		
108	0.1434	262.40	0.1036	240.64	0.1581	238.99
109	0.1434	258.32	0.1037	240.66	0.1581	239.18
110	0.1433	261.88	0.1036	240.93	0.1581	238.95
118	0.1437	258.72	0.1037	239.87	0.1581	239.20
119	0.1441	262.53	0.1037	239.96	0.1581	240.01
120	0.1434	257.41	0.1037	238.63	0.1583	240.18

Subject: 2 Board: Straight Pickup: Centre

	----Deltoid-----		---Trapezius----		-Infraspinatus--	
Min	RMS	MPF	RMS	MPF	RMS	MPF
8	0.1339	239.47	0.1047	240.21	0.1544	240.26
9	0.1339	239.86	0.1046	241.06	0.1544	239.19
10	0.1340	240.51	0.1047	240.18	0.1545	239.61
18	0.1343	239.66	0.1046	239.64	0.1546	240.06
19	0.1345	240.10	0.1046	241.56	0.1548	240.42
20	0.1345	239.55	0.1047	239.96	0.1549	239.45
28	0.1349	240.02	0.1047	240.41	0.1550	239.73
29	0.1351	239.27	0.1047	240.31	0.1551	238.95
30	0.1351	240.74	0.1046	240.76	0.1551	239.71
38	0.1355	239.03	0.1047	240.04	0.1553	238.91
39	0.1357	240.06	0.1046	241.16	0.1553	240.02
40	0.1357	239.77	0.1047	242.54	0.1552	240.29
48	0.1362	240.60	0.1047	242.05	0.1555	239.62
49	0.1362	239.95	0.1047	241.70	0.1556	239.61
50	0.1363	240.89	0.1047	242.14	0.1556	240.28
58	0.1366	240.55	0.1046	240.97	0.1558	240.04
59	0.1367	239.58	0.1046	240.96	0.1558	239.69
60	0.1368	239.18	0.1047	241.80	0.1558	239.55
68	0.1372	240.12	0.1048	244.62	0.1560	241.42
69	0.1371	240.55	0.1047	244.33	0.1561	241.35
70	0.1372	240.20	0.1049	242.15	0.1560	239.70
78	0.1382	254.67	0.1045	242.81	0.1564	241.37
79	0.1379	245.91	0.1047	241.07	0.1563	242.48
80	0.1384	255.06	0.1047	242.33	0.1564	240.58
88	0.1383	245.31	0.1048	242.56	0.1566	240.68
89	0.1403	282.01	0.1049	243.14	0.1565	241.21
90	0.1401	283.81	0.1048	248.07	0.1565	239.81
98	0.1407	280.98	0.1049	249.51	0.1568	240.32
99	0.1402	267.61	0.1049	246.55	0.1567	240.66
100	0.1391	254.63	0.1047	246.50	0.1568	242.12
108	0.1405	279.56	0.1050	245.81	0.1570	240.10
109	0.1411	276.87	0.1053	258.48	0.1569	240.14
110	0.1404	263.64	0.1049	249.34	0.1569	240.35
118	0.1489	413.98	0.1052	250.78	0.1571	239.54
119	0.1415	286.77	0.1051	248.53	0.1571	239.62
120	0.1400	255.54	0.1050	247.61	0.1571	239.16

Subject: 2 Board: V-Shaped Pickup: Opposite

Min	----Deltoid-----		---Trapezius----		-Infraspinatus--	
	RMS	MPF	RMS	MPF	RMS	MPF
8	0.1520	709.13	0.1112	326.98	0.1518	240.77
9	0.1463	608.64	0.1102	306.73	0.1520	240.36
10	0.1393	495.02	0.1097	304.78	0.1522	240.37
18	0.1341	361.74	0.1104	300.16	0.1533	239.61
19	0.1336	332.36	0.1108	314.51	0.1535	239.69
20	0.1334	330.21	0.1114	317.30	0.1536	240.12
28	0.1328	291.96	0.1117	338.24	0.1544	239.99
29	0.1348	319.18	0.1101	290.80	0.1546	240.11
30	0.1339	303.22	0.1108	293.75	0.1547	239.61
38	0.1338	284.13	0.1111	299.18	0.1555	239.67
39	0.1343	292.59	0.1109	317.79	0.1555	239.49
40	0.1346	284.58	0.1111	303.06	0.1556	239.95
48	0.1349	275.35	0.1098	280.23	0.1561	239.22
49	0.1354	275.87	0.1105	295.66	0.1563	239.24
50	0.1358	269.35	0.1095	295.17	0.1562	239.83
58	0.1366	275.45	0.1115	311.71	0.1568	240.11
59	0.1369	268.61	0.1099	287.19	0.1568	239.72
60	0.1372	287.97	0.1101	310.01	0.1569	239.89
68	0.1369	264.33	0.1109	296.33	0.1574	239.43
69	0.1373	261.52	0.1088	265.42	0.1575	239.59
70	0.1377	262.30	0.1099	289.93	0.1575	238.99
78	0.1381	266.89	0.1105	319.31	0.1580	239.54
79	0.1382	267.54	0.1099	304.93	0.1579	239.70
80	0.1383	259.79	0.1089	267.67	0.1580	239.07
88	0.1405	277.58	0.1119	322.19	0.1584	239.54
89	0.1404	282.38	0.1107	304.56	0.1584	239.84
90	0.1400	288.54	0.1111	337.14	0.1585	239.70
98	0.1402	270.63	0.1108	293.38	0.1588	239.15
99	0.1401	270.04	0.1102	303.24	0.1588	240.11
100	0.1397	256.05	0.1083	246.03	0.1588	239.69
108	0.1414	279.06	0.1105	307.19	0.1591	240.36
109	0.1407	268.32	0.1100	296.52	0.1593	239.99
110	0.1416	276.41	0.1105	303.01	0.1592	239.85
118	0.1417	272.28	0.1102	286.29	0.1594	239.96
119	0.1419	272.12	0.1099	282.99	0.1595	240.27
120	0.1417	279.93	0.1125	334.26	0.1595	240.23

Subject: 2 Board: V-Shaped Pickup: Centre

	----Deltoid-----		---Trapezius----		-Infraspinatus--	
Min	RMS	MPF	RMS	MPF	RMS	MPF
8	0.1463	268.85	0.1129	257.48	0.1639	239.97
9	0.1460	268.16	0.1129	266.50	0.1639	239.86
10	0.1462	269.02	0.1130	259.17	0.1639	239.86
18	0.1462	269.00	0.1127	253.93		
19	0.1463	273.42	0.1128	263.45		
20	0.1465	263.62	0.1131	263.85		
28	0.1464	271.78	0.1130	261.72	0.1640	238.57
29	0.1472	271.42	0.1135	270.51	0.1639	239.84
30	0.1464	279.00	0.1130	276.24	0.1640	240.10
38	0.1460	261.19	0.1129	263.67	0.1640	239.82
39	0.1458	259.77	0.1127	254.75	0.1638	239.29
40	0.1459	263.39	0.1127	267.29	0.1639	239.74
48	0.1455	258.38	0.1125	257.81	0.1640	239.88
49	0.1465	275.53	0.1129	269.04	0.1639	240.50
50	0.1455	261.14	0.1130	264.68	0.1640	240.49
58	0.1456	254.43	0.1130	259.01	0.1640	240.12
59	0.1458	260.38	0.1130	263.48	0.1640	240.54
60	0.1586	470.60	0.1127	267.95	0.1640	240.47
68	0.1460	252.78	0.1133	258.18	0.1640	240.04
69	0.1451	254.34	0.1123	261.00	0.1640	239.69
70	0.1457	264.20	0.1131	271.44	0.1641	240.61
78	0.1459	258.45	0.1131	260.03	0.1640	239.20
79	0.1456	260.80	0.1128	261.50	0.1641	239.22
80	0.1463	270.59	0.1137	267.15	0.1640	239.38
88	0.1463	266.83	0.1131	271.39	0.1641	239.37
89	0.1461	258.04	0.1129	256.25	0.1641	240.38
90	0.1463	268.48	0.1129	265.91	0.1640	239.92
98	0.1457	251.71	0.1128	255.14	0.1641	239.57
99	0.1463	258.77	0.1135	266.97	0.1641	239.91
100	0.1456	262.17	0.1135	266.08	0.1641	239.52
108	0.1464	263.05	0.1129	265.34	0.1641	239.57
109	0.1462	259.26	0.1133	262.94	0.1642	239.52
110	0.1459	250.68	0.1128	256.38	0.1642	239.39
118	0.1462	258.18	0.1129	260.87	0.1642	239.35
119	0.1464	271.54	0.1135	279.36	0.1642	239.07
120	0.1459	257.31	0.1133	253.81	0.1643	239.20

Subject: 2 Board: Inclined Pickup: Opposite

Min	----Deltoid-----		---Trapezius----		-Infraspinatus--	
	RMS	MPF	RMS	MPF	RMS	MPF
8	0.1451	239.81	0.1109	239.19	0.1655	270.24
9	0.1450	240.25	0.1109	240.33	0.1639	243.11
10	0.1450	240.55	0.1108	240.45	0.1664	281.13
18	0.1450	240.38	0.1108	240.01	0.1640	242.56
19	0.1451	240.44	0.1108	240.38	0.1639	244.14
20	0.1451	240.14	0.1108	239.48	0.1640	244.41
28	0.1451	240.31	0.1106	239.17	0.1638	242.52
29	0.1452	241.01	0.1106	239.63	0.1636	242.09
30	0.1452	241.30	0.1106	239.45	0.1640	244.01
38	0.1453	240.89	0.1107	239.88	0.1638	241.66
39	0.1454	239.64	0.1106	241.29	0.1638	242.68
40	0.1454	241.12	0.1107	241.35	0.1638	241.83
48	0.1455	240.99	0.1107	241.25	0.1639	242.43
49	0.1455	241.12	0.1106	240.32	0.1639	241.65
50	0.1454	240.95	0.1107	240.04	0.1640	245.34
58	0.1456	240.74	0.1106	239.59	0.1639	240.47
59	0.1456	240.72	0.1107	241.68	0.1642	243.80
60	0.1457	240.89	0.1106	240.43	0.1643	244.23
68	0.1457	240.34	0.1106	239.35	0.1641	244.31
69	0.1456	240.21	0.1106	240.25	0.1640	243.51
70	0.1457	240.11	0.1106	241.12	0.1640	240.90
78	0.1457	241.01	0.1106	240.97	0.1641	244.70
79	0.1459	241.56	0.1106	241.02	0.1644	242.56
80	0.1459	242.92	0.1106	239.44	0.1642	242.56
88	0.1461	246.10	0.1106	240.53	0.1640	241.29
89	0.1461	244.61	0.1106	240.01	0.1640	241.99
90	0.1460	244.63	0.1106	240.33	0.1642	241.71
98	0.1464	249.66	0.1106	239.91	0.1642	241.55
99	0.1464	248.34	0.1106	240.61	0.1640	242.08
100	0.1468	258.42	0.1106	239.79	0.1642	243.53
108	0.1473	257.71	0.1106	240.57	0.1641	245.66
109	0.1469	255.29	0.1105	240.24	0.1641	242.06
110	0.1468	253.68	0.1106	239.45	0.1642	241.53
118	0.1474	268.20	0.1106	240.71	0.1641	241.70
119	0.1470	258.11	0.1106	239.80	0.1641	240.79
120	0.1478	273.33	0.1106	239.73	0.1641	241.78

Subject: 2 Board: Inclined Pickup: Centre

	----Deltoid-----		---Trapezius----		-Infraspinatus--	
Min	RMS	MPF	RMS	MPF	RMS	MPF
8	0.1426	245.00	0.1130	284.77	0.1630	249.37
9	0.1427	249.75	0.1131	281.47	0.1628	247.71
10	0.1430	256.44	0.1130	279.32	0.1628	250.29
18	0.1445	280.03	0.1133	283.95	0.1632	252.77
19	0.1444	280.13	0.1134	293.51	0.1629	249.86
20	0.1445	283.78	0.1131	284.32	0.1634	252.99
28	0.1448	282.32	0.1124	280.37	0.1638	263.83
29	0.1455	294.81	0.1124	278.57	0.1638	264.29
30	0.1470	307.42	0.1134	298.27	0.1647	273.89
38	0.1450	291.68	0.1115	276.54	0.1642	272.09
39	0.1447	281.15	0.1120	263.70	0.1637	260.04
40	0.1440	274.54	0.1126	274.94	0.1635	261.14
48	0.1442	266.48	0.1123	272.28	0.1632	252.30
49	0.1453	285.12	0.1122	273.55	0.1630	249.07
50	0.1460	289.07	0.1123	282.86	0.1635	257.60
58	0.1452	282.00	0.1122	275.73	0.1630	247.45
59	0.1447	262.83	0.1119	260.16	0.1631	247.58
60	0.1453	272.36	0.1117	269.58	0.1631	248.91
68	0.1476	305.50	0.1121	271.71	0.1630	246.87
69	0.1479	325.25	0.1126	280.84	0.1630	249.08
70	0.1452	264.56	0.1119	268.64	0.1633	247.51
78	0.1455	276.70	0.1108	260.94	0.1637	257.88
79	0.1440	254.44	0.1119	263.50	0.1629	244.92
80	0.1450	264.07	0.1119	271.90	0.1629	243.10
88	0.1445	265.20	0.1117	260.59	0.1631	244.16
89	0.1454	282.28	0.1117	267.37	0.1629	243.44
90	0.1473	302.57	0.1113	260.34	0.1632	245.97
98	0.1468	295.24	0.1114	269.98	0.1636	248.20
99	0.1465	285.53	0.1114	263.62	0.1636	250.95
100	0.1457	271.94	0.1121	274.26	0.1634	248.67
108	0.1469	288.65	0.1128	281.47	0.1633	246.23
109	0.1466	288.39	0.1122	280.95	0.1631	243.89
110	0.1458	283.56	0.1135	300.61	0.1633	246.48
118	0.1467	282.95	0.1132	290.80	0.1633	245.14
119	0.1469	290.86	0.1134	294.03	0.1632	243.70
120	0.1487	328.56	0.1132	306.31	0.1637	252.69

Subject: 3 Board: Straight Pickup: Opposite

	----Deltoid-----		---Trapezius----		-Infraspinatus--	
Min	RMS	MPF	RMS	MPF	RMS	MPF
8	0.1464	276.21	0.1046	239.98	0.1596	239.57
9	0.1464	283.04	0.1046	239.30	0.1595	239.71
10	0.1454	269.15	0.1050	246.73	0.1596	239.36
18	0.1471	290.90	0.1047	240.33	0.1597	239.47
19	0.1473	289.29	0.1047	239.96	0.1597	240.09
20	0.1469	282.96	0.1048	240.13	0.1598	239.66
28	0.1484	285.38	0.1048	240.25	0.1597	239.98
29	0.1467	278.85	0.1047	239.41	0.1597	239.58
30	0.1479	297.89	0.1047	239.76	0.1597	240.23
38	0.1459	266.44	0.1048	240.20	0.1598	239.34
39	0.1467	294.72	0.1048	240.21	0.1598	239.54
40	0.1464	286.28	0.1047	240.51	0.1598	239.93
48	0.1463	277.39	0.1048	240.06	0.1598	239.65
49	0.1490	327.41	0.1048	240.74	0.1598	239.56
50	0.1485	305.68	0.1047	240.99	0.1598	239.72
58	0.1477	285.32	0.1048	241.84	0.1598	239.89
59	0.1474	298.75	0.1048	239.63	0.1598	239.82
60	0.1484	295.67	0.1048	240.44	0.1599	240.21
68	0.1468	280.39	0.1047	240.45	0.1598	239.78
69	0.1467	267.56	0.1049	239.99	0.1599	239.49
70	0.1491	321.32	0.1049	241.39	0.1599	239.82
78	0.1466	274.55	0.1049	242.01	0.1598	239.48
79	0.1479	305.01	0.1049	241.37	0.1599	240.40
80	0.1471	278.79	0.1048	240.84	0.1598	239.23
88	0.1496	300.15	0.1049	241.20	0.1600	239.54
89	0.1469	273.65	0.1049	240.55	0.1599	240.01
90	0.1471	274.11	0.1049	239.28	0.1599	240.28
98	0.1479	286.21	0.1049	239.38	0.1599	239.19
99	0.1470	279.60	0.1049	240.54	0.1600	238.72
100	0.1471	271.47	0.1049	240.10	0.1599	239.48
108	0.1466	275.46	0.1050	241.67	0.1599	239.97
109	0.1495	299.27	0.1049	240.74	0.1600	240.40
110	0.1474	286.61	0.1050	241.35	0.1600	240.09
118	0.1463	274.38	0.1048	241.24	0.1600	239.70
119	0.1462	270.18	0.1049	240.20	0.1600	239.06
120	0.1484	292.98	0.1049	241.87	0.1601	239.92

Subject: 3 Board: Straight Pickup: Centre

Min	----Deltoid-----		---Trapezius----		-Infraspinatus--	
	RMS	MPF	RMS	MPF	RMS	MPF
8	0.1455	239.77	0.1113	240.38	0.1641	240.01
9	0.1455	239.32	0.1113	239.11	0.1640	239.23
10	0.1455	239.80	0.1112	240.58	0.1640	239.30
18	0.1455	239.15	0.1113	240.07	0.1641	239.00
19	0.1456	240.29	0.1113	240.81	0.1641	239.56
20	0.1456	239.61	0.1112	241.56	0.1641	239.46
28	0.1457	240.17	0.1113	242.72	0.1641	239.40
29	0.1457	238.98	0.1112	240.63	0.1641	239.80
30	0.1457	238.87	0.1112	240.14	0.1641	239.29
38	0.1458	239.60	0.1112	240.97	0.1641	239.10
39	0.1459	239.29	0.1112	239.15	0.1641	238.92
40	0.1458	239.53	0.1113	240.61	0.1640	239.54
48	0.1460	240.16	0.1112	240.36	0.1642	239.12
49	0.1460	238.59	0.1113	242.48	0.1642	239.22
50	0.1460	239.43	0.1111	247.43	0.1641	239.83
58	0.1462	240.79	0.1114	246.37	0.1642	239.46
59	0.1461	239.81	0.1115	245.80	0.1643	239.59
60	0.1461	239.81	0.1113	244.01	0.1643	239.27
68	0.1463	239.89	0.1115	245.36	0.1643	239.67
69	0.1462	240.15	0.1111	245.12	0.1643	239.59
70	0.1462	239.72	0.1111	243.07	0.1644	239.82
78	0.1463	239.90	0.1113	243.50	0.1643	239.43
79	0.1464	239.13	0.1109	242.15	0.1644	239.34
80	0.1464	237.77	0.1113	245.57	0.1643	239.95
88	0.1466	240.07	0.1110	250.38	0.1644	239.41
89	0.1466	239.94	0.1111	245.74	0.1645	239.59
90	0.1465	239.78	0.1114	251.07	0.1644	239.77
98	0.1467	239.93	0.1116	255.17	0.1645	239.66
99	0.1467	239.95	0.1114	249.55	0.1645	239.56
100	0.1467	239.67	0.1111	250.81	0.1645	239.37
108	0.1468	240.23	0.1113	246.11	0.1646	239.15
109	0.1468	238.44	0.1114	259.45	0.1645	239.75
110	0.1468	239.34	0.1119	262.61	0.1646	239.24
118	0.1470	240.04	0.1113	256.66	0.1646	239.33
119	0.1470	239.96	0.1113	254.80	0.1646	239.36
120	0.1470	240.38	0.1113	254.40	0.1646	239.81

Subject: 3 Board: V-Shaped Pickup: Opposite

	----Deltoid-----		---Trapezius----		-Infraspinatus--	
Min	RMS	MPF	RMS	MPF	RMS	MPF
8	0.1308	242.65	0.1043	239.74	0.1539	258.43
9	0.1311	245.86	0.1043	239.85	0.1543	261.41
10	0.1314	246.95	0.1043	239.92	0.1548	272.53
18	0.1329	248.00	0.1042	239.92	0.1546	254.66
19	0.1332	251.30	0.1041	240.03	0.1550	261.07
20	0.1335	253.57	0.1042	240.55	0.1551	261.09
28	0.1342	244.28	0.1040	239.45	0.1550	251.03
29	0.1344	251.00	0.1040	240.40	0.1546	253.57
30	0.1343	247.73	0.1040	238.33	0.1549	253.59
38	0.1361	249.83	0.1039	239.71	0.1559	256.95
39	0.1356	247.37	0.1039	240.67	0.1556	249.01
40	0.1361	254.79	0.1039	239.28	0.1556	250.68
48	0.1365	249.59	0.1038	240.53	0.1558	250.05
49	0.1377	258.25	0.1038	239.91	0.1563	250.74
50	0.1374	259.25	0.1039	239.35	0.1558	250.00
58	0.1382	262.72	0.1037	240.58	0.1558	247.46
59	0.1380	262.74	0.1038	241.19	0.1566	249.58
60	0.1383	256.76	0.1038	239.83	0.1601	309.46
68	0.1399	262.02	0.1036	242.28	0.1569	251.06
69	0.1390	261.16	0.1038	241.34	0.1568	250.74
70	0.1389	255.32	0.1038	242.69	0.1562	249.45
78	0.1406	259.12	0.1037	245.98	0.1568	247.43
79	0.1401	268.77	0.1037	247.10	0.1570	246.61
80	0.1403	262.23	0.1037	246.82	0.1576	260.53
88	0.1410	266.00	0.1037	247.17	0.1571	250.36
89	0.1407	273.91	0.1039	251.10	0.1568	252.96
90	0.1404	263.88	0.1037	246.60	0.1574	253.43
98	0.1419	278.65	0.1038	248.67	0.1601	294.61
99	0.1427	282.97	0.1035	250.90	0.1601	299.70
100	0.1416	264.53	0.1036	242.70	0.1580	261.52
108	0.1425	272.12	0.1035	248.73	0.1588	271.94
109	0.1425	264.68	0.1038	252.84	0.1576	248.23
110	0.1407	254.10	0.1034	247.29	0.1575	253.94
118	0.1424	278.43	0.1036	259.44	0.1581	254.94
119	0.1443	302.52	0.1038	254.19	0.1609	305.32
120	0.1427	275.76	0.1040	263.71	0.1577	251.22

Subject: 3 Board: V-Shaped Pickup: Centre

	----Deltoid-----		---Trapezius----		-Infraspinatus--	
Min	RMS	MPF	RMS	MPF	RMS	MPF
8	0.1309	254.82	0.1032	239.81	0.1515	240.14
9	0.1335	292.72	0.1033	240.33	0.1516	239.30
10	0.1338	289.97	0.1033	242.03	0.1517	239.65
18	0.1332	274.65	0.1034	242.13	0.1526	239.81
19	0.1345	282.65	0.1031	238.77	0.1526	240.06
20	0.1345	280.68	0.1032	239.76	0.1527	241.14
28	0.1350	275.88	0.1032	240.29	0.1534	239.63
29	0.1349	281.73	0.1032	241.26	0.1535	239.54
30	0.1360	270.38	0.1032	241.53	0.1536	239.81
38	0.1369	272.39	0.1032	241.94	0.1542	240.20
39	0.1384	286.34	0.1033	242.68	0.1542	240.06
40	0.1381	299.66	0.1034	246.32	0.1542	240.92
48	0.1376	272.57	0.1034	242.52	0.1549	240.34
49	0.1385	276.32	0.1034	242.64	0.1548	239.84
50	0.1384	260.83	0.1033	242.87	0.1549	239.90
58	0.1394	275.89	0.1034	245.26	0.1552	239.63
59	0.1386	268.28	0.1036	244.75	0.1554	239.59
60	0.1386	264.94	0.1033	244.11	0.1553	240.25
68	0.1397	271.63	0.1036	246.91	0.1559	240.09
69	0.1399	263.49	0.1034	242.50	0.1559	239.62
70	0.1400	276.60	0.1038	245.89	0.1560	240.79
78	0.1400	270.34	0.1038	243.72	0.1564	240.70
79	0.1408	268.79	0.1038	241.04	0.1563	240.71
80	0.1416	276.94	0.1038	250.08	0.1563	240.34
88	0.1410	277.93	0.1037	249.83	0.1566	240.68
89	0.1415	260.12	0.1038	245.65	0.1569	240.74
90	0.1409	266.44	0.1036	244.65	0.1567	239.24
98	0.1419	272.68	0.1038	248.50	0.1569	240.58
99	0.1418	277.62	0.1039	249.45	0.1571	240.71
100	0.1423	276.75	0.1037	251.35	0.1570	241.48
108	0.1418	261.33	0.1040	249.50	0.1571	240.68
109	0.1425	268.48	0.1040	251.38	0.1575	240.75
110	0.1420	265.36	0.1038	244.85	0.1572	239.83
118	0.1437	280.83	0.1043	255.14	0.1576	242.51
119	0.1422	255.25	0.1039	242.97	0.1576	240.38
120	0.1441	284.13	0.1043	251.53	0.1577	243.47

Subject: 3 Board: Inclined Pickup: Opposite

Min	----Deltoid----- RMS	MPF	---Trapezius---- RMS	MPF	-Infraspinatus-- RMS	MPF
8	0.1397	241.70	0.1098	240.63	0.1603	240.31
9	0.1397	240.82	0.1099	240.65	0.1604	241.31
10	0.1397	239.95	0.1098	239.00	0.1604	239.94
18	0.1400	240.88	0.1098	241.31	0.1605	239.41
19	0.1402	241.25	0.1098	239.48	0.1605	239.70
20	0.1400	240.75	0.1097	240.87	0.1606	239.06
28	0.1403	238.99	0.1098	240.56	0.1606	240.59
29	0.1404	239.61	0.1097	240.41	0.1606	239.23
30	0.1404	240.12	0.1097	240.31	0.1606	239.98
38	0.1406	240.33	0.1099	241.41	0.1608	239.67
39	0.1406	239.79	0.1096	241.22	0.1608	240.28
40	0.1407	241.39	0.1097	241.75	0.1608	241.16
48	0.1409	238.96	0.1097	241.83	0.1609	240.62
49	0.1409	240.72	0.1098	242.66	0.1609	240.48
50	0.1409	239.53	0.1096	241.38	0.1608	239.51
58	0.1411	239.90	0.1097	240.53	0.1610	240.48
59	0.1412	240.82	0.1096	241.48	0.1610	240.51
60	0.1411	241.00	0.1096	240.67	0.1611	240.59
68	0.1413	240.14	0.1096	242.07	0.1611	240.78
69	0.1415	241.54	0.1097	241.44	0.1611	241.11
70	0.1414	240.33	0.1096	238.79	0.1610	240.43
78	0.1417	240.40	0.1096	240.23	0.1612	240.15
79	0.1416	240.51	0.1098	241.53	0.1613	240.70
80	0.1416	240.72	0.1096	241.49	0.1612	240.55
88	0.1418	240.56	0.1097	242.29	0.1615	242.33
89	0.1420	239.61	0.1097	243.37	0.1613	242.02
90	0.1419	240.13	0.1098	243.42	0.1612	240.94
98	0.1419	239.50	0.1097	243.37	0.1613	239.97
99	0.1420	240.24	0.1095	241.03	0.1614	241.47
100	0.1420	240.44	0.1099	246.21	0.1615	241.42
108	0.1422	240.99	0.1098	249.84	0.1616	241.27
109	0.1422	239.30	0.1097	240.77	0.1614	240.49
110	0.1423	239.92	0.1099	244.73	0.1615	240.81
118	0.1424	240.40	0.1098	246.72	0.1615	241.68
119	0.1424	240.30	0.1098	245.81	0.1615	239.39
120	0.1423	240.85	0.1100	243.69	0.1615	239.29

Subject: 3 Board: Inclined Pickup: Centre

Min	----Deltoid-----		---Trapezius----		-Infraspinatus--	
	RMS	MPF	RMS	MPF	RMS	MPF
8	0.1358	291.01	0.1015	240.05	0.1519	240.20
9	0.1363	299.83	0.1016	243.30	0.1521	239.92
10	0.1368	329.47	0.1015	243.80	0.1522	239.95
18	0.1382	302.53	0.1015	243.06	0.1530	239.75
19	0.1383	300.02	0.1017	244.50	0.1530	239.68
20	0.1377	279.67	0.1014	241.52	0.1530	240.66
28	0.1384	273.11	0.1013	240.91	0.1537	239.72
29	0.1404	311.30	0.1013	245.03	0.1538	240.60
30	0.1399	295.74	0.1013	242.58	0.1539	240.18
38	0.1394	268.01	0.1014	242.19	0.1544	240.77
39	0.1400	284.19	0.1013	241.72	0.1545	240.97
40	0.1396	273.44	0.1013	241.27	0.1546	239.92
48	0.1418	280.75	0.1012	243.96	0.1551	241.08
49	0.1412	272.83	0.1012	243.44	0.1550	240.83
50	0.1422	269.29	0.1012	245.59	0.1551	240.38
58	0 1445	310.97	0.1011	243.73	0.1557	241.76
59	0.1432	271.22	0.1011	243.47	0.1558	242.03
60	0.1436	288.80	0.1012	244.70	0.1558	243.22
68	0.1442	291.36	0.1013	243.73	0.1562	241.84
69	0.1439	265.17	0.1013	241.88	0.1562	241.10
70	0.1429	263.12	0.1013	243.53	0.1563	243.20
78	0.1428	257.78	0.1012	240.88	0.1564	241.44
79	0.1438	272.42	0.1011	244.70	0.1567	240.92
80	0.1444	262.50	0.1012	241.84	0.1569	245.50
88	0.1452	287.59	0.1015	249.58	0.1570	243.60
89	0.1440	266.25	0.1014	240.70	0.1570	243.02
90	0.1462	286.50	0.1013	248.51	0.1571	241.66
98	0.1455	269.36	0.1012	242.43	0.1573	241.79
99	0.1457	275.92	0.1013	246.80	0.1575	243.04
100	0.1456	273.01	0.1013	243.59	0.1574	243.17
108	0.1457	262.51	0.1013	244.99	0.1575	240.11
109	0.1463	290.30	0.1012	248.73	0.1576	242.42
110	0.1447	253.92	0.1010	239.63	0.1575	241.13
118	0.1459	278.68	0.1012	246.50	0.1578	240.98
119	0.1479	298.02	0.1015	247.55	0.1576	240.71
120	0.1479	286.54	0.1014	248.91	0.1578	239.65

Subject: 4 Board: Straight Pickup: Opposite

	----Deltoid-----		---Trapezius----		-Infraspinatus--	
Min	RMS	MPF	RMS	MPF	RMS	MPF
8	0.1442	239.57	0.1111	240.59	0.1634	239.64
9	0.1442	239.38	0.1111	241.18	0.1634	240.02
10	0.1442	239.60	0.1109	241.33	0.1634	239.98
18	0.1443	240.28	0.1111	241.21	0.1639	248.37
19	0.1443	240.49	0.1112	240.91	0.1642	251.87
20	0.1444	239.35	0.1110	240.51	0.1637	243.70
28	0.1445	239.17	0.1110	242.61	0.1635	240.27
29	0.1444	240.26	0.1111	239.15	0.1636	239.92
30	0.1445	239.65	0.1111	240.99	0.1636	242.69
38	0.1446	239.43	0.1111	240.01	0.1635	240.87
39	0.1447	239.59	0.1110	241.50	0.1636	240.75
40	0.1447	239.55	0.1110	240.12	0.1635	240.56
48	0.1448	241.74	0.1112	243.72	0.1636	239.99
49	0.1447	240.29	0.1111	242.33	0.1636	240.17
50	0.1447	239.75	0.1112	242.02	0.1636	240.94
58	0.1448	239.84	0.1110	241.76	0.1636	240.00
59	0.1449	239.95	0.1111	240.84	0.1636	240.01
60	0.1448	239.04	0.1109	239.95	0.1636	240.43
68	0.1451	238.62	0.1110	241.16	0.1637	240.19
69	0.1449	239.60	0.1111	240.65	0.1638	240.26
70	0.1451	240.51	0.1111	242.44	0.1637	240.90
78	0.1452	241.70	0.1110	240.33	0.1638	239.93
79	0.1452	241.19	0.1110	242.58	0.1637	240.10
80	0.1452	239.55	0.1111	241.55	0.1638	240.41
88	0.1452	241.25	0.1109	243.15	0.1639	239.98
89	0.1452	240.99	0.1113	242.28	0.1638	240.33
90	0.1454	241.37	0.1111	242.46	0.1639	240.44
98	0.1451	240.89	0.1110	240.53	0.1638	240.46
99	0.1453	242.18	0.1110	240.76	0.1640	240.90
100	0.1456	245.10	0.1112	241.36	0.1637	239.56
108	0.1459	246.21	0.1112	242.45	0.1639	240.37
109	0.1455	245.15	0.1110	240.46	0.1639	240.48
110	0.1458	245.45	0.1110	243.02	0.1639	240.93
118	0.1458	244.97	0.1111	241.49	0.1638	241.03
119	0.1456	245.90	0.1111	240.18	0.1640	241.40
120	0.1457	245.22	0.1113	241.61	0.1640	240.88

Subject: 4 Board: Straight Pickup: Centre

Min	----Deltoid-----		---Trapezius----		-Infraspinatus--	
	RMS	MPF	RMS	MPF	RMS	MPF
8	0.1446	348.85	0.1117	443.46	0.1554	239.88
9	0.1429	303.12	0.1111	406.95	0.1554	240.44
10	0.1454	370.97	0.1144	439.23	0.1554	239.44
18	0.1437	318.31	0.1076	352.83	0.1554	239.53
19	0.1450	349.81	0.1114	422.83	0.1556	239.76
20	0.1435	315.82	0.1074	388.75	0.1554	240.31
28	0.1457	380.38	0.1129	447.92	0.1555	239.87
29	0.1456	351.09	0.1132	454.11	0.1555	240.42
30	0.1509	440.64	0.1157	558.55	0.1554	240.23
38	0.1427	312.10	0.1131	480.43	0.1554	238.64
39	0.1438	328.30	0.1131	447.99	0.1554	240.04
40	0.1441	332.25	0.1154	523.47	0.1555	240.44
48	0.1434	305.88	0.1104	418.53	0.1555	239.51
49	0.1442	329.91	0.1165	556.56	0.1556	238.94
50	0.1450	347.43	0.1155	540.95	0.1557	239.73
58	0.1444	339.77	0.1182	539.39	0.1557	239.23
59	0.1448	331.94	0.1153	507.77	0.1557	240.85
60	0.1452	326.63	0.1155	537.31	0.1558	240.51
68	0.1431	293.11	0.1125	438.96	0.1557	240.03
69	0.1433	312.24	0.1111	406.67	0.1557	240.05
70	0.1418	298.40	0.1097	416.93	0.1558	239.94
78	0.1434	319.86	0.1161	511.04	0.1561	241.85
79	0.1442	316.47	0.1154	489.10	0.1562	244.56
80	0.1428	300.13	0.1106	401.92	0.1559	240.53
88	0.1436	327.62	0.1105	404.82	0.1561	242.72
89	0.1426	276.49	0.1093	386.12	0.1559	241.22
90	0.1448	320.55	0.1145	481.71	0.1561	241.63
98	0.1436	342.16	0.1099	413.18	0.1564	245.76
99	0.1450	356.37	0.1185	545.74	0.1564	249.19
100	0.1452	346.26	0.1166	503.79	0.1564	247.29
108	0.1433	321.19	0.1132	498.16	0.1565	247.62
109	0.1433	334.69	0.1145	468.99	0.1567	249.10
110	0.1443	318.79	0.1120	442.26	0.1565	247.23
118	0.1430	321.98	0.1119	429.72	0.1570	255.44
119	0.1434	331.24	0.1102	390.38	0.1568	251.65
120	0.1440	319.46	0.1136	455.27	0.1570	252.50

Subject: 4 Board: V-Shaped Pickup: Opposite

	----Deltoid-----		---Trapezius----		-Infraspinatus--	
Min	RMS	MPF	RMS	MPF	RMS	MPF
8	0.1360	240.44	0.1029	239.56	0.1568	278.93
9	0.1360	240.83	0.1030	239.66	0.1574	298.54
10	0.1361	239.26	0.1030	240.56	0.1573	290.14
18	0.1369	240.87	0.1031	240.72	0.1578	287.10
19	0.1369	245.77	0.1032	240.25	0.1577	282.05
20	0.1369	246.16	0.1031	239.80	0.1585	301.87
28	0.1375	246.62	0.1034	239.50	0.1600	322.40
29	0.1371	246.08	0.1034	239.78	0.1610	345.17
30	0.1376	244.80	0.1033	239.40	0.1591	311.79
38	0.1378	247.60	0.1034	240.64	0.1646	391.42
39	0.1377	245.99	0.1035	239.06	0.1571	269.97
40	0.1376	244.07	0.1034	240.30	0.1583	284.85
48	0.1382	246.12	0.1036	240.00	0.1595	300.27
49	0.1385	255.68	0.1036	241.16	0.1585	297.64
50	0.1386	257.01	0.1036	239.44	0.1575	272.14
58	0.1387	263.90	0.1038	240.02	0.1581	285.47
59	0.1387	262.90	0.1039	240.59	0.1583	276.30
60	0.1388	259.00	0.1038	240.74	0.1582	278.84
68	0.1390	260.13	0.1040	239.86	0.1573	261.17
69	0.1391	259.00	0.1040	239.58	0.1573	259.10
70	0.1391	268.12	0.1039	239.96	0.1577	270.15
78	0.1390	269.23	0.1041	240.73	0.1574	263.41
79	0.1395	269.54	0.1041	240.79	0.1572	260.61
80	0.1391	252.88	0.1041	239.72	0.1576	262.33
88	0.1395	270.81	0.1041	240.29	0.1571	265.92
89	0.1400	264.51	0.1042	240.69	0.1574	258.88
90	0.1396	250.91	0.1043	239.95	0.1575	256.81
98	0.1409	275.55	0.1042	239.53	0.1583	270.41
99	0.1402	265.13	0.1043	240.57	0.1577	263.58
100	0.1404	270.48	0.1043	240.58	0.1578	276.32
108	0.1406	267.49	0.1043	241.34	0.1583	264.73
109	0.1400	273.61	0.1043	240.57	0.1573	263.96
110	0.1407	283.35	0.1044	242.12	0.1573	261.03
118	0.1402	269.05	0.1044	239.83	0.1573	255.12
119	0.1395	260.99	0.1045	240.38	0.1576	257.09
120	0.1400	273.20	0.1045	240.48	0.1589	275.54

Subject: 4 Board: V-Shaped Pickup: Centre

	----Deltoid-----		---Trapezius----		-Infraspinatus--	
Min	RMS	MPF	RMS	MPF	RMS	MPF
8	0.1333	241.04	0.1108	239.08	0.1579	239.40
9	0.1337	243.13	0.1108	239.21	0.1580	240.07
10	0.1339	245.81	0.1108	239.10	0.1581	239.88
18	0.1351	243.94	0.1107	240.09	0.1587	239.98
19	0.1359	247.40	0.1107	239.51	0.1587	239.36
20	0.1353	247.01	0.1108	239.78	0.1588	239.69
28	0.1373	251.57	0.1106	239.47	0.1594	239.19
29	0.1367	250.24	0.1107	238.72	0.1594	240.35
30	0.1377	262.19	0.1107	239.70	0.1595	239.69
38	0.1385	258.66	0.1107	240.01	0.1599	240.34
39	0.1388	259.88	0.1107	240.13	0.1601	240.17
40	0.1382	247.47	0.1106	239.36	0.1599	239.86
48	0.1397	298.69	0.1106	238.89	0.1604	240.23
49	0.1408	265.74	0.1107	239.16	0.1604	240.18
50	0.1416	286.43	0.1107	240.23	0.1606	240.15
58	0.1426	287.18	0.1107	240.17	0.1609	239.72
59	0.1414	266.18	0.1106	239.72	0.1609	239.87
60	0.1429	283.27	0.1105	239.75	0.1610	239.63
68	0.1437	312.51	0.1107	239.80	0.1613	240.19
69	0.1434	305.04	0.1107	239.75	0.1613	239.29
70	0.1434	271.54	0.1107	239.85	0.1613	240.37
78	0.1452	305.66	0.1106	240.20	0.1616	239.70
79	0.1439	294.63	0.1107	239.64	0.1617	240.20
80	0.1442	292.98	0.1106	240.31	0.1618	239.39
88	0.1437	283.63	0.1106	240.49	0.1620	240.03
89	0.1443	293.64	0.1107	239.22	0.1620	239.91
90	0.1451	294.77	0.1107	240.82	0.1620	239.29
98	0.1451	286.57	0.1108	239.87	0.1623	240.24
99	0.1440	270.90	0.1107	240.47	0.1623	239.37
100	0.1449	281.34	0.1107	240.18	0.1623	240.32
108	0.1439	269.82	0.1107	239.68	0.1625	239.71
109	0.1441	269.78	0.1108	239.91	0.1627	240.03
110	0.1461	294.68	0.1107	239.95	0.1627	240.15
118	0.1477	298.78	0.1107	240.75	0.1628	239.75
119	0.1454	279.38	0.1107	240.19	0.1628	239.72
120	0.1454	285.17	0.1107	241.59	0.1628	239.13

Subject: 4 Board: Inclined Pickup: Opposite

Min	----Deltoid-----		---Trapezius----		-Infraspinatus--	
	RMS	MPF	RMS	MPF	RMS	MPF
8	0.1278	241.88	0.1119	274.50	0.1552	239.50
9	0.1280	240.63	0.1124	278.21	0.1553	240.09
10	0.1283	241.46	0.1126	285.14	0.1554	239.45
18	0.1298	240.97	0.1134	307.98	0.1564	239.06
19	0.1302	241.52	0.1137	291.13	0.1564	239.75
20	0.1303	240.80	0.1145	319.10	0.1565	239.48
28	0.1318	240.72	0.1121	262.34	0.1572	239.07
29	0.1320	240.94	0.1142	308.69	0.1573	239.98
30	0.1321	240.97	0.1134	298.99	0.1573	239.67
38	0.1335	242.84	0.1137	291.70	0.1579	239.12
39	0.1336	244.98	0.1136	286.50	0.1581	239.80
40			0.1130	286.69	0.1581	239.46
48			0.1114	251.55	0.1586	239.86
49			0.1116	268.53	0.1586	240.05
50			0.1116	273.13	0.1587	239.93
58	0.1358	240.79	0.1120	284.04	0.1591	240.51
59	0.1359	240.61	0.1120	268.58	0.1592	240.52
60	0.1360	240.13	0.1136	302.34	0.1592	240.08
68	0.1369	240.66	0.1137	308.93	0.1597	240.07
69	0.1369	240.94	0.1143	320.43	0.1596	240.24
70			0.1127	282.25	0.1598	240.63
78	0.1379	239.99	0.1131	299.87	0.1600	241.07
79	0.1380	240.04	0.1117	269.65	0.1602	239.79
80	0.1380	239.71	0.1141	312.98	0.1603	241.52
88	0.1386	239.75	0.1138	303.18	0.1605	242.43
89	0.1387	239.47	0.1127	297.55	0.1607	244.77
90	0.1387	240.32	0.1141	320.95	0.1606	245.18
98	0.1393	241.44	0.1143	321.88	0.1614	251.74
99	0.1393	240.36	0.1121	273.23	0.1607	243.01
100	0.1394	239.47	0.1123	272.98	0.1614	247.87
108	0.1399	240.77	0.1146	320.01	0.1624	258.96
109	0.1400	240.32	0.1149	328.70	0.1628	267.33
110	0.1401	240.37	0.1139	311.71	0.1623	261.55
118	0.1405	239.93	0.1121	260.60	0.1618	251.15
119	0.1405	240.06	0.1140	313.41	0.1625	258.61
120	0.1407	240.12	0.1122	282.67	0.1628	263.23

Subject: 4 Board: Inclined Pickup: Centre

Min	----Deltoid----- RMS	MPF	---Trapezius---- RMS	MPF	-Infraspinatus-- RMS	MPF
8	0.1500	238.90	0.1026	240.06	0.1608	239.71
9	0.1500	239.41	0.1026	239.70	0.1609	239.74
10	0.1500	239.15	0.1027	239.00	0.1608	239.68
18	0.1499	239.50	0.1029	240.77	0.1608	239.90
19	0.1499	239.75	0.1027	240.82	0.1609	239.35
20	0.1498	239.57	0.1027	240.07	0.1608	239.76
28	0.1496	239.62	0.1028	239.86	0.1608	239.32
29	0.1496	240.05	0.1030	244.56	0.1607	239.38
30	0.1496	239.08	0.1156	528.14	0.1607	239.11
38	0.1500	246.90	0.1030	241.14	0.1607	239.17
39	0.1496	241.27	0.1030	240.60	0.1607	239.31
40	0.1495	239.47	0.1029	240.64	0.1608	239.42
48	0.1494	238.23	0.1030	240.33	0.1607	239.85
49	0.1495	238.63	0.1030	239.43	0.1607	239.16
50	0.1494	239.95	0.1030	239.26	0.1607	239.84
58	0.1493	239.66	0.1030	240.51	0.1607	239.08
59	0.1493	239.13	0.1030	239.56	0.1607	239.51
60	0.1493	239.53	0.1030	239.70	0.1607	239.56
68	0.1492	239.47	0.1030	239.10	0.1607	239.52
69	0.1492	239.66	0.1030	240.08	0.1607	239.89
70	0.1492	239.43	0.1031	241.20	0.1606	240.11
78	0.1490	239.20	0.1031	239.11	0.1606	239.13
79	0.1490	239.52	0.1031	239.91	0.1606	239.13
80	0.1489	239.14	0.1031	239.88	0.1606	239.23
88	0.1488	239.86	0.1032	240.43	0.1605	239.41
89	0.1487	239.60	0.1033	239.38	0.1605	239.03
90	0.1488	239.37	0.1032	241.33	0.1606	239.18
98	0.1487	238.93	0.1034	239.62	0.1605	239.76
99	0.1487	239.20	0.1035	240.66	0.1606	239.74
100	0.1486	239.39	0.1035	240.67	0.1606	239.40
108	0.1484	239.33	0.1035	240.37	0.1605	239.36
109	0.1483	240.60	0.1036	240.07	0.1605	239.23
110	0.1484	239.74	0.1036	240.49	0.1606	240.05
118	0.1482	240.04	0.1037	241.08	0.1604	239.16
119	0.1481	239.96	0.1037	240.92	0.1605	239.45
120	0.1480	239.45	0.1037	239.90	0.1605	239.25

Subject: 5 Board: Straight Pickup: Opposite

	----Deltoid-----		---Trapezius----		-Infraspinatus--	
Min	RMS	MPF	RMS	MPF	RMS	MPF
8	0.1004	325.54	0.0806	278.52	0.1246	311.60
9	0.1036	391.69	0.0821	286.31	0.1254	317.43
10	0.1015	308.18	0.0819	275.75	0.1271	349.23
18	0.1083	327.65	0.0832	279.54	0.1346	412.28
19	0.1086	335.06	0.0835	277.13	0.1328	379.67
20	0.1072	290.99	0.0838	278.34	0.1324	366.96
28	0.1095	258.19	0.0837	262.82	0.1292	269.89
29	0.1114	333.52	0.0837	269.15	0.1339	351.00
30	0.1132	322.31	0.0841	272.06	0.1340	364.68
38	0.1124	278.92	0.0844	272.79	0.1318	307.86
39	0.1123	287.25	0.0844	280.43	0.1316	290.21
40	0.1148	314.70	0.0844	281.44	0.1338	302.52
48	0.1157	309.11	0.0851	290.02	0.1337	330.42
49	0.1160	311.83	0.0851	305.23	0.1336	312.12
50	0.1161	300.94	0.0850	288.99	0.1342	306.28
58	0.1169	285.58	0.0848	270.87	0.1333	294.23
59	0.1170	306.23	0.0851	292.48	0.1337	297.52
60	0.1194	353.59	0.0854	283.52	0.1361	328.75
68	0.1187	306.59			0.1362	318.88
69	0.1181	305.56			0.1388	367.25
70	0.1177	269.10			0.1343	284.35
78	0.1183	273.48	0.0847	262.03	0.1343	281.63
79	0.1201	311.50	0.0850	270.01	0.1364	303.99
80	0.1203	301.87	0.0845	260.21	0.1364	306.71
88	0.1193	272.46	0.0846	263.09	0.1340	260.83
89	0.1201	272.88	0.0848	268.50	0.1354	284.58
90	0.1204	281.34	0.0845	262.32	0.1346	273.35
98	0.1205	278.33	0.0845	259.13	0.1381	327.41
99	0.1226	319.04	0.0850	281.00	0.1409	377.57
100	0.1204	265.62	0.0844	256.25	0.1373	310.49
108	0.1231	302.05	0.0845	264.24	0.1364	292.10
109	0.1221	277.61	0.0859	283.27	0.1372	301.66
110	0.1207	273.54	0.0841	254.25	0.1362	283.69
118	0.1208	255.86	0.0848	265.74	0.1362	279.12
119	0.1228	301.68	0.0852	289.24	0.1394	325.65
120	0.1232	322.05	0.0851	298.61	0.1377	312.69

Subject: 5 Board: Straight Pickup: Centre

Min	----Deltoid-----		---Trapezius----		-Infraspinatus--	
	RMS	MPF	RMS	MPF	RMS	MPF
8	0.1261	301.70	0.0797	372.51	0.1312	252.59
9	0.1261	311.18	0.0814	390.08	0.1309	256.90
10	0.1253	293.48	0.0808	394.17	0.1313	250.36
18	0.1267	305.63	0.0812	379.02	0.1312	253.53
19	0.1250	283.62	0.0806	370.94	0.1311	252.69
20	0.1247	283.43	0.0819	386.76	0.1313	250.05
28	0.1262	299.18	0.0805	365.24	0.1314	256.48
29	0.1247	286.73	0.0812	390.68	0.1314	253.08
30	0.1251	278.76	0.0806	369.12	0.1314	258.72
38	0.1268	318.97	0.0837	473.15	0.1314	256.36
39	0.1253	288.97	0.0802	325.93	0.1310	251.10
40	0.1251	291.53	0.0808	360.22	0.1309	253.84
48	0.1245	295.75	0.0829	418.29	0.1312	254.65
49	0.1246	293.39	0.0815	352.66	0.1313	256.93
50	0.1259	307.28	0.0822	386.12	0.1314	250.20
58	0.1245	280.90	0.0801	342.72	0.1316	254.43
59	0.1257	328.77	0.0826	421.53	0.1310	261.72
60	0.1262	297.09	0.0812	378.86	0.1315	257.99
68	0.1257	319.29	0.0825	389.77	0.1314	253.57
69	0.1258	306.13	0.0831	418.69	0.1310	250.57
70	0.1240	265.89	0.0803	343.14	0.1312	252.18
78	0.1263	306.64	0.0860	477.10	0.1319	253.12
79	0.1269	330.05	0.0849	474.84	0.1315	253.06
80	0.1251	295.46	0.0811	364.52	0.1317	250.09
88	0.1265	312.95	0.0837	437.05	0.1315	251.93
89	0.1235	259.08	0.0810	361.71	0.1313	252.16
90	0.1241	271.10	0.0817	367.79	0.1316	248.13
98	0.1272	318.42	0.0820	367.40	0.1312	250.21
99	0.1251	284.54	0.0802	340.01	0.1316	255.14
100	0.1270	319.06	0.0833	397.20	0.1315	250.73
108	0.1243	284.60	0.0811	358.89	0.1315	253.11
109	0.1250	281.36	0.0801	324.08	0.1317	254.07
110	0.1254	293.13	0.0813	360.91	0.1319	256.18
118	0.1255	298.74	0.0824	423.48	0.1315	255.71
119	0.1271	327.97	0.0852	485.83	0.1314	262.31
120	0.1268	318.57	0.0838	421.15	0.1316	253.53

Subject: 5 Board: V-Shaped Pickup: Opposite

Min	----Deltoid----- RMS	MPF	---Trapezius---- RMS	MPF	-Infraspinatus-- RMS	MPF
8	0.1042	243.52	0.0691	323.67	0.1183	274.32
9	0.1044	244.83	0.0692	321.85	0.1175	266.36
10	0.1045	244.93	0.0686	304.12	0.1178	271.02
18	0.1062	246.36	0.0691	301.02	0.1202	288.57
19	0.1066	245.78	0.0686	314.36	0.1200	285.30
20	0.1066	245.61	0.0698	356.57	0.1200	296.61
28	0.1079	244.35	0.0697	335.00	0.1203	275.11
29	0.1081	240.47	0.0701	375.26	0.1199	270.35
30	0.1083	243.21	0.0693	331.10	0.1198	271.94
38	0.1098	246.29	0.0714	393.29	0.1215	270.94
39	0.1097	241.83	0.0690	303.20	0.1205	262.95
40	0.1100	243.62	0.0690	316.11	0.1208	264.84
48	0.1111	241.50	0.0678	270.47	0.1214	261.64
49	0.1115	243.41	0.0694	322.77	0.1217	265.97
50	0.1116	244.32	0.0718	395.10	0.1225	282.55
58	0.1127	246.52	0.0689	309.71	0.1223	267.06
59	0.1126	241.83	0.0684	280.83	0.1221	260.86
60	0.1127	241.45	0.0680	291.43	0.1216	257.43
68	0.1138	241.60	0.0688	304.71	0.1225	265.49
69	0.1139	245.71	0.0700	339.65	0.1226	269.75
70	0.1142	250.03	0.0703	356.58	0.1231	267.92
78	0.1150	244.21	0.0696	325.32	0.1236	268.36
79	0.1151	247.11	0.0705	363.21	0.1237	279.32
80	0.1151	244.64	0.0701	314.66	0.1238	273.75
88	0.1158	242.50	0.0695	322.60	0.1239	277.13
89	0.1159	244.75	0.0690	306.08	0.1244	287.57
90	0.1159	239.59	0.0693	300.19	0.1245	266.82
98	0.1166	240.73	0.0683	261.49	0.1236	259.82
99	0.1167	241.07	0.0677	251.37	0.1241	274.78
100	0.1281	468.42	0.0683	267.18	0.1240	264.94
108	0.1172	241.16	0.0682	255.46	0.1249	274.70
109	0.1173	240.18	0.0682	251.57	0.1246	261.12
110	0.1173	240.30	0.0685	256.41	0.1246	270.51
118	0.1182	244.60	0.0681	250.68	0.1245	276.38
119	0.1181	242.44	0.0681	249.51	0.1247	276.68
120	0.1181	242.72	0.0681	248.12	0.1252	274.01

Subject: 5 Board: V-Shaped Pickup: Centre

Min	----Deltoid-----		---Trapezius----		-Infraspinatus--	
	RMS	MPF	RMS	MPF	RMS	MPF
8	0.1009	302.08	0.0822	301.90	0.1219	250.14
9	0.1041	363.16	0.0834	327.78	0.1231	269.25
10	0.1026	315.10	0.0827	311.66	0.1234	262.58
18	0.1047	299.13	0.0836	312.71	0.1246	258.86
19	0.1073	350.97	0.0834	309.35	0.1253	263.68
20	0.1072	347.06	0.0836	300.62	0.1245	256.54
28	0.1115	371.35	0.0855	335.38	0.1263	251.25
29	0.1107	341.51	0.0845	330.07	0.1264	258.85
30	0.1130	385.41	0.0867	349.99	0.1268	263.09
38	0.1104	298.78	0.0840	324.65	0.1263	241.63
39	0.1149	424.44	0.0855	344.44	0.1267	240.62
40	0.1118	343.43	0.0853	335.10	0.1268	241.88
48	0.1147	350.97	0.0870	377.85	0.1278	250.04
49	0.1145	349.46	0.0855	343.25	0.1280	248.52
50	0.1125	320.38	0.0841	299.17	0.1279	243.33
58	0.1145	334.76	0.0847	318.88	0.1292	252.92
59	0.1163	353.19	0.0851	331.18	0.1290	250.37
60	0.1159	337.20	0.0853	340.71	0.1292	249.71
68	0.1135	282.88	0.0855	316.55	0.1297	243.16
69	0.1157	302.71	0.0864	347.76	0.1299	245.22
70	0.1150	295.67	0.0842	286.27	0.1298	245.79
78	0.1157	295.69	0.0868	357.27	0.1305	245.87
79	0.1175	343.94	0.0856	345.18	0.1308	249.70
80	0.1180	336.24	0.0857	326.06	0.1308	252.12
88	0.1179	290.10	0.0854	335.55	0.1313	244.41
89	0.1163	267.55	0.0847	299.98	0.1313	241.37
90	0.1176	298.99	0.0875	351.52	0.1317	245.56
98	0.1194	304.75	0.0885	398.88	0.1315	242.68
99	0.1200	319.27	0.0879	376.30	0.1321	245.04
100	0.1202	332.14	0.0886	387.77	0.1323	245.47
108	0.1215	344.00	0.0874	381.71	0.1328	248.16
109	0.1190	276.13	0.0871	332.20	0.1326	242.10
110	0.1198	291.98	0.0878	364.00	0.1326	243.92
118	0.1200	283.78	0.0880	379.78	0.1330	244.18
119	0.1199	283.94	0.0876	361.02	0.1332	241.79
120	0.1201	281.52	0.0861	357.76	0.1334	242.02

Subject: 5 Board: Inclined Pickup: Opposite

	----Deltoid-----		---Trapezius----		-Infraspinatus--	
Min	RMS	MPF	RMS	MPF	RMS	MPF
8	0.0972	301.62	0.0739	300.48	0.1153	255.64
9	0.0984	318.65	0.0734	317.28	0.1155	255.05
10	0.0982	307.35	0.0735	313.13	0.1156	256.83
18	0.1013	329.54	0.0735	286.95	0.1173	261.18
19	0.1018	329.89	0.0750	312.96	0.1178	256.80
20	0.1005	306.93	0.0732	295.98	0.1173	262.48
28	0.1020	295.11	0.0736	303.33	0.1179	256.49
29	0.1036	327.71	0.0743	318.44	0.1183	257.51
30	0.1034	328.21	0.0744	307.45	0.1186	266.60
38	0.1064	352.59	0.0741	305.26	0.1194	275.46
39	0.1041	294.18	0.0737	297.84	0.1197	262.80
40	0.1052	320.62	0.0743	307.40	0.1194	271.87
48	0.1076	357.41	0.0737	280.67	0.1201	262.85
49	0.1094	395.67	0.0740	293.91	0.1207	270.66
50	0.1057	295.83	0.0736	273.82	0.1202	261.21
58	0.1081	323.84	0.0750	320.81	0.1217	284.59
59	0.1073	300.59	0.0742	301.26	0.1218	276.01
60	0.1082	329.34	0.0747	303.10	0.1221	280.24
68	0.1104	338.29	0.0762	335.53	0.1231	287.14
69	0.1099	320.28	0.0763	343.29	0.1227	282.11
70	0.1092	318.65	0.0744	282.39	0.1221	264.07
78	0.1090	294.31	0.0753	300.20	0.1228	269.99
79	0.1097	301.06	0.0748	312.61	0.1228	267.20
80	0.1093	296.38	0.0739	267.46	0.1227	260.37
88	0.1107	291.34	0.0748	299.96	0.1230	262.90
89	0.1106	304.75	0.0755	294.97	0.1233	269.83
90	0.1103	286.07	0.0744	282.54	0.1233	265.66
98	0.1107	284.65	0.0742	255.62	0.1237	260.77
99	0.1127	342.69	0.0755	305.59	0.1238	271.35
100	0.1128	335.26	0.0748	299.78	0.1236	267.57
108	0.1126	297.09	0.0754	302.60	0.1243	259.69
109	0.1128	324.42	0.0754	305.86	0.1248	269.34
110	0.1124	290.56	0.0755	285.49	0.1239	260.84
118	0.1121	286.76	0.0758	286.94	0.1243	257.10
119	0.1135	307.60	0.0764	321.51	0.1250	274.02
120	0.1133	297.49	0.0759	294.42	0.1248	273.85

Subject: 5 Board: Inclined Pickup: Centre

	----Deltoid-----		---Trapezius----		-Infraspinatus--	
Min	RMS	MPF	RMS	MPF	RMS	MPF
8	0.1323	282.99	0.0837	359.03	0.1365	248.25
9	0.1306	249.75	0.0829	309.44	0.1367	245.10
10	0.1312	260.32	0.0815	298.72	0.1365	244.69
18	0.1331	294.57	0.0867	398.16	0.1367	249.20
19	0.1309	261.97	0.0831	328.67	0.1367	247.21
20	0.1320	279.34	0.0839	348.42	0.1366	249.11
28	0.1320	272.73	0.0847	343.79	0.1368	247.48
29	0.1310	272.19	0.0845	348.41	0.1367	248.58
30	0.1330	306.32	0.0836	358.05	0.1367	245.85
38	0.1322	288.37	0.0865	412.99	0.1366	247.10
39	0.1330	290.98	0.0895	472.87	0.1366	251.10
40	0.1335	313.02	0.0887	455.56	0.1368	249.63
48	0.1315	275.59	0.0852	373.19	0.1365	250.48
49	0.1308	269.51	0.0871	437.67	0.1366	247.03
50	0.1311	273.66	0.0850	394.48	0.1366	247.55
58	0.1298	274.72	0.0858	410.57	0.1364	247.42
59	0.1311	271.19	0.0860	373.49	0.1361	244.46
60	0.1324	298.36	0.0845	343.51	0.1365	247.31
68	0.1318	315.60	0.0898	482.56	0.1366	248.22
69	0.1301	279.39	0.0874	422.20	0.1364	246.50
70	0.1305	263.98	0.0866	379.96	0.1365	245.88
78	0.1308	283.69	0.0890	437.55	0.1367	246.62
79	0.1303	286.06	0.0883	445.60	0.1363	247.42
80	0.1299	269.42	0.0855	390.85	0.1366	248.76
88	0.1292	258.05	0.0862	386.19	0.1363	244.90
89	0.1295	260.78	0.0838	341.67	0.1364	247.04
90	0.1331	313.95	0.0872	424.88	0.1368	251.47
98	0.1296	277.08	0.0895	455.92	0.1361	247.46
99	0.1300	276.04	0.0875	433.84	0.1368	248.69
100	0.1304	281.37	0.0874	430.26	0.1363	245.61
108	0.1311	295.12	0.0868	425.89	0.1362	247.60
109	0.1299	277.15	0.0861	372.65	0.1364	244.72
110	0.1303	283.81	0.0875	452.55	0.1364	249.92
118	0.1303	283.37	0.0864	401.29	0.1362	248.99
119	0.1305	287.95	0.0888	442.97	0.1366	248.19
120	0.1306	272.42	0.0847	330.70	0.1363	247.27

Subject: 6 Board: Straight Pickup: Opposite

Min	----Deltoid----- RMS	MPF	---Trapezius---- RMS	MPF	-Infraspinatus-- RMS	MPF
8	0.1112	448.24	0.0800	427.13	0.1211	268.39
9	0.1067	326.48	0.0789	379.49	0.1206	256.36
10	0.1088	353.60	0.0789	386.35	0.1204	256.42
18	0.1081	316.90	0.0789	380.42	0.1219	258.64
19	0.1105	337.14	0.0802	382.82	0.1214	256.29
20	0.1109	353.73	0.0801	399.79	0.1218	265.65
28	0.1113	339.75	0.0786	365.34	0.1235	265.04
29	0.1147	417.83	0.0803	410.47	0.1239	270.24
30	0.1136	347.24	0.0811	397.24	0.1235	266.15
38	0.1148	363.12	0.0814	409.85	0.1236	269.51
39	0.1129	317.78	0.0788	382.22	0.1233	251.65
40	0.1120	304.12	0.0783	318.30	0.1237	256.24
48	0.1133	293.56	0.0810	409.25	0.1239	253.78
49	0.1127	290.15	0.0803	393.23	0.1240	252.35
50	0.1131	313.51	0.0810	420.78	0.1237	254.45
58	0.1125	270.90	0.0795	363.68	0.1242	246.55
59	0.1145	309.57	0.0804	396.32	0.1249	255.05
60	0.1133	280.31	0.0795	382.98	0.1243	249.22
68	0.1143	277.89	0.0790	360.30	0.1251	253.45
69	0.1171	342.45	0.0790	339.11	0.1254	257.67
70	0.1152	289.20	0.0809	386.98	0.1251	256.60
78	0.1148	279.36	0.0786	341.11	0.1255	248.40
79	0.1158	286.86	0.0790	376.79	0.1256	255.93
80	0.1142	261.73	0.0792	344.64	0.1255	241.03
88	0.1163	299.77	0.0809	388.48	0.1258	254.11
89	0.1161	273.86	0.0785	348.90	0.1259	251.33
90	0.1158	270.78	0.0794	343.69	0.1261	251.27
98	0.1173	281.21	0.0816	442.96	0.1259	247.08
99	0.1168	281.36	0.0799	378.43	0.1262	250.02
100	0.1168	284.36	0.0796	347.68	0.1266	251.81
108	0.1174	302.84	0.0805	413.62	0.1269	258.52
109	0.1214	363.61	0.0828	422.89	0.1272	268.69
110	0.1169	279.56	0.0799	357.47	0.1266	248.03
118	0.1190	315.80	0.0800	387.60	0.1273	262.48
119	0.1193	325.70	0.0816	416.11	0.1279	267.88
120	0.1189	306.03	0.0816	391.16	0.1278	271.09

Subject: 6 Board: Straight Pickup: Centre

	----Deltoid-----		---Trapezius----		-Infraspinatus--	
Min	RMS	MPF	RMS	MPF	RMS	MPF
8	0.1219	238.94	0.0871	303.53	0.1359	247.84
9	0.1218	239.85	0.0888	322.61	0.1359	251.56
10	0.1218	239.28	0.0890	334.44	0.1364	250.50
18	0.1219	242.15	0.0889	347.00	0.1362	251.86
19	0.1217	241.45	0.0885	357.41	0.1367	259.53
20	0.1216	240.33	0.0875	318.30	0.1356	247.53
28	0.1215	239.54	0.0874	309.74	0.1359	243.84
29	0.1216	245.24	0.0876	324.66	0.1366	248.84
30	0.1217	245.01	0.0894	343.48	0.1367	256.97
38	0.1215	241.21	0.0883	310.17	0.1362	250.48
39	0.1214	240.00	0.0871	297.44	0.1361	242.08
40	0.1214	244.47	0.0882	301.28	0.1361	247.49
48	0.1213	241.59	0.0888	310.54	0.1362	253.15
49	0.1215	246.66	0.0889	319.90	0.1364	256.77
50	0.1213	241.87	0.0875	316.70	0.1357	255.93
58	0.1214	244.03	0.0941	473.12	0.1365	257.05
59	0.1211	239.98	0.0888	322.93	0.1359	244.73
60	0.1215	247.94	0.1061	734.48	0.1360	252.36
68	0.1209	238.61	0.0875	298.39	0.1356	239.91
69	0.1209	241.23	0.0927	417.15	0.1361	249.21
70	0.1210	240.61	0.0876	315.49	0.1356	250.11
78	0.1209	241.80	0.0859	240.65	0.1356	248.04
79	0.1209	243.97	0.0858	242.33	0.1360	250.97
80	0.1207	241.12	0.0859	240.24	0.1357	243.88
88	0.1206	240.20	0.0860	241.89	0.1356	245.49
89	0.1210	240.57	0.0860	243.74	0.1359	250.00
90	0.1208	243.33	0.0861	243.13	0.1364	254.94
98	0.1207	240.03	0.0862	241.69	0.1358	244.95
99	0.1208	239.47	0.0863	242.10	0.1361	244.85
100	0.1208	239.27	0.0862	243.36	0.1356	242.55
108	0.1207	240.59	0.0863	241.51	0.1360	248.08
109	0.1207	240.11	0.0863	241.55	0.1363	247.91
110	0.1207	239.24	0.0862	242.29	0.1359	246.28
118	0.1207	239.89	0.0861	243.70	0.1357	243.49
119	0.1206	238.49	0.0863	243.14	0.1359	243.29
120	0.1206	239.67	0.0862	243.41	0.1363	246.69

Subject: 6 Board: V-Shaped Pickup: Opposite

Min	----Deltoid-----		---Trapezius----		-Infraspinatus--	
	RMS	MPF	RMS	MPF	RMS	MPF
8	0.1135	340.28	0.0821	513.78	0.1230	261.93
9	0.1129	305.03	0.0802	480.56	0.1225	256.05
10	0.1119	271.27	0.0802	464.19	0.1220	250.15
18	0.1142	305.69	0.0793	449.15	0.1230	255.47
19	0.1166	345.37	0.0813	479.67	0.1239	259.18
20	0.1134	283.81	0.0802	456.09	0.1228	245.23
28	0.1163	323.45	0.0797	465.15	0.1236	254.21
29	0.1158	305.87	0.0799	488.86	0.1238	260.19
30	0.1147	277.51	0.0789	434.71	0.1236	245.99
38	0.1183	341.86	0.0825	525.26	0.1249	263.55
39	0.1163	283.06	0.0801	457.73	0.1245	252.96
40	0.1201	356.33	0.0814	468.92	0.1254	262.29
48	0.1182	303.70	0.0779	419.43	0.1254	254.57
49	0.1176	285.03	0.0775	382.57	0.1254	253.52
50	0.1168	274.02	0.0765	345.28	0.1251	250.98
58	0.1176	265.58	0.0792	425.29	0.1256	251.74
59	0.1170	258.90	0.0793	402.85	0.1256	246.31
60	0.1194	305.76	0.0807	438.79	0.1258	250.78
68	0.1175	260.82	0.0788	421.82	0.1258	245.69
69	0.1191	273.72	0.0782	390.80	0.1262	248.48
70	0.1190	289.49	0.0787	412.62	0.1265	249.02
78	0.1193	281.77	0.0791	415.33	0.1265	258.52
79	0.1191	268.59	0.0770	356.90	0.1266	254.42
80	0.1214	304.54	0.0775	373.36	0.1278	265.19
88	0.1201	268.66	0.0784	388.25	0.1268	249.78
89	0.1219	317.82	0.0792	392.70	0.1285	275.27
90	0.1216	298.09	0.0793	380.39	0.1277	257.94
98	0.1203	258.82	0.0778	357.50		
99	0.1218	292.85	0.0810	456.30		
100	0.1213	304.13	0.0806	440.86		
108	0.1232	327.94	0.0824	493.35	0.1283	260.20
109	0.1212	265.34	0.0809	479.19	0.1275	247.54
110	0.1205	255.53	0.0804	429.79	0.1279	244.62
118	0.1238	324.03	0.0813	459.66	0.1280	251.84
119	0.1220	278.64	0.0822	474.71	0.1283	254.08
120	0.1241	333.05	0.0829	523.11	0.1292	267.84

Subject: 6 Board: V-Shaped Pickup: Centre

Min	----Deltoid-----		---Trapezius----		-Infraspinatus--	
	RMS	MPF	RMS	MPF	RMS	MPF
8	0.1187	317.63	0.0849	466.49	0.1269	239.72
9	0.1200	327.44	0.0870	528.53	0.1269	238.42
10	0.1171	276.99	0.0870	511.12	0.1270	239.40
18	0.1176	260.54	0.0865	502.50	0.1277	239.55
19	0.1187	272.11	0.0836	431.41	0.1277	239.67
20	0.1183	263.84	0.0836	428.69	0.1279	239.24
28	0.1198	268.55	0.0829	414.75	0.1286	239.83
29	0.1195	259.97	0.0830	402.26	0.1286	240.22
30	0.1196	278.00	0.0851	472.56	0.1287	240.77
38	0.1213	268.93	0.0852	467.57	0.1293	239.88
39	0.1224	293.17	0.0859	493.03	0.1293	239.87
40	0.1221	294.14	0.0861	559.40	0.1294	240.20
48	0.1226	262.26	0.0866	502.61	0.1301	240.45
49	0.1224	266.51	0.0841	453.54	0.1302	240.60
50	0.1240	276.17	0.0852	452.50	0.1302	239.38
58	0.1244	290.22	0.0857	456.18	0.1306	239.28
59	0.1241	276.45	0.0831	432.03	0.1307	239.12
60	0.1254	282.74	0.0826	423.69	0.1308	241.20
68	0.1251	292.28	0.0863	507.92	0.1312	239.85
69	0.1249	291.44	0.0860	499.96	0.1313	239.76
70	0.1261	295.68	0.0844	474.43	0.1312	238.71
78	0.1255	267.95	0.0845	442.29	0.1316	240.28
79	0.1261	285.63	0.0847	507.13	0.1317	240.98
80	0.1263	271.27	0.0858	482.58	0.1317	240.60
88	0.1302	315.60	0.0895	584.19	0.1321	241.31
89	0.1254	250.28	0.0828	400.61	0.1321	239.78
90	0.1269	280.93	0.0837	458.06	0.1321	239.73
98	0.1275	286.38	0.0835	446.51	0.1325	241.07
99	0.1286	288.12	0.0838	467.42	0.1325	240.48
100	0.1268	264.47	0.0826	402.39	0.1325	239.40
108	0.1279	272.89	0.0850	453.66	0.1328	239.36
109	0.1286	282.31	0.0860	498.25	0.1328	240.66
110	0.1268	270.91	0.0852	470.16	0.1328	240.27
118	0.1282	266.85	0.0840	433.32	0.1330	240.98
119	0.1287	289.84	0.0850	457.71	0.1331	240.19
120	0.1294	298.14	0.0858	502.03	0.1331	240.21

Subject: 6 Board: Inclined Pickup: Opposite

Min	----Deltoid-----		---Trapezius----		-Infraspinatus--	
	RMS	MPF	RMS	MPF	RMS	MPF
8	0.1247	310.00	0.0720	359.04	0.1278	300.06
9	0.1239	293.99	0.0717	318.73	0.1340	406.75
10	0.1269	348.18	0.0718	325.96	0.1260	252.79
18	0.1224	262.17	0.0716	360.06	0.1268	254.33
19	0.1243	285.11	0.0732	417.50	0.1263	260.05
20	0.1265	348.88	0.0730	393.58	0.1266	252.69
28	0.1215	242.60			0.1265	252.61
29	0.1218	248.02			0.1265	252.40
30	0.1217	244.73			0.1262	256.26
38	0.1489	680.98	0.0752	462.25	0.1265	248.59
39	0.1403	574.61	0.0758	488.64	0.1264	248.81
40	0.1426	666.28	0.0766	463.71	0.1263	247.56
48	0.1325	459.75	0.0767	500.43	0.1267	255.48
49	0.1276	372.15	0.0769	474.92	0.1261	246.79
50	0.1277	374.88	0.0755	465.48	0.1263	243.24
58	0.1282	362.13	0.0757	452.35	0.1265	248.79
59	0.1257	345.97	0.0793	540.45	0.1264	259.19
60	0.1278	354.25	0.0775	480.69	0.1262	242.64
68	0.1358	520.09	0.0772	494.77	0.1267	251.30
69	0.1320	448.99	0.0793	581.10	0.1265	250.80
70	0.1268	344.71	0.0802	534.44	0.1267	254.40
78	0.1240	294.71	0.0779	490.73	0.1271	247.39
79	0.1242	296.58	0.0818	624.12	0.1265	243.60
80	0.1256	285.19	0.0782	524.56	0.1266	244.83
88	0.1230	265.81	0.0802	579.51	0.1267	245.99
89	0.1250	281.25	0.0801	615.68	0.1267	246.67
90	0.1235	281.31	0.0823	650.10	0.1269	251.02
98	0.1231	275.77	0.0811	579.86	0.1270	245.09
99	0.1255	297.08	0.0804	566.31	0.1272	244.52
100	0.1231	258.18	0.0838	610.52	0.1267	246.50
108	0.1633	880.82	0.0818	634.07	0.1274	247.39
109	0.1341	485.29	0.0824	635.31	0.1276	249.62
110	0.1620	912.21	0.0809	593.72	0.1273	247.73
118	0.1819	1148.75	0.0851	647.30	0.1280	264.45
119	0.1660	914.10	0.0837	647.86	0.1271	250.78
120	0.1430	641.19	0.0875	729.36	0.1272	247.86

Subject: 6 Board: Inclined Pickup: Centre

Min	----Deltoid-----		---Trapezius----		-Infraspinatus--	
	RMS	MPF	RMS	MPF	RMS	MPF
8	0.1553	741.26	0.0875	284.27	0.1384	245.78
9	0.1276	281.41	0.0886	317.37	0.1391	254.51
10	0.1270	262.25	0.0883	321.19	0.1384	243.91
18	0.1270	264.26	0.0894	351.02	0.1383	240.25
19	0.1283	279.43	0.0900	348.78	0.1384	240.45
20	0.1270	272.13	0.0894	356.86	0.1384	241.69
28	0.1272	265.24	0.0902	359.90	0.1387	244.39
29	0.1276	270.30	0.0890	337.26	0.1385	239.08
30	0.1291	316.47	0.0898	376.74	0.1387	244.96
38	0.1286	290.65	0.0914	386.86	0.1387	242.03
39	0.1276	263.88	0.0910	398.04	0.1386	243.36
40	0.1271	257.17	0.0901	379.75	0.1387	242.66
48	0.1283	279.90	0.0902	385.59	0.1387	244.12
49	0.1285	286.75	0.0916	377.78	0.1388	244.45
50	0.1282	289.75	0.0907	396.98	0.1388	243.62
58	0.1276	259.31	0.0899	358.08	0.1387	240.96
59	0.1286	276.27	0.0897	342.51	0.1387	240.70
60	0.1274	259.70	0.0890	327.18	0.1389	241.41
68	0.1270	252.98	0.0897	349.20	0.1388	241.47
69	0.1274	265.26	0.0890	322.38	0.1388	240.05
70	0.1290	288.52	0.0923	389.31	0.1389	241.99
78	0.1273	250.58	0.0897	331.81	0.1390	241.10
79	0.1281	267.99	0.0910	374.70	0.1388	243.16
80	0.1287	275.24	0.0904	361.80	0.1390	242.76
88	0.1272	260.74	0.0893	344.11	0.1389	241.21
89	0.1279	264.01	0.0903	357.23	0.1390	242.16
90	0.1276	262.93	0.0907	382.62	0.1390	241.65
98	0.1266	240.35	0.0879	288.23	0.1391	243.17
99	0.1266	240.03	0.0894	301.67	0.1392	242.79
100	0.1266	240.39	0.0891	310.07	0.1390	244.23
108	0.1271	246.40	0.0892	313.57	0.1391	242.86
109	0.1269	244.32	0.0889	303.57	0.1392	240.00
110	0.1273	251.84	0.0901	302.11	0.1391	241.14
118	0.1271	250.97	0.0891	298.50		
119	0.1273	251.86	0.0884	291.57		
120	0.1283	264.09	0.0887	290.16		

Subject: 7 Board: Straight Pickup: Opposite

	----Deltoid-----		---Trapezius----		-Infraspinatus--	
Min	RMS	MPF	RMS	MPF	RMS	MPF
8	0.0702	627.15	0.0356	1609.18	0.0677	401.18
9	0.0733	741.98	0.0347	1557.86	0.0687	383.59
10	0.0756	802.01	0.0426	1716.69	0.0693	415.25
18	0.0719	627.71	0.0372	1566.63	0.0694	366.27
19	0.0738	641.47	0.0390	1641.63	0.0697	365.21
20	0.0723	574.74	0.0328	1442.25	0.0693	346.37
28	0.0727	539.24	0.0339	1470.41	0.0699	344.13
29	0.0759	643.25	0.0444	1655.86	0.0711	378.15
30	0.0723	551.34	0.0403	1539.63	0.0715	342.44
38	0.0740	516.43	0.0404	1574.73	0.0729	365.93
39	0.0740	501.85	0.0352	1496.06	0.0718	348.98
40	0.0767	601.09	0.0389	1558.22	0.0722	373.49
48	0.0748	494.30	0.0338	1440.81	0.0728	347.14
49	0.0768	516.34	0.0353	1538.18	0.0730	340.99
50	0.0771	541.20	0.0410	1629.59	0.0729	360.02
58	0.0787	549.08	0.0311	1334.08	0.0740	348.41
59	0.0768	525.27	0.0343	1393.40	0.0736	355.12
60	0.0782	501.00	0.0339	1392.19	0.0733	359.31
68	0.0783	480.81	0.0345	1361.42	0.0748	338.65
69	0.0792	497.50	0.0354	1440.20	0.0749	345.39
70	0.0804	535.11	0.0382	1498.90	0.0745	361.16
78	0.0789	501.43	0.0349	1393.38	0.0752	333.34
79	0.0792	489.24	0.0302	1173.06	0.0753	340.12
80	0.0780	411.18	0.0304	1256.82	0.0749	314.20
88	0.0845	599.27	0.0373	1431.82	0.0762	358.18
89	0.0798	466.66	0.0320	1281.87	0.0759	334.24
90	0.0825	523.09	0.0396	1443.50	0.0756	355.55
98	0.0825	478.20	0.0334	1319.11	0.0760	324.63
99	0.0824	487.00	0.0390	1453.03	0.0767	345.80
100	0.0818	451.52	0.0359	1382.50	0.0765	328.47
108	0.0836	485.90	0.0388	1477.59	0.0778	359.16
109	0.0799	427.69	0.0296	1123.07	0.0762	326.07
110	0.0812	415.72	0.0339	1221.64	0.0765	313.08
118	0.0820	427.72	0.0345	1284.00	0.0770	322.08
119	0.0852	527.52	0.0390	1469.74	0.0793	394.07
120	0.0826	478.37	0.0397	1484.29	0.0777	344.73

Subject: 7 Board: Straight Pickup: Centre

Min	Deltoid RMS	Deltoid MPF	Trapezius RMS	Trapezius MPF	Infraspinatus RMS	Infraspinatus MPF
8	0.0714	562.46	0.0430	1718.34	0.0706	467.92
9	0.0674	480.98	0.0354	1567.46	0.0693	414.27
10	0.0759	695.36	0.0383	1676.87	0.0707	479.67
18	0.0742	650.36	0.0359	1591.61	0.0709	418.26
19	0.0813	875.36	0.0361	1533.42	0.0712	451.85
20	0.0713	507.05	0.0400	1644.17	0.0703	424.01
28	0.0721	504.14	0.0337	1526.43	0.0702	384.12
29	0.0699	427.01	0.0315	1449.53	0.0697	391.92
30	0.0709	431.09	0.0318	1451.81	0.0714	398.29
38	0.0763	547.79	0.0367	1569.09	0.0718	419.81
39	0.0737	534.73	0.0373	1631.00	0.0713	398.40
40	0.0737	502.14	0.0357	1548.13	0.0714	393.13
48	0.0744	470.10	0.0317	1451.60	0.0732	407.88
49	0.0741	443.44	0.0325	1433.65	0.0723	379.42
50	0.0780	562.79	0.0386	1604.84	0.0740	435.81
58	0.0772	508.35	0.0364	1548.42	0.0742	444.08
59	0.0766	473.79	0.0369	1605.12	0.0731	423.73
60	0.0789	561.22	0.0371	1565.85	0.0735	435.89
68	0.0761	418.99	0.0306	1325.96	0.0732	370.35
69	0.0760	411.31	0.0336	1476.95	0.0736	376.63
70	0.0773	449.70	0.0313	1387.44	0.0738	387.63
78	0.0773	427.24	0.0359	1467.48	0.0751	393.59
79	0.0767	398.51	0.0314	1367.04	0.0753	390.02
80	0.0758	408.68	0.0360	1571.85	0.0750	399.66
88	0.0784	433.64	0.0395	1534.83	0.0767	405.92
89	0.0771	369.61	0.0377	1540.12	0.0762	414.44
90	0.0771	350.99	0.0348	1518.97	0.0775	423.95
98	0.0789	459.57	0.0421	1608.29	0.0756	385.85
99	0.0774	358.32	0.0303	1250.98	0.0752	378.79
100	0.0769	364.26	0.0320	1401.94	0.0760	391.38
108	0.0767	334.80	0.0349	1515.17	0.0764	402.76
109	0.0763	311.22	0.0346	1376.50	0.0763	376.13
110	0.0787	382.82	0.0416	1644.69	0.0789	465.09
118	0.0770	315.17	0.0332	1390.30	0.0765	394.06
119	0.0762	291.52	0.0377	1531.75	0.0772	428.57
120	0.0760	289.18	0.0392	1508.11	0.0779	423.99

Subject: 7 Board: V-Shaped Pickup: Opposite

	----Deltoid-----		---Trapezius----		-Infraspinatus--	
Min	RMS	MPF	RMS	MPF	RMS	MPF
8	0.0788	625.16	0.0297	2028.67	0.0645	513.61
9	0.0823	694.29	0.0294	2023.05	0.0643	465.25
10	0.0847	774.97	0.0362	2029.37	0.0667	545.57
18	0.0790	578.59	0.0283	2024.81	0.0659	509.71
19	0.0783	569.95	0.0250	2000.73	0.0658	467.70
20	0.0765	503.71	0.0250	2009.34	0.0647	485.65
28	0.0842	700.70	0.0273	2001.67	0.0713	641.85
29	0.0781	558.79	0.0254	2016.50	0.0640	415.24
30	0.0842	690.50	0.0294	2016.46	0.0668	508.89
38	0.0847	654.82	0.0244	2002.09	0.0686	531.65
39	0.0865	702.60	0.0269	1992.42	0.0682	528.45
40	0.0844	660.41	0.0271	2008.23	0.0658	440.23
48	0.0838	596.30	0.0276	2001.81	0.0671	463.12
49	0.0836	613.01	0.0299	2018.90	0.0673	460.46
50	0.0857	624.32	0.0242	1993.70	0.0671	450.13
58	0.0896	733.58	0.0275	2003.46	0.0695	496.17
59	0.0887	713.08	0.0306	2001.25	0.0703	530.14
60	0.0850	609.01	0.0250	1997.82	0.0662	413.69
68	0.0816	477.39	0.0240	1986.74	0.0665	410.93
69	0.0840	496.81	0.0259	1984.33	0.0674	420.92
70	0.0819	496.33	0.0226	1953.97	0.0663	376.72
78	0.0918	703.82	0.0311	1987.68	0.0694	477.28
79	0.0855	557.28	0.0280	1998.04	0.0676	396.91
80	0.0878	579.89	0.0264	1992.64	0.0669	394.96
88	0.0862	564.28	0.0232	1954.02	0.0681	409.67
89	0.0843	501.84	0.0276	1984.57	0.0891	993.15
90	0.0852	505.00	0.0230	1930.13	0.0748	591.78
98	0.0830	451.47	0.0292	1986.46	0.0787	743.24
99	0.0888	629.71	0.0273	1987.04	0.0770	686.55
100	0.0893	621.37	0.0282	1995.45	0.0801	777.49
108	0.0870	543.91	0.0220	1930.48	0.0756	644.00
109	0.0880	575.72	0.0279	1984.50	0.0828	802.84
110	0.0910	615.19	0.0283	1983.47	0.0802	748.92
118	0.0875	568.20	0.0331	1985.88	0.0820	780.85
119	0.0844	479.63	0.0290	1960.12	0.0773	697.49
120	0.0884	539.28	0.0294	1954.71	0.0808	804.96

Subject: 7   Board: V-Shaped   Pickup: Centre

Min	----Deltoid----- RMS	MPF	---Trapezius---- RMS	MPF	-Infraspinatus-- RMS	MPF
8	0.0625	338.36	0.0254	279.16	0.2235	1804.15
9	0.0623	323.30	0.0255	283.41	0.1968	1735.68
10	0.0610	251.62	0.0256	289.70	0.2409	1858.08
18	0.0629	244.71			0.2724	1880.24
19	0.0630	243.51			0.2242	1799.25
20	0.0633	241.28			0.2658	1868.04
28	0.0650	243.14			0.2435	1838.77
29	0.0654	245.06			0.2411	1840.88
30	0.0655	244.20			0.2427	1820.65
38	0.0671	244.31	0.0268	283.23	0.2828	1879.44
39	0.0673	245.22	0.0269	287.30	0.3367	1933.99
40	0.0675	245.36	0.0269	281.69	0.3322	1932.85
48	0.0690	246.87	0.0272	288.78	0.3529	1944.12
49	0.0690	245.56	0.0272	282.81	0.3165	1909.34
50	0.0692	246.91	0.0273	280.29	0.2825	1854.37
58	0.0705	246.58	0.0277	294.67	0.3444	1919.12
59	0.0706	247.31	0.0279	305.47	0.2377	1820.97
60	0.0708	247.71	0.0280	309.45	0.3279	1912.01
68			0.0281	287.77	0.3006	1897.38
69			0.0281	280.84	0.2614	1860.35
70			0.0281	279.38	0.2819	1862.89
78	0.0805	497.89	0.0286	294.60	0.4476	1973.51
79	0.0795	433.67	0.0282	274.83	0.3117	1890.35
80	0.0781	402.04	0.0284	271.24	0.3002	1877.99
88	0.0780	365.39	0.0285	261.15	0.2564	1824.55
89	0.0829	501.90	0.0286	275.14	0.3638	1934.51
90	0.0813	447.69	0.0287	281.54	0.2945	1849.53
98	0.0826	479.03	0.0289	276.52	0.3944	1941.17
99	0.0824	510.55	0.0290	278.01	0.4315	1964.93
100	0.0802	393.65	0.0288	261.67	0.2609	1827.55
108	0.0823	460.34	0.0291	269.82	0.3619	1937.86
109	0.0824	448.01	0.0293	284.35	0.4038	1941.84
110	0.0839	519.18	0.0292	277.85	0.3033	1882.78
118	0.0833	456.96			0.3657	1918.67
119	0.0798	377.82	0.0295	267.12	0.2694	1833.82
120	0.0840	461.51	0.0295	267.75	0.2424	1784.16

Subject: 7 Board: Inclined Pickup: Opposite

Min	----Deltoid-----		---Trapezius----		-Infraspinatus--	
	RMS	MPF	RMS	MPF	RMS	MPF
8	0.0615	249.57	0.0239	2024.93	0.0667	615.61
9	0.0617	250.38	0.0242	2038.86	0.0673	655.29
10	0.0621	250.92	0.0225	2026.55	0.0672	677.81
18	0.0637	250.06	0.0246	2017.78	0.0658	537.33
19	0.0642	262.56	0.0250	2026.03	0.0667	577.87
20	0.0641	247.50	0.0231	2016.24	0.0700	712.84
28	0.0654	244.71	0.0230	2016.26	0.0627	443.28
29	0.0657	251.62	0.0227	2005.08	0.0659	563.36
30	0.0660	253.94	0.0195	1983.98	0.0640	477.58
38	0.0672	251.54	0.0238	1979.01	0.0676	574.64
39	0.0674	251.66	0.0198	1987.70	0.0649	482.93
40	0.0675	247.96	0.0201	1952.78	0.0637	436.81
48	0.0689	251.13	0.0231	1987.67	0.0698	607.73
49	0.0689	248.71	0.0273	1986.95	0.0695	618.24
50	0.0689	247.78	0.0241	1982.77	0.0689	604.64
58	0.0699	244.30	0.0218	1946.83	0.0668	473.52
59	0.0701	245.79	0.0228	1966.34	0.0692	574.35
60	0.0704	250.44	0.0306	1992.07	0.0705	601.65
68	0.0713	242.82	0.0230	1954.27	0.0690	558.02
69	0.0714	246.24	0.0246	1959.29	0.0699	564.52
70	0.0716	245.11	0.0251	1940.40	0.0693	518.68
78	0.0726	247.20	0.0235	1915.78	0.0697	524.76
79	0.0728	251.90	0.0276	1932.06	0.0725	583.80
80	0.0727	254.53	0.0252	1946.04	0.0714	561.46
88	0.0734	246.47	0.0221	1897.99	0.0737	549.02
89	0.0736	248.24	0.0241	1903.85	0.0714	541.66
90	0.0738	255.71	0.0271	1957.10	0.0737	599.63
98	0.0743	251.54	0.0255	1923.37	0.0699	490.95
99	0.0746	245.60	0.0256	1916.22	0.0704	482.55
100	0.0744	251.76	0.0264	1876.67	0.0712	525.79
108	0.0752	257.27	0.0244	1896.05	0.0705	524.95
109	0.0753	251.83	0.0265	1893.84	0.0725	537.93
110	0.0754	252.05	0.0229	1891.03	0.0718	485.06
118	0.0759	251.19	0.0250	1897.66	0.0714	501.51
119	0.0760	257.68	0.0290	1918.47	0.0746	584.95
120	0.0761	247.95	0.0225	1866.12	0.0720	516.27

Subject: 7 Board: Inclined Pickup: Centre

	----Deltoid-----		---Trapezius----		-Infraspinatus--	
Min	RMS	MPF	RMS	MPF	RMS	MPF
8	0.0719	538.32	0.0221	2038.17	0.0788	1036.65
9	0.0720	589.69	0.0266	2043.80	0.0891	1274.00
10	0.0719	543.47	0.0224	2036.21	0.0908	1296.44
18	0.0764	614.60	0.0282	2045.02	0.1248	1616.61
19	0.0751	617.10	0.0230	2041.83	0.0950	1291.12
20	0.0763	628.33	0.0301	2047.29	0.0854	1127.27
28	0.0769	577.82	0.0230	2043.30	0.0916	1232.43
29	0.0738	467.50	0.0212	2038.93	0.0909	1219.44
30	0.0755	510.86	0.0219	2040.63	0.1131	1489.87
38	0.0772	546.49	0.0241	2043.18	0.0982	1283.10
39	0.0764	572.00	0.0275	2045.46	0.0928	1242.29
40	0.0730	454.11	0.0240	2047.98	0.0907	1172.90
48	0.0804	556.58	0.0263	2048.00	0.1184	1521.52
49	0.0743	400.48	0.0186	2047.78	0.1070	1321.64
50	0.0745	406.63	0.0197	2047.05	0.1119	1481.04
58	0.0775	507.56	0.0240	2047.98	0.1155	1461.36
59	0.0764	421.97	0.0236	2047.98	0.1091	1336.68
60	0.0786	478.34	0.0243	2047.28	0.1056	1307.70
68	0.0788	488.73	0.0235	2045.40	0.1082	1353.10
69	0.0800	525.34	0.0238	2044.90	0.1241	1521.26
70	0.0822	548.96	0.0241	2047.25	0.1059	1368.31
78	0.0804	494.51	0.0260	2043.93	0.1236	1529.90
79	0.0785	429.19	0.0227	2047.73	0.1145	1409.49
80	0.0804	501.94	0.0259	2045.16	0.1176	1455.31
88	0.0798	434.67	0.0237	2045.26	0.1324	1538.09
89	0.0793	425.80	0.0213	2043.37	0.1124	1431.77
90	0.0792	413.50	0.0209	2044.20	0.1239	1482.57
98	0.0819	481.28	0.0226	2039.59	0.1450	1638.87
99	0.0784	366.90	0.0222	2037.23	0.1178	1405.40
100	0.0796	437.41	0.0224	2040.95	0.1338	1560.79
108	0.0797	389.92	0.0197	2042.02	0.1224	1517.00
109	0.0804	442.84	0.0222	2038.21	0.1344	1612.17
110	0.0806	426.68	0.0216	2039.70	0.1209	1465.09
118	0.0857	534.53	0.0266	2041.79	0.1306	1534.35
119	0.0802	400.23	0.0218	2019.25	0.1396	1588.99
120	0.0819	416.05	0.0246	2037.29	0.1344	1547.37

Subject: 8 Board: Straight Pickup: Opposite

	----Deltoid-----		---Trapezius----		-Infraspinatus--	
Min	RMS	MPF	RMS	MPF	RMS	MPF
8	0.0429	986.54	0.0290	1461.51	0.0808	1652.30
9	0.0459	1037.80	0.0298	1505.10	0.0981	1769.92
10	0.0463	1028.13	0.0293	1525.56	0.1021	1801.00
18	0.0484	957.07	0.0323	1652.15	0.1315	1877.07
19	0.0487	938.84	0.0310	1634.71	0.1473	1903.24
20	0.0426	651.38	0.0291	1557.00	0.1371	1885.70
28	0.0496	818.18	0.0317	1674.50	0.1743	1932.95
29	0.0492	849.69	0.0304	1658.27	0.1802	1929.74
30	0.0451	627.20	0.0282	1605.80	0.1404	1862.56
38	0.0493	757.08	0.0285	1637.93	0.1650	1900.70
39	0.0493	704.72	0.0270	1589.18	0.1684	1919.31
40	0.0477	614.55	0.0298	1675.67	0.1799	1924.33
48	0.0511	700.80	0.0315	1731.57	0.2227	1959.36
49	0.0506	629.20	0.0302	1721.76	0.1852	1934.01
50	0.0570	850.11	0.0318	1733.72	0.1929	1938.60
58	0.0531	687.91	0.0300	1716.15	0.2141	1964.15
59	0.0539	733.22	0.0315	1760.03	0.2346	1960.39
60	0.0537	698.34	0.0315	1686.65	0.2087	1954.49
68	0.0531	593.90	0.0317	1724.29	0.2220	1963.49
69	0.0559	688.71	0.0338	1808.95	0.2262	1966.55
70	0.0501	444.88	0.0301	1732.37	0.1974	1927.08
78	0.0535	548.73	0.0306	1780.23	0.1861	1905.55
79	0.0530	503.32	0.0309	1802.26	0.1862	1909.66
80	0.0556	622.29	0.0322	1721.88	0.2547	1965.76
88	0.0570	601.49	0.0334	1798.90	0.1949	1931.37
89	0.0533	514.89	0.0319	1836.67	0.2397	1965.18
90	0.0551	561.07	0.0304	1757.46	0.1915	1919.70
98	0.0535	414.80	0.0295	1762.83	0.1580	1858.24
99	0.0520	348.12	0.0290	1746.16	0.1242	1742.09
100	0.0576	596.00	0.0315	1786.37	0.2280	1944.96
108	0.0591	607.70	0.0311	1783.40	0.2029	1921.82
109	0.0579	594.48	0.0325	1807.97	0.2444	1965.21
110	0.0546	463.53	0.0317	1833.28	0.1514	1861.72
118	0.0572	522.13	0.0302	1793.63	0.2072	1941.82
119	0.0579	506.86	0.0290	1781.90	0.1550	1840.29
120	0.0593	589.17	0.0315	1807.16	0.2017	1930.33

Subject: 8 Board: Straight Pickup: Centre

	----Deltoid-----		---Trapezius----		-Infraspinatus--	
Min	RMS	MPF	RMS	MPF	RMS	MPF
8	0.0454	856.59	0.0494	1961.61	0.1293	1841.68
9	0.0441	727.44	0.0444	1906.82	0.0775	1524.99
10	0.0524	1000.50	0.0493	1957.90	0.1122	1732.23
18	0.0563	1040.72	0.0534	1992.68	0.1395	1834.69
19	0.0475	717.75	0.0477	1933.59	0.1034	1683.63
20	0.0503	800.72	0.0477	1972.45	0.1196	1771.77
28	0.0555	890.32	0.0518	1990.11	0.2265	1962.45
29	0.0571	908.29	0.0527	2003.07	0.1820	1905.91
30	0.0556	886.30	0.0484	1972.63	0.1417	1846.09
38	0.0540	685.58	0.0497	1994.43	0.1432	1825.61
39	0.0554	751.64	0.0493	1968.75	0.1258	1758.95
40	0.0573	777.43	0.0497	1979.18	0.1021	1634.66
48	0.0551	666.00	0.0450	1979.72	0.1199	1729.87
49	0.0587	814.13	0.0492	2003.00	0.1207	1717.44
50	0.0565	690.50	0.0456	1966.35	0.0811	1384.52
58	0.0555	611.20	0.0433	1936.11	0.1234	1706.65
59	0.0572	653.09	0.0478	2005.08	0.1098	1657.43
60	0.0625	816.36	0.0528	1988.13	0.2022	1928.41
68	0.0549	473.28	0.0416	1987.87	0.1255	1728.30
69	0.0575	607.10	0.0440	1979.60	0.0997	1533.33
70	0.0601	682.60	0.0467	1989.36	0.1268	1755.23
78	0.0589	606.67	0.0458	1999.55	0.1185	1681.08
79	0.0618	737.65	0.0419	1973.88	0.1547	1828.73
80	0.0591	608.96	0.0432	1985.01	0.1351	1755.75
88	0.0612	652.25	0.0466	1995.29	0.1959	1904.97
89	0.0604	602.84	0.0481	1995.94	0.1182	1653.28
90	0.0579	506.09	0.0401	1977.82	0.0901	1394.96
98	0.0619	629.09	0.0469	2012.59	0.1730	1864.11
99	0.0595	566.07	0.0441	1981.70	0.1318	1720.38
100	0.0648	714.93	0.0478	2002.59	0.2094	1918.31
108	0.0644	652.16	0.0487	2015.92	0.2149	1913.40
109	0.0618	588.45	0.0430	2015.95	0.1695	1839.88
110	0.0591	497.40	0.0410	1990.48	0.1394	1765.28
118	0.0622	591.38	0.0433	1991.70	0.1657	1840.43
119	0.0644	606.37	0.0485	2011.97	0.2058	1903.84
120	0.0620	568.22	0.0471	2008.24	0.1818	1868.58

Subject: 8 Board: V-Shaped Pickup: Opposite

	----Deltoid-----		---Trapezius----		-Infraspinatus--	
Min	RMS	MPF	RMS	MPF	RMS	MPF
8	0.0621	1592.91	0.0481	1658.99	0.0614	1530.10
9	0.0493	1315.04	0.0367	1530.07	0.0498	1282.32
10	0.0605	1500.17	0.0428	1635.46	0.0538	1364.84
18	0.0454	1032.16	0.0350	1531.52	0.0487	1150.47
19	0.0471	1107.27	0.0361	1482.98	0.0494	1170.19
20	0.0502	1166.20	0.0374	1535.62	0.0527	1254.46
28	0.0503	1093.63	0.0539	1813.78	0.0529	1200.32
29	0.0448	860.64	0.0460	1696.61	0.0431	853.94
30	0.0484	968.55	0.0426	1634.45	0.0467	987.72
38	0.0472	844.26	0.0388	1591.97	0.0443	863.20
39	0.0504	1010.37	0.0427	1667.92	0.0509	1086.31
40	0.0480	839.33	0.0406	1601.32	0.0483	1004.86
48	0.0494	846.44	0.0373	1599.29	0.0509	1039.93
49	0.0505	875.09	0.0397	1670.78	0.0512	992.76
50	0.0465	701.51	0.0360	1522.93	0.0466	855.53
58	0.0496	711.80	0.0352	1528.21	0.0538	1075.06
59	0.0507	811.77	0.0364	1588.86	0.0535	1055.97
60	0.0474	661.64	0.0357	1590.08	0.0487	917.28
68	0.0485	593.68	0.0355	1608.30	0.0496	880.80
69	0.0526	774.53	0.0370	1588.24	0.0497	870.08
70	0.0526	772.25	0.0366	1645.28	0.0474	753.72
78	0.0537	757.62	0.0349	1592.39	0.0560	1070.63
79	0.0569	848.60	0.0385	1672.12	0.0667	1278.24
80	0.0552	769.31	0.0377	1623.79	0.0524	931.90
88	0.0518	607.50	0.0359	1654.92	0.0498	838.96
89	0.0518	619.02	0.0351	1626.66	0.0497	778.72
90	0.0511	589.61	0.0343	1597.14	0.0487	754.83
98	0.0520	566.89	0.0339	1598.59	0.0505	776.42
99	0.0512	574.75	0.0326	1532.60	0.0527	854.56
100	0.0532	628.60	0.0352	1618.86	0.0535	901.76
108	0.0531	613.68	0.0339	1652.74	0.0494	716.24
109	0.0516	559.66	0.0309	1567.70	0.0498	694.20
110	0.0525	533.00	0.0327	1545.25	0.0508	729.75
118	0.0552	605.21	0.0347	1677.22	0.0545	867.14
119	0.0527	517.15	0.0338	1608.75	0.0541	871.54
120	0.0599	790.17	0.0396	1693.68	0.0582	985.72

Subject: 8 Board: V-Shaped Pickup: Centre

Min	----Deltoid-----		---Trapezius----		-Infraspinatus--	
	RMS	MPF	RMS	MPF	RMS	MPF
8	0.0499	1232.49	0.0373	1488.99	0.0551	1413.92
9	0.0566	1344.58	0.0388	1516.70	0.0525	1337.79
10	0.0525	1294.12	0.0389	1493.83	0.0536	1353.31
18	0.0543	1252.77	0.0401	1479.36	0.0476	1111.95
19	0.0518	1208.20	0.0401	1509.06	0.0476	1104.39
20	0.0512	1124.41	0.0365	1461.26	0.0415	893.07
28	0.0505	1041.35	0.0367	1450.08	0.0396	735.96
29	0.0585	1263.57	0.0401	1541.72	0.0492	1103.22
30	0.0467	853.85	0.0359	1403.33	0.0397	736.97
38	0.0552	1067.91	0.0382	1547.15	0.0491	1038.27
39	0.0534	1009.50	0.0384	1527.21	0.0453	901.03
40	0.0583	1179.16	0.0382	1481.05	0.0543	1187.43
48	0.0521	929.82	0.0383	1430.35	0.0465	901.23
49	0.0553	986.95	0.0387	1515.34	0.0480	949.57
50	0.0628	1218.23	0.0435	1597.23	0.0601	1300.19
58	0.0586	1030.57	0.0387	1535.68	0.0542	1129.52
59	0.0556	1005.86	0.0383	1564.94	0.0521	1033.42
60	0.0584	1050.28	0.0407	1578.99	0.0480	881.56
68	0.0639	1149.36	0.0420	1662.88		
69	0.0601	1046.84	0.0384	1575.90		
70	0.0633	1140.73	0.0364	1566.67		
78	0.0700	1268.66	0.0410	1683.37		
79	0.0645	1124.67	0.0411	1688.84		
80	0.0557	889.25	0.0371	1592.85		
88	0.0595	866.64	0.0385	1603.11	0.0447	630.49
89	0.0626	1043.13	0.0404	1619.44	0.0485	774.77
90	0.0688	1163.72	0.0425	1676.37	0.0585	1151.02
98	0.0606	945.68	0.0392	1672.64	0.0482	743.44
99	0.0663	1073.43	0.0436	1723.03	0.0564	1058.01
100	0.0695	1013.19	0.0364	1630.47	0.0540	935.08
108	0.0571	797.62	0.0424	1753.02	0.0489	755.68
109	0.0734	1198.20	0.0420	1760.75	0.0518	867.13
110	0.0604	919.24	0.0385	1688.71	0.0481	710.92
118	0.0730	1226.67	0.0454	1779.32	0.0569	996.88
119	0.0640	1011.98	0.0411	1727.85	0.0484	695.93
120	0.0644	981.32	0.0400	1703.42	0.0486	690.36

Subject: 8 Board: Inclined Pickup: Opposite

	----Deltoid-----		---Trapezius----		-Infraspinatus--	
Min	RMS	MPF	RMS	MPF	RMS	MPF
8	0.1917	1978.64	0.0381	1619.70	0.0672	1558.24
9	0.2258	2010.52	0.0382	1666.46	0.0837	1701.08
10	0.1970	1997.16	0.0381	1668.00	0.0716	1566.44
18	0.2196	1983.78	0.0381	1626.50	0.0773	1613.07
19	0.2403	1990.83	0.0383	1697.29	0.0863	1690.34
20	0.1819	1963.64	0.0379	1731.22	0.0677	1484.95
28	0.1565	1923.50	0.0374	1693.41	0.0729	1497.52
29	0.2111	1964.00	0.0397	1743.27	0.0951	1718.68
30	0.1783	1935.91	0.0393	1726.04	0.0772	1548.20
38	0.1459	1892.62	0.0390	1758.28	0.0744	1494.95
39	0.1826	1934.45	0.0386	1739.24	0.0764	1530.69
40	0.2484	1988.54	0.0421	1807.35	0.1035	1737.89
48	0.2040	1942.55	0.0391	1767.16	0.0831	1573.50
49	0.2399	1976.01	0.0405	1791.71	0.0937	1650.21
50	0.2123	1964.72	0.0394	1759.72	0.0836	1564.17
58	0.1915	1931.09	0.0398	1786.31	0.0968	1697.21
59	0.2447	1972.70	0.0386	1741.65	0.1024	1692.85
60	0.2334	1968.34	0.0444	1829.29	0.0997	1692.27
68	0.1683	1900.26	0.0396	1788.76	0.0881	1567.40
69	0.1565	1876.13	0.0388	1799.13	0.0850	1553.94
70	0.1768	1915.62	0.0352	1764.90	0.0782	1412.12
78	0.1801	1920.63	0.0368	1768.50	0.0934	1579.98
79	0.1924	1918.97	0.0391	1793.63	0.0963	1617.79
80	0.1837	1904.08	0.0375	1779.24	0.0972	1623.39
88	0.2104	1931.26	0.0374	1842.84	0.0974	1640.73
89	0.1849	1910.34	0.0369	1768.58	0.0992	1657.68
90	0.1599	1831.21	0.0392	1853.63	0.1099	1698.49
98	0.2713	1971.88	0.0441	1916.70	0.1266	1790.23
99	0.1633	1848.24	0.0376	1849.78	0.1069	1673.05
100	0.2799	1993.95	0.0401	1873.71	0.1551	1872.70
108	0.2416	1959.18	0.0392	1870.47	0.1453	1835.60
109	0.2641	1970.25	0.0406	1863.53	0.1770	1900.58
110	0.3440	1999.32	0.0395	1889.57	0.2114	1947.27
118	0.2435	1954.97	0.0389	1828.48	0.1927	1920.37
119	0.2255	1935.75	0.0391	1832.24	0.1323	1772.78
120	0.2094	1917.14	0.0397	1862.13	0.1187	1712.66

Subject: 8 Board: Inclined Pickup: Centre

	----Deltoid-----		---Trapezius----		-Infraspinatus--	
Min	RMS	MPF	RMS	MPF	RMS	MPF
8	0.0465	603.72	0.0226	1929.11	0.0527	742.05
9	0.0495	700.77	0.0214	1909.78	0.0496	606.22
10	0.0494	718.52	0.0202	1868.57	0.0521	696.08
18	0.0504	614.70	0.0221	1937.30	0.0514	587.34
19	0.0534	710.87	0.0231	1948.11	0.0546	739.81
20	0.0495	569.29	0.0231	1941.81	0.0509	562.77
28	0.0530	625.22	0.0228	1949.43	0.0509	519.23
29	0.0520	554.26	0.0215	1942.38	0.0518	536.71
30	0.0530	602.52	0.0221	1942.88	0.0531	584.01
38	0.0521	503.83	0.0198	1974.20	0.0503	421.05
39	0.0555	629.71	0.0220	1944.64	0.0531	529.59
40	0.0537	564.40	0.0211	1976.07	0.0527	529.25
48	0.0557	557.64	0.0220	1976.99	0.0522	440.91
49	0.0575	610.51	0.0219	2003.25	0.0528	474.55
50	0.0551	542.58	0.0212	1969.42	0.0526	427.78
58	0.0563	511.66	0.0201	1980.50	0.0539	477.77
59	0.0573	577.12	0.0228	1990.98	0.0525	427.53
60	0.0565	548.11	0.0229	2006.67	0.0549	523.97
68	0.0561	432.41	0.0213	2008.68	0.0517	328.38
69	0.0608	663.50	0.0252	1997.13	0.0603	695.16
70	0.0607	574.09	0.0252	2003.13	0.0546	475.11
78	0.0590	481.54	0.0222	2002.54	0.0549	424.36
79	0.0575	439.97	0.0198	2004.32	0.0535	358.81
80	0.0602	552.01	0.0207	1988.24	0.0543	397.86
88	0.0568	358.37	0.0204	2004.86	0.0537	336.25
89	0.0594	434.42	0.0203	1989.07	0.0539	357.61
90	0.0608	534.43	0.0219	2019.04	0.0550	392.88
98	0.0608	472.10	0.0223	1991.50	0.0549	371.10
99	0.0593	408.51	0.0212	2022.79	0.0546	339.95
100	0.0610	440.45	0.0227	2002.87	0.0554	381.55
108	0.0629	518.24	0.0225	2023.69	0.0569	414.82
109	0.0652	591.37	0.0242	2033.10	0.0585	488.54
110	0.0613	443.83	0.0211	2025.26	0.0616	596.56
118	0.0656	576.35	0.0247	2031.74	0.0578	434.27
119	0.0636	510.77	0.0239	2014.14	0.0584	472.92
120	0.0629	508.61	0.0234	2034.90	0.0558	350.31

Subject: A Board: Straight Pickup: Opposite

	----Deltoid-----		---Trapezius----		-Infraspinatus--	
Min	RMS	MPF	RMS	MPF	RMS	MPF
8	0.1283	239.60	0.0919	313.12	0.1426	252.37
9	0.1285	239.13	0.0904	267.64	0.1427	250.39
10	0.1284	239.63	0.0908	267.44	0.1428	253.28
18	0.1286	239.94	0.0932	335.29	0.1421	242.37
19	0.1286	239.93	0.0904	272.89	0.1424	241.32
20	0.1287	239.11	0.0914	294.47	0.1424	243.65
28	0.1287	240.23	0.0919	318.11	0.1422	240.03
29	0.1289	238.87	0.0929	335.49	0.1423	239.49
30	0.1288	239.75	0.0917	315.88	0.1423	240.29
38	0.1290	239.11	0.0906	301.21	0.1424	241.03
39	0.1291	240.77	0.0909	299.96	0.1423	240.31
40	0.1291	239.41	0.0916	297.63	0.1425	241.30
48	0.1293	240.26	0.0915	324.72	0.1423	241.76
49	0.1293	239.33	0.0915	305.84	0.1424	240.60
50	0.1294	239.03	0.0913	295.09	0.1424	240.17
58	0.1295	239.86	0.0930	342.36	0.1425	239.71
59	0.1296	239.84	0.0902	263.44	0.1424	241.02
60	0.1296	239.63	0.0911	308.13	0.1425	239.50
68	0.1298	239.80	0.0913	326.91	0.1426	241.81
69	0.1299	238.59	0.0905	285.95	0.1425	240.60
70	0.1298	239.50	0.0933	359.92	0.1426	240.15
78	0.1301	240.74	0.0921	313.61	0.1428	242.68
79	0.1301	239.15	0.0942	380.63	0.1427	240.90
80	0.1303	239.90	0.0932	348.59	0.1425	240.40
88	0.1305	242.75	0.0919	333.38	0.1429	240.76
89	0.1303	242.31	0.0934	351.72	0.1427	240.76
90	0.1304	242.68	0.0935	357.65	0.1430	243.32
98	0.1305	241.64	0.0947	410.63	0.1428	244.33
99	0.1307	240.62	0.0935	377.21	0.1429	242.25
100	0.1306	240.81	0.0925	332.04	0.1430	240.77
108	0.1310	240.45	0.0943	385.20	0.1429	240.93
109	0.1310	240.34	0.0914	317.69	0.1430	240.60
110	0.1310	241.15	0.0925	351.70	0.1430	242.25
118	0.1312	241.56	0.0927	346.50	0.1431	241.19
119	0.1311	243.14	0.0961	403.72	0.1435	242.27
120	0.1312	242.18	0.0933	381.57	0.1433	241.70

Subject: A Board: Straight Pickup: Centre

	----Deltoid-----		---Trapezius----		-Infraspinatus--	
Min	RMS	MPF	RMS	MPF	RMS	MPF
8	0.1064	418.57	0.0719	398.45	0.1168	278.51
9	0.1076	506.74	0.0732	447.95	0.1172	284.29
10	0.1054	425.99	0.0706	373.19	0.1156	262.79
18	0.1094	523.42	0.0732	455.67	0.1173	284.80
19	0.1105	486.96	0.0706	357.50	0.1175	267.58
20	0.1085	423.52	0.0693	346.14	0.1173	259.06
28	0.1064	357.55	0.0694	313.18	0.1175	259.57
29	0.1122	493.56	0.0724	435.32	0.1182	283.98
30	0.1107	430.80	0.0721	407.98	0.1184	274.75
38	0.1127	446.05	0.0734	429.41	0.1201	280.82
39	0.1131	470.90	0.0708	361.20	0.1187	273.62
40	0.1106	385.96	0.0693	309.99	0.1191	271.90
48	0.1189	522.17	0.0749	504.45	0.1210	302.55
49	0.1160	491.22	0.0746	508.35	0.1204	281.64
50	0.1162	433.67	0.0727	399.38	0.1203	273.99
58	0.1166	483.20	0.0736	438.37	0.1222	295.73
59	0.1157	427.07	0.0733	451.86	0.1210	280.47
60	0.1192	472.05	0.0757	518.52	0.1224	300.44
68	0.1170	440.19	0.0738	449.98	0.1219	274.67
69	0.1178	464.25	0.0756	492.31	0.1217	270.24
70	0.1169	441.46	0.0727	419.81	0.1215	268.14
78	0.1161	400.03	0.0726	350.99	0.1219	261.74
79	0.1164	413.81	0.0738	395.36	0.1225	266.97
80	0.1172	401.09	0.0742	416.70	0.1224	266.82
88	0.1201	432.77	0.0769	497.56	0.1231	264.04
89	0.1178	397.38	0.0723	348.98	0.1229	258.05
90	0.1181	390.06	0.0741	371.13	0.1227	259.67
98	0.1245	491.34	0.0790	543.43	0.1246	286.03
99	0.1219	453.73	0.0788	563.04	0.1236	269.44
100	0.1198	423.02	0.0788	548.17	0.1234	263.24
108	0.1190	381.16	0.0764	438.70	0.1242	263.58
109	0.1264	488.86	0.0797	562.47	0.1244	281.97
110	0.1183	373.04	0.0753	400.46	0.1242	262.95
118	0.1224	424.41	0.0811	562.82	0.1246	270.40
119	0.1226	455.13	0.0809	535.60	0.1254	265.85
120	0.1211	407.57	0.0756	410.30	0.1250	270.81

Subject: A Board: V-Shaped Pickup: Opposite

	----Deltoid-----		---Trapezius----		-Infraspinatus--	
Min	RMS	MPF	RMS	MPF	RMS	MPF
8	0.1347	240.25	0.0997	243.49	0.1513	257.52
9	0.1348	240.82	0.0996	242.60	0.1517	258.33
10	0.1348	240.50	0.0998	244.76	0.1520	255.42
18	0.1354	239.80	0.0998	245.10	0.1515	251.75
19	0.1355	239.74	0.0997	243.39	0.1526	262.85
20	0.1356	241.14	0.1002	247.52	0.1522	262.46
28	0.1360	240.06	0.0995	242.93	0.1523	252.50
29	0.1360	240.08	0.0997	243.15	0.1519	250.91
30	0.1361	239.65	0.0998	248.34	0.1531	264.10
38	0.1367	240.86	0.0997	242.91	0.1532	272.76
39	0.1366	239.84	0.0999	245.30	0.1533	273.93
40	0.1367	239.61	0.1002	246.43	0.1534	264.34
48	0.1372	239.70	0.1000	250.28	0.1541	277.23
49	0.1371	239.66	0.0999	246.25	0.1531	258.58
50	0.1374	240.23	0.0999	251.36	0.1539	270.50
58	0.1377	240.04	0.0997	243.97	0.1532	257.39
59	0.1378	241.10	0.1000	249.47	0.1534	258.22
60	0.1379	240.82	0.1004	245.68	0.1532	257.81
68	0.1382	240.26	0.1001	248.94	0.1536	261.97
69	0.1383	241.30	0.1001	243.32	0.1543	264.16
70	0.1383	239.90	0.1001	245.59	0.1539	266.60
78	0.1385	240.75	0.1006	254.72	0.1549	270.59
79	0.1387	240.16	0.1003	247.46	0.1541	261.49
80	0.1386	240.36	0.1002	252.74	0.1544	262.18
88	0.1391	240.62	0.1005	250.76	0.1554	273.57
89	0.1391	241.17	0.1004	251.46	0.1542	253.27
90	0.1391	239.11	0.1002	247.60	0.1544	260.39
98	0.1394	239.69	0.1005	260.55	0.1551	276.17
99	0.1395	241.17	0.1008	256.72	0.1552	270.98
100	0.1395	240.03	0.1007	257.03	0.1549	268.91
108	0.1398	242.01	0.1009	251.73	0.1553	261.20
109	0.1399	240.94	0.1014	271.80	0.1569	303.08
110	0.1398	241.42	0.1008	254.84	0.1555	268.07
118	0.1401	242.12	0.1006	266.82	0.1562	280.98
119	0.1400	242.72	0.1009	264.38	0.1567	285.65
120	0.1403	240.72	0.1006	254.93	0.1557	271.11

Subject: A Board: V-Shaped Pickup: Centre

	----Deltoid-----		---Trapezius----		-Infraspinatus--	
Min	RMS	MPF	RMS	MPF	RMS	MPF
8			0.0904	423.68	0.1411	239.15
9			0.0877	365.94	0.1411	239.85
10			0.0879	395.22	0.1411	239.52
18			0.0936	543.31	0.1410	240.04
19			0.0914	461.52	0.1411	239.12
20			0.0878	382.74	0.1411	239.92
28	0.1362	297.16	0.0904	418.18	0.1411	240.15
29	0.1364	297.23	0.0882	392.67	0.1411	240.18
30	0.1358	319.28	0.0868	347.54	0.1411	239.28
38	0.1365	307.62	0.0898	450.98	0.1411	239.61
39	0.1368	301.49	0.0910	464.89	0.1410	240.09
40	0.1373	308.16	0.0892	462.75	0.1412	240.69
48	0.1361	297.78	0.0873	350.42	0.1410	239.33
49	0.1375	316.87	0.0928	482.26	0.1411	241.27
50	0.1364	314.84	0.0911	474.44	0.1411	241.33
58	0.1360	289.92	0.0894	401.79	0.1410	240.75
59	0.1357	316.01	0.0877	354.02	0.1411	241.35
60	0.1356	285.82	0.0901	413.53	0.1411	241.18
68	0.1356	274.71	0.0881	387.80	0.1410	240.60
69	0.1362	313.67	0.0915	511.68	0.1411	241.44
70	0.1368	300.82	0.0913	503.40	0.1411	240.36
78	0.1366	289.61	0.0889	407.69	0.1410	240.69
79	0.1362	299.86	0.0933	553.65	0.1411	241.58
80	0.1375	313.73	0.0928	506.70	0.1411	240.61
88	0.1349	284.97	0.0872	350.51	0.1410	240.97
89	0.1359	289.13	0.0870	350.70	0.1410	239.71
90	0.1356	287.45	0.0876	375.48	0.1410	239.99
98	0.1356	318.01	0.0914	464.11	0.1411	241.96
99	0.1359	307.16	0.0932	499.53	0.1410	241.75
100	0.1356	289.77	0.0894	417.65	0.1410	239.77
108	0.1354	279.28	0.0910	434.44	0.1410	240.13
109	0.1357	287.64	0.0927	484.45	0.1410	240.41
110	0.1366	301.87	0.0899	442.55	0.1410	239.94
118	0.1355	282.53	0.0870	338.99	0.1410	240.04
119	0.1375	298.34	0.0901	462.32	0.1410	239.84
120	0.1367	304.63	0.0922	488.34	0.1409	240.55

Subject: A Board: Inclined Pickup: Opposite

	----Deltoid-----		---Trapezius----		-Infraspinatus--	
Min	RMS	MPF	RMS	MPF	RMS	MPF
8	0.1394	266.71	0.1060	272.34	0.1549	240.12
9	0.1408	281.73	0.1065	284.47	0.1549	239.32
10	0.1395	280.52	0.1062	283.77	0.1549	239.22
18	0.1408	277.16	0.1057	281.27	0.1553	239.52
19	0.1405	269.90	0.1065	298.80	0.1553	240.13
20	0.1402	276.89	0.1057	274.78	0.1554	239.95
28	0.1405	266.46	0.1061	270.99	0.1557	240.04
29	0.1416	278.27	0.1068	291.05	0.1558	239.74
30	0.1405	258.18	0.1062	274.48	0.1558	241.04
38	0.1410	263.26	0.1061	283.67	0.1560	239.96
39	0.1410	271.25	0.1072	286.04	0.1560	240.43
40	0.1413	278.29	0.1075	311.60	0.1560	239.85
48	0.1421	279.19	0.1077	290.32	0.1561	239.08
49	0.1410	278.50	0.1073	275.61	0.1561	239.14
50	0.1415	265.73	0.1061	287.67	0.1561	239.78
58	0.1412	278.27	0.1065	270.72	0.1562	240.40
59	0.1418	283.59	0.1086	291.88	0.1563	241.21
60	0.1420	292.39	0.1070	286.92	0.1562	240.58
68	0.1407	262.47	0.1068	264.47	0.1561	239.66
69	0.1412	271.99	0.1066	272.96	0.1563	240.17
70	0.1405	255.38	0.1066	250.60	0.1562	240.28
78	0.1396	258.52	0.1068	268.22	0.1562	239.87
79	0.1404	274.48	0.1070	272.64	0.1562	240.28
80	0.1405	269.37	0.1072	290.87	0.1563	240.27
88	0.1398	268.12	0.1076	279.70	0.1562	239.40
89	0.1411	288.36	0.1080	300.19	0.1562	240.44
90	0.1414	282.22	0.1077	287.29	0.1562	239.68
98	0.1427	319.45	0.1084	305.79	0.1562	240.12
99	0.1407	288.66	0.1091	316.99	0.1562	239.81
100	0.1407	282.94	0.1086	285.11	0.1561	239.82
108	0.1410	289.20	0.1068	275.38	0.1562	239.86
109	0.1394	258.38	0.1068	255.62	0.1562	240.64
110	0.1401	273.47	0.1073	279.19	0.1562	240.53
118	0.1390	253.78	0.1081	287.44	0.1562	243.37
119	0.1391	264.30	0.1082	292.78	0.1560	239.50
120	0.1400	279.82	0.1080	270.82	0.1563	242.32

Subject: A Board: Inclined Pickup: Centre

	----Deltoid-----		---Trapezius----		-Infraspinatus--	
Min	RMS	MPF	RMS	MPF	RMS	MPF
8	0.1213	240.98	0.1047	240.60	0.1477	253.50
9	0.1219	242.02	0.1046	240.95	0.1478	244.26
10	0.1221	241.98	0.1047	240.18	0.1481	242.75
18	0.1248	240.12	0.1052	239.60	0.1492	241.72
19	0.1250	239.91	0.1051	239.45	0.1496	240.07
20	0.1252	241.39	0.1087	334.20	0.1496	242.98
28	0.1271	240.02	0.1054	239.56	0.1506	242.14
29	0.1272	240.30	0.1054	239.90	0.1506	242.14
30	0.1275	240.25	0.1055	238.75	0.1511	242.15
38	0.1290	239.97	0.1055	240.50	0.1516	242.26
39	0.1290	239.78	0.1054	239.96	0.1516	241.38
40	0.1293	240.33	0.1054	241.01	0.1517	242.31
48	0.1305	240.94	0.1055	239.93	0.1526	243.02
49	0.1307	241.08	0.1055	240.20	0.1523	241.86
50	0.1308	240.45	0.1053	239.31	0.1524	240.27
58	0.1319	239.85	0.1055	240.10	0.1529	240.91
59	0.1321	239.58	0.1055	240.01	0.1530	240.47
60	0.1322	239.61	0.1055	239.39	0.1532	241.15
68	0.1331	239.91	0.1055	240.39	0.1535	240.86
69	0.1332	240.31	0.1055	240.53	0.1536	239.98
70	0.1334	240.75	0.1055	238.65	0.1536	240.04
78	0.1342	239.82	0.1056	238.84	0.1543	240.30
79	0.1344	240.17	0.1056	239.83	0.1543	239.35
80	0.1345	239.71	0.1057	240.23	0.1542	241.64
88	0.1352	240.58	0.1056	240.27	0.1546	241.23
89	0.1352	240.57	0.1056	239.55	0.1547	240.85
90	0.1354	239.79	0.1057	240.35	0.1547	241.38
98	0.1360	239.22	0.1058	240.42	0.1552	240.75
99	0.1360	240.01	0.1058	239.46	0.1550	242.08
100	0.1360	239.35	0.1057	239.49	0.1551	238.65
108	0.1368	240.38	0.1058	241.02	0.1554	240.91
109	0.1368	239.12	0.1057	240.80	0.1554	242.49
110	0.1369	239.93	0.1058	241.07	0.1556	239.87
118	0.1375	239.83	0.1057	240.72	0.1558	240.27
119	0.1375	240.89	0.1058	240.48	0.1560	240.04
120	0.1376	239.79	0.1058	239.26	0.1559	241.07

Subject: B　　Board: Straight　　Pickup: Opposite

	----Deltoid-----		---Trapezius----		-Infraspinatus--	
Min	RMS	MPF	RMS	MPF	RMS	MPF
8	0.0637	1682.78	0.0485	243.31	0.0222	1091.10
9	0.0625	1654.46	0.0486	246.64	0.0236	1140.60
10	0.0480	1451.65	0.0485	243.66	0.0204	887.36
18	0.0558	1622.33	0.0483	245.84	0.0211	878.43
19	0.0572	1615.40	0.0483	243.67	0.0210	833.64
20	0.0510	1467.91	0.0483	243.33	0.0200	734.56
28	0.0593	1591.49	0.0481	247.80	0.0226	889.65
29	0.0583	1545.30	0.0480	246.37	0.0219	830.90
30	0.0584	1577.53	0.0481	251.28	0.0224	894.61
38	0.0589	1569.98	0.0478	241.98	0.0230	862.93
39	0.0620	1578.33	0.0478	245.08	0.0227	844.65
40	0.0524	1400.09	0.0479	246.60	0.0223	778.28
48	0.0659	1635.14	0.0477	247.12	0.0237	836.50
49	0.0586	1506.80	0.0477	243.75	0.0220	721.06
50	0.0556	1462.52	0.0476	247.05	0.0225	751.90
58	0.0631	1524.85	0.0474	243.94	0.0229	756.75
59	0.0611	1541.84	0.0474	245.01	0.0230	762.00
60	0.0626	1479.45	0.0474	246.01	0.0240	863.98
68	0.0592	1484.18	0.0472	245.04	0.0232	736.05
69	0.0554	1351.73	0.0471	242.74	0.0236	694.89
70	0.0661	1530.81	0.0472	246.94	0.0252	877.49
78	0.0583	1456.28	0.0470	244.98	0.0239	711.31
79	0.0554	1339.92	0.0470	247.90	0.0239	702.97
80	0.0607	1424.15	0.0469	244.35	0.0247	779.59
88	0.0668	1599.24	0.0468	245.09	0.0253	792.27
89	0.0682	1517.82	0.0468	243.72	0.0253	805.25
90	0.0608	1417.02	0.0468	244.56	0.0245	710.69
98	0.0513	1247.35	0.0465	244.98	0.0243	688.19
99	0.0594	1396.67	0.0465	244.82	0.0245	659.38
100	0.0624	1442.77	0.0466	244.96	0.0264	867.32
108	0.0625	1479.37	0.0464	243.21	0.0319	1157.74
109	0.0574	1302.98	0.0463	244.70	0.0432	1486.26
110	0.0566	1317.19	0.0463	244.03	0.0260	781.11
118	0.0624	1462.36	0.0462	244.60	0.0262	778.94
119	0.0623	1305.18	0.0462	242.44	0.0261	680.53
120	0.0608	1340.81	0.0462	243.92	0.0263	709.07

Subject: B   Board: Straight   Pickup: Centre

Min	----Deltoid-----		---Trapezius----		-Infraspinatus--	
	RMS	MPF	RMS	MPF	RMS	MPF
8	0.0498	1693.57	0.0501	404.02	0.0391	1776.40
9	0.0522	1662.91	0.0498	396.73	0.0371	1716.50
10	0.0487	1666.27	0.0488	335.61	0.0664	1931.52
18	0.0484	1605.74	0.0496	404.73	0.0609	1877.51
19	0.0499	1578.97	0.0485	353.92	0.0567	1877.66
20	0.0422	1457.87	0.0484	309.05	0.0410	1692.21
28	0.0506	1466.12	0.0505	446.49	0.0448	1722.85
29	0.0448	1354.19	0.0495	382.94	0.0412	1677.76
30	0.0455	1353.18	0.0480	310.19	0.0434	1696.47
38	0.0562	1530.44	0.0498	401.54	0.1083	1989.12
39	0.0519	1496.01	0.0498	428.28	0.0862	1950.23
40	0.0470	1331.38	0.0483	346.41	0.1050	1975.45
48	0.0436	1179.55	0.0479	313.49	0.0755	1900.91
49	0.0403	1067.13	0.0477	297.06	0.0739	1904.05
50	0.0443	1207.61	0.0474	314.99	0.1139	1972.28
58	0.0474	1203.20	0.0483	330.08	0.0979	1949.84
59	0.0535	1414.23	0.0489	398.91	0.1162	1984.25
60	0.0477	1220.04	0.0484	353.85	0.1035	1954.78
68	0.0431	1059.31	0.0468	292.91	0.0883	1929.94
69	0.0529	1330.81	0.0486	363.58	0.0891	1925.53
70	0.0491	1154.99	0.0486	355.13	0.0965	1949.52
78	0.0557	1349.26	0.0490	444.25	0.1085	1962.52
79	0.0528	1232.52	0.0484	372.28	0.1192	1968.93
80	0.0500	1123.98	0.0472	335.95	0.1316	1983.03
88	0.0533	1222.12	0.0474	364.27	0.1051	1941.74
89	0.0506	1185.92	0.0489	386.74	0.1618	2009.80
90	0.0526	1212.74	0.0471	347.63	0.1104	1952.59
98	0.0517	1069.31	0.0473	351.30	0.1871	2014.39
99	0.0535	1201.92	0.0482	372.03	0.1697	2007.76
100	0.0487	1059.13	0.0486	405.06	0.0985	1936.69
108	0.0540	1208.63	0.0480	378.16	0.1365	1978.21
109	0.0488	988.19	0.0469	325.08	0.1063	1937.91
110	0.0585	1304.03	0.0484	433.04	0.1091	1939.45
118	0.0472	842.75	0.0465	312.94	0.1227	1960.70
119	0.0499	955.49	0.0469	361.99	0.1600	1996.00
120	0.0520	1072.47	0.0478	407.51	0.1464	1995.87

Subject: B Board: V-Shaped Pickup: Opposite

	----Deltoid-----		---Trapezius----		-Infraspinatus--	
Min	RMS	MPF	RMS	MPF	RMS	MPF
8	0.0509	913.92	0.0421	463.59	0.0364	839.56
9	0.0508	1000.65	0.0433	496.73	0.0364	848.25
10	0.0507	1040.42	0.0417	450.96	0.0386	946.03
18	0.0522	988.83	0.0423	455.68	0.0560	1458.14
19	0.0512	977.70	0.0440	600.27	0.0609	1561.33
20	0.0499	939.11	0.0424	504.18	0.0590	1530.44
28	0.0500	884.15	0.0421	457.95	0.0747	1739.67
29	0.0531	1009.96	0.0431	516.90	0.0744	1691.07
30	0.0544	1045.16	0.0442	605.65	0.0878	1805.79
38	0.0499	895.54	0.0429	519.69	0.0911	1813.22
39	0.0540	1035.76	0.0447	580.00	0.0987	1845.79
40	0.0482	820.11	0.0417	439.78	0.0936	1767.94
48	0.0478	776.69	0.0500	811.65	0.0775	1752.19
49	0.0482	784.07	0.0421	475.10	0.0845	1770.15
50	0.0491	794.83	0.0411	391.20	0.0458	1271.23
58	0.0562	1088.26	0.0439	570.12	0.1162	1882.79
59	0.0482	794.51	0.0424	491.14	0.0676	1619.05
60	0.0543	1008.21	0.0439	627.02	0.1151	1902.93
68	0.0488	829.17	0.0402	313.94	0.0528	1377.35
69	0.0507	945.91	0.0425	482.52	0.0880	1785.62
70	0.0547	993.91	0.0443	596.52	0.1325	1922.10
78	0.0463	697.16	0.0405	385.26	0.0522	1387.53
79	0.0529	969.01	0.0447	614.70	0.0964	1810.76
80	0.0506	853.45	0.0420	465.75	0.0974	1849.11
88	0.0541	1024.99	0.0534	965.27	0.1091	1852.89
89	0.0517	896.98	0.0411	419.38	0.0903	1784.23
90	0.0537	960.55	0.0417	451.02	0.0966	1826.48
98	0.0561	1056.78	0.0424	452.91	0.0862	1758.08
99	0.0518	967.09	0.0429	520.99	0.0952	1842.00
100	0.0550	939.05	0.0433	520.41	0.1062	1874.65
108	0.0537	957.73	0.0424	495.95	0.0953	1827.46
109	0.0588	1125.06	0.0459	663.34	0.1137	1877.02
110	0.0587	1169.99	0.0450	623.65	0.1020	1841.31
118	0.0500	806.67	0.0461	672.39	0.0647	1556.40
119	0.0553	991.54	0.0432	538.96	0.0845	1741.07
120	0.0533	903.68	0.0445	604.54	0.0934	1817.14

Subject: B Board: V-Shaped Pickup: Centre

	----Deltoid-----		---Trapezius----		-Infraspinatus--	
Min	RMS	MPF	RMS	MPF	RMS	MPF
8	0.0507	2008.43	0.0626	335.75		
9	0.0415	1989.28	0.0610	287.36		
10	0.0425	1959.87	0.0608	300.22		
18	0.0465	1906.34	0.0607	301.41		
19	0.0702	1988.54	0.0611	328.18		
20	0.0575	1926.10	0.0608	313.41		
28	0.0579	1903.15	0.0619	355.34	0.0330	2005.42
29	0.0541	1877.89	0.0633	416.13	0.0324	2001.55
30	0.0542	1884.64	0.0607	297.08	0.0325	2004.94
38	0.0585	1873.47	0.0609	321.09	0.0492	2023.18
39	0.0576	1835.00	0.0611	360.67	0.0503	2014.14
40	0.0502	1772.02	0.0606	291.69	0.0444	2024.35
48	0.0464	1699.53	0.0600	294.97	0.0466	1995.12
49	0.0517	1744.80	0.0600	330.90	0.0503	1977.91
50	0.0585	1801.91	0.0614	349.77	0.0608	2015.57
58	0.0573	1738.69	0.0607	337.43	0.0546	1999.56
59	0.0564	1726.85	0.0597	290.85	0.0442	1971.78
60	0.0538	1658.13	0.0601	319.36	0.0511	1987.17
68	0.0475	1526.76	0.0591	275.29	0.0493	1974.59
69	0.0552	1654.19	0.0599	310.60	0.0539	1978.73
70	0.0545	1685.64	0.0595	302.45	0.0587	1989.74
78	0.0553	1593.34	0.0592	299.04	0.0557	1965.47
79	0.0464	1427.01	0.0589	268.35	0.0491	1972.97
80	0.0511	1535.92	0.0584	270.62	0.0514	1972.78
88	0.0613	1604.27	0.0597	328.39	0.0772	2008.13
89	0.0552	1590.95	0.0595	315.74	0.0658	1985.69
90	0.0581	1617.91	0.0601	365.05	0.0785	2011.07
98	0.0467	1337.90	0.0584	282.01	0.0552	1939.85
99	0.0528	1436.14	0.0583	282.27	0.0637	1959.00
100	0.0604	1554.76	0.0605	356.77	0.0778	1994.93
108	0.0608	1510.53	0.0588	308.92	0.0686	1992.72
109	0.0556	1430.54	0.0586	301.86	0.0630	1933.35
110	0.0510	1304.66	0.0583	279.62	0.0614	1907.40
118	0.0623	1536.26	0.0592	327.15	0.0727	1976.09
119	0.0587	1447.25	0.0591	320.03	0.0708	1983.58
120	0.0553	1430.20	0.0587	291.12	0.0616	1932.45

Subject: B Board: Inclined Pickup: Opposite

Min	----Deltoid-----		---Trapezius----		-Infraspinatus--	
	RMS	MPF	RMS	MPF	RMS	MPF
8	0.0126	1433.80	0.0568	310.01		
9	0.0102	1099.76	0.0565	324.44		
10	0.0124	1327.29	0.0563	319.66		
18	0.0136	918.66	0.0552	284.91	0.0463	2022.69
19	0.0147	950.33	0.0559	302.01	0.0409	2013.41
20	0.0173	1211.59	0.0554	304.01	0.0427	2002.96
28	0.0187	1036.32	0.0559	339.02	0.0510	2004.27
29	0.0173	851.81	0.0547	289.41	0.0373	1974.47
30	0.0178	906.81	0.0547	308.10	0.0455	1982.19
38	0.0401	1700.79	0.0546	282.39	0.0439	1980.62
39	0.0235	1111.01	0.0540	277.15	0.0394	1949.31
40	0.0195	768.03	0.0544	288.57	0.0428	1957.68
48	0.0218	816.92	0.0547	309.30	0.0616	1993.69
49	0.0225	843.65	0.0548	305.98	0.0603	1995.39
50	0.0220	837.04	0.0550	332.42	0.0778	2021.28
58	0.0234	750.43	0.0538	319.81	0.0873	2008.80
59	0.0218	573.42	0.0536	274.49	0.0521	1965.13
60	0.0233	726.93	0.0539	292.46	0.0921	2026.13
68	0.0270	852.86	0.0546	332.03	0.0933	2018.27
69	0.0248	666.87	0.0536	309.59	0.0816	2005.45
70	0.0256	722.95	0.0538	301.41	0.0838	2012.07
78	0.0276	740.93	0.0532	296.00	0.0566	1936.59
79	0.0273	775.10	0.0528	284.89	0.0533	1943.36
80	0.0264	636.19	0.0528	288.62	0.0480	1876.77
88	0.0269	611.63	0.0525	286.47	0.0571	1943.94
89	0.0250	408.07	0.0521	252.59	0.0508	1901.09
90	0.0286	688.33	0.0537	311.15	0.0648	1972.68
98	0.0304	701.58	0.0529	315.72	0.0709	1955.66
99	0.0267	498.91	0.0524	286.60	0.0618	1934.57
100	0.0289	631.62	0.0523	286.34	0.0626	1950.82
108	0.0303	669.83	0.0530	328.26	0.0556	1913.87
109	0.0302	635.68	0.0518	280.59	0.0472	1902.90
110	0.0290	570.49	0.0527	312.74	0.0571	1834.48
118	0.0324	741.96	0.0524	294.45	0.0581	1866.57
119	0.0338	833.05	0.0528	330.92	0.0606	1889.02
120	0.0310	647.62	0.0523	305.14	0.0584	1881.89

Subject: B Board: Inclined Pickup: Centre

	----Deltoid-----		---Trapezius----		-Infraspinatus--	
Min	RMS	MPF	RMS	MPF	RMS	MPF
8	0.0399	2042.81	0.0628	310.65		
9	0.0302	2039.71	0.0618	281.82		
10	0.0304	2043.58	0.0615	280.48		
18	0.0408	2046.56	0.0617	336.69	0.0193	1984.99
19	0.0500	2042.67	0.0615	330.05	0.0213	1993.37
20	0.0399	2045.68	0.0614	319.49	0.0201	2008.35
28	0.0406	1987.66	0.0611	337.89	0.0171	2032.28
29	0.0365	1989.13	0.0613	314.35	0.0174	2040.85
30	0.0377	2014.56	0.0610	320.25	0.0164	2039.44
38	0.0404	1961.34	0.0613	331.32	0.0191	2047.80
39	0.0335	1978.95	0.0601	302.15	0.0159	2047.98
40	0.0330	1942.44	0.0604	326.02	0.0171	2047.53
48	0.0310	1854.10	0.0596	293.55	0.0179	2028.73
49	0.0331	1845.17	0.0601	309.54	0.0161	2032.04
50	0.0333	1909.92	0.0593	291.41	0.0178	2027.50
58	0.0201	1394.31	0.0585	263.47	0.0129	1966.09
59	0.0267	1739.55	0.0597	315.84	0.0172	1995.15
60	0.0387	1865.15	0.0600	324.07	0.0194	1989.95
68	0.0273	1629.01	0.0588	300.82	0.0157	1941.60
69	0.0263	1541.90	0.0588	289.35	0.0147	1910.06
70	0.0306	1673.00	0.0594	315.24	0.0163	1932.17
78	0.0374	1747.88	0.0603	390.09	0.0191	1934.75
79	0.0284	1533.86	0.0586	304.30	0.0157	1886.99
80	0.0285	1515.81	0.0585	300.61	0.0165	1862.68
88	0.0304	1540.84	0.0584	314.00	0.0163	1793.58
89	0.0314	1598.88	0.0584	319.55	0.0174	1808.67
90	0.0296	1465.75	0.0584	321.79	0.0163	1807.61
98	0.0278	1370.15	0.0578	297.55	0.0154	1723.60
99	0.0325	1528.87	0.0582	326.47	0.0182	1768.91
100	0.0267	1233.68	0.0571	276.80	0.0147	1632.26
108	0.0351	1513.95	0.0584	341.71	0.0187	1761.56
109	0.0313	1425.92	0.0578	308.17	0.0168	1677.67
110	0.0331	1455.30	0.0575	297.05	0.0177	1739.35
118	0.0380	1581.72	0.0579	336.30	0.0196	1741.08
119	0.0324	1407.03	0.0574	323.77	0.0182	1618.90
120	0.0346	1457.54	0.0566	293.61	0.0168	1612.24

Subject: C Board: Straight Pickup: Opposite

	----Deltoid-----		---Trapezius----		-Infraspinatus--	
Min	RMS	MPF	RMS	MPF	RMS	MPF
8	0.1322	295.77	0.0907	240.30	0.1430	238.88
9	0.1338	325.82	0.0908	239.78	0.1431	239.28
10	0.1323	314.28	0.0908	239.48	0.1431	239.66
18	0.1325	319.79	0.0908	241.12	0.1431	239.20
19	0.1345	331.78	0.0909	240.34	0.1432	239.46
20	0.1342	330.31	0.0908	239.96	0.1432	239.86
28	0.1324	307.40	0.0909	239.49	0.1432	239.28
29	0.1333	325.15	0.0909	239.56	0.1433	239.78
30	0.1333	317.15	0.0909	241.26	0.1433	239.44
38	0.1316	274.52	0.0909	241.40	0.1434	239.68
39	0.1334	312.14	0.0910	239.59	0.1434	238.76
40	0.1361	370.99	0.0909	241.47	0.1434	239.40
48	0.1334	316.93	0.0910	241.66	0.1435	240.09
49	0.1317	293.86	0.0910	239.12	0.1435	239.29
50	0.1322	308.21	0.0910	240.36	0.1434	239.52
58	0.1327	301.99	0.0911	240.55	0.1436	239.93
59	0.1373	372.68	0.0911	241.15	0.1436	239.36
60	0.1340	311.31	0.0910	241.44	0.1436	239.15
68	0.1331	312.18	0.0912	239.12	0.1437	239.70
69	0.1367	358.83	0.0912	240.83	0.1437	239.75
70	0.1331	324.86	0.0912	242.50	0.1437	239.83
78	0.1322	293.64	0.0912	240.57	0.1438	239.18
79	0.1345	332.52	0.0913	243.13	0.1438	240.08
80	0.1340	316.93	0.0912	240.43	0.1438	239.60
88	0.1352	324.18	0.0914	241.26	0.1439	239.29
89	0.1325	282.65	0.0913	240.30	0.1439	239.74
90	0.1389	406.57	0.0915	241.90	0.1439	239.45
98	0.1348	341.65	0.0915	244.51	0.1440	238.55
99	0.1362	335.38	0.0916	242.74	0.1441	239.54
100	0.1339	315.04	0.0916	243.81	0.1440	239.97
108	0.1384	386.57	0.0915	246.93	0.1441	239.39
109	0.1338	316.74	0.0917	245.68	0.1441	240.16
110	0.1404	404.90	0.0917	251.69	0.1441	239.62
118	0.1339	321.89	0.0921	250.56	0.1442	239.49
119	0.1380	364.67	0.0919	248.81	0.1442	239.77
120	0.1391	377.64	0.0920	254.58	0.1442	239.45

Subject: C Board: Straight Pickup: Centre

	----Deltoid-----		---Trapezius----		-Infraspinatus--	
Min	RMS	MPF	RMS	MPF	RMS	MPF
8	0.1452	330.61	0.1118	374.32	0.1583	249.73
9	0.1439	313.68	0.1090	313.27	0.1585	250.74
10	0.1441	307.26	0.1088	284.37	0.1586	251.78
18	0.1432	284.09	0.1092	307.11	0.1581	246.79
19	0.1435	298.67	0.1094	313.37	0.1587	249.50
20	0.1454	331.21	0.1108	335.22	0.1583	246.69
28	0.1443	306.78	0.1093	314.75	0.1581	251.53
29	0.1440	309.08	0.1109	333.31	0.1590	251.12
30	0.1455	335.58	0.1103	333.68	0.1585	253.86
38	0.1442	302.89	0.1117	370.49	0.1582	246.92
39	0.1458	344.49	0.1113	369.84	0.1589	256.92
40	0.1442	300.25	0.1100	320.55	0.1590	251.99
48	0.1448	336.73	0.1107	358.05	0.1584	255.56
49	0.1433	292.79	0.1104	338.21	0.1584	252.72
50	0.1456	324.33	0.1098	323.55	0.1585	247.65
58	0.1438	324.68	0.1103	331.06	0.1583	250.11
59	0.1443	316.17	0.1094	315.76	0.1587	255.59
60	0.1427	286.62	0.1090	323.25	0.1583	250.86
68	0.1434	294.08	0.1103	327.81	0.1581	244.66
69	0.1433	285.35	0.1094	325.57	0.1583	248.10
70	0.1428	290.97	0.1125	353.86	0.1580	243.19
78	0.1418	271.98	0.1095	298.58	0.1587	250.49
79	0.1425	271.82	0.1102	336.65	0.1584	244.95
80	0.1428	296.91	0.1097	328.78	0.1583	247.86
88	0.1426	306.86	0.1105	341.51	0.1583	248.18
89	0.1437	299.79	0.1113	323.56	0.1579	255.06
90	0.1463	348.84	0.1116	335.29	0.1586	255.36
98	0.1459	328.27	0.1110	350.15	0.1583	252.82
99	0.1463	356.41	0.1124	364.75	0.1586	251.90
100	0.1475	342.57	0.1129	364.26	0.1584	252.21
108	0.1419	296.64	0.1110	331.45	0.1581	252.21
109	0.1489	442.27	0.1128	401.67	0.1586	250.55
110	0.1414	294.46	0.1105	332.53	0.1579	254.79
118	0.1434	329.89	0.1118	345.26	0.1578	260.03
119	0.1479	381.97	0.1131	375.88	0.1590	265.60
120	0.1450	371.05	0.1123	357.10	0.1582	251.19

Subject: C Board: V-Shaped Pickup: Opposite

	----Deltoid-----		---Trapezius----		-Infraspinatus--	
Min	RMS	MPF	RMS	MPF	RMS	MPF
8			0.1079	264.08	0.1603	267.43
9			0.1084	267.89	0.1611	270.14
10			0.1080	268.98	0.1603	258.67
18	0.1427	242.24	0.1098	315.19	0.1608	274.83
19	0.1422	245.82	0.1096	311.74	0.1607	262.61
20	0.1423	239.89	0.1102	299.23	0.1602	264.28
28	0.1424	240.82	0.1106	321.78	0.1602	252.37
29	0.1424	239.31	0.1106	318.98	0.1601	253.80
30			0.1096	322.10	0.1602	257.55
38	0.1425	239.93	0.1104	324.94	0.1602	253.53
39	0.1427	240.69	0.1114	371.05	0.1610	270.39
40			0.1133	400.37	0.1601	262.27
48	0.1427	240.88	0.1137	407.56	0.1607	261.18
49	0.1427	240.39	0.1141	408.70	0.1605	262.95
50	0.1426	239.63	0.1119	366.55	0.1602	257.83
58	0.1429	240.13	0.1130	379.07	0.1615	279.62
59	0.1428	239.06	0.1124	380.86	0.1609	260.22
60	0.1427	240.76	0.1142	426.75	0.1613	255.68
68	0.1429	240.07	0.1128	388.55	0.1598	256.30
69	0.1428	240.72	0.1151	400.28	0.1603	257.43
70	0.1428	240.49	0.1117	353.31	0.1600	252.50
78	0.1429	241.27	0.1161	459.84	0.1613	270.60
79	0.1428	240.55	0.1128	407.04	0.1610	260.71
80	0.1428	240.24	0.1141	439.27	0.1607	264.30
88	0.1430	241.11	0.1139	399.35	0.1610	260.20
89	0.1431	240.07	0.1127	383.70	0.1608	257.81
90	0.1430	240.15	0.1124	382.87	0.1601	256.34
98	0.1431	240.15	0.1144	434.55	0.1606	257.19
99	0.1429	240.00	0.1164	469.72	0.1604	264.63
100	0.1432	240.78	0.1156	424.85	0.1609	262.78
108	0.1430	239.96	0.1157	417.62	0.1606	276.03
109	0.1430	241.65	0.1152	403.18	0.1616	277.67
110	0.1431	239.95	0.1134	389.61	0.1611	270.12
118	0.1431	240.68	0.1078	256.43	0.1613	264.68
119	0.1430	241.74	0.1082	255.74	0.1605	265.70
120	0.1431	239.86	0.1084	252.12	0.1603	269.24

Subject: C Board: V-Shaped Pickup: Centre

	----Deltoid-----		---Trapezius----		-Infraspinatus--	
Min	RMS	MPF	RMS	MPF	RMS	MPF
8	0.1391	314.05	0.1068	292.34	0.3365	1586.19
9	0.1385	303.23	0.1059	288.80	0.2260	1065.29
10	0.1423	371.55	0.1069	301.36	0.3225	1545.70
18	0.1472	453.92	0.1063	292.96	0.3233	1508.56
19	0.1416	324.57	0.1060	285.78	0.3771	1680.11
20	0.1400	300.53	0.1062	285.61	0.5001	1828.89
28	0.1407	332.53	0.1062	287.96	0.6451	1900.42
29	0.1433	368.09	0.1061	287.76	0.5802	1876.94
30	0.1427	329.94	0.1067	312.23	0.6394	1908.49
38	0.1432	355.92	0.1069	308.17	0.4562	1762.49
39	0.1404	307.17	0.1062	280.32	0.4272	1736.33
40	0.1411	314.46	0.1060	274.11	0.3641	1635.18
48	0.1418	306.68	0.1061	279.37	0.4959	1817.26
49	0.1436	350.16	0.1074	303.41	0.4461	1770.11
50	0.1434	338.15	0.1073	304.16	0.4343	1739.06
58	0.1515	447.68	0.1070	310.01	0.4860	1799.82
59	0.1443	349.35	0.1075	299.61	0.4117	1711.07
60	0.1444	335.35	0.1069	291.21	0.4220	1710.44
68	0.1481	376.22	0.1077	309.36	0.5149	1822.85
69	0.1442	335.36	0.1072	313.52	0.5252	1840.12
70	0.1424	315.45	0.1073	299.81	0.4402	1747.09
78	0.1441	329.98	0.1074	291.00	0.4370	1764.70
79	0.1423	297.97	0.1068	280.89	0.3938	1706.28
80	0.1426	335.19	0.1080	306.69	0.4753	1780.18
88	0.1416	304.18	0.1069	283.13	0.3858	1684.34
89	0.1423	307.30	0.1073	285.33	0.4967	1793.21
90	0.1462	353.71	0.1079	304.26	0.5234	1825.21
98	0.1443	326.58	0.1071	295.55	0.3228	1508.36
99			0.1066	284.83	0.5174	1829.34
100	0.1474	380.18	0.1074	295.55	0.4270	1724.66
108	0.1387	249.23	0.1072	282.14	0.3520	1560.12
109	0.1385	251.66	0.1067	274.85	0.3899	1663.88
110	0.1386	246.43	0.1072	285.88	0.3524	1578.74
118	0.1392	255.19	0.1065	269.75	0.6070	1882.44
119	0.1392	254.31	0.1074	295.54	0.5880	1880.44
120	0.1391	258.50	0.1075	284.79	0.5685	1872.98

Subject: C Board: Inclined Pickup: Opposite

	Deltoid		Trapezius		Infraspinatus	
Min	RMS	MPF	RMS	MPF	RMS	MPF
8	0.1275	398.05	0.0980	451.62	0.1430	347.98
9	0.1266	331.74	0.0961	405.84	0.1394	290.52
10	0.1265	329.97	0.0976	469.27	0.1448	357.14
18	0.1261	346.95	0.0960	423.82	0.1403	290.66
19	0.1253	321.54	0.0939	385.53	0.1397	271.71
20	0.1387	557.41	0.0960	399.08	0.1394	284.98
28	0.1281	350.93	0.0974	457.31	0.1408	304.16
29	0.1252	335.63	0.0956	416.93	0.1390	270.60
30	0.1265	331.83	0.0963	437.36	0.1395	283.12
38	0.1267	340.21	0.0940	376.94	0.1400	274.95
39	0.1283	376.92	0.0961	437.93	0.1391	276.08
40	0.1258	323.45	0.0961	436.55	0.1395	273.09
48	0.1274	348.27	0.0967	440.05	0.1401	289.61
49	0.1263	327.47	0.0968	444.40	0.1386	269.79
50	0.1266	313.17	0.0953	395.14	0.1398	281.39
58	0.1297	400.95	0.0969	472.38	0.1410	308.79
59	0.1280	365.18	0.0983	452.10	0.1403	285.02
60	0.1283	367.39	0.0980	481.63	0.1391	273.32
68	0.1285	362.20	0.0968	447.52	0.1407	294.43
69	0.1285	375.93	0.0987	481.69	0.1402	287.06
70	0.1276	349.52	0.0971	454.21	0.1406	300.44
78	0.1288	354.93	0.0954	416.91	0.1395	271.48
79	0.1282	360.56	0.0972	421.64	0.1395	281.73
80	0.1293	399.74	0.0979	483.83	0.1397	287.02
88	0.1272	332.87	0.0947	414.07	0.1404	290.64
89	0.1280	369.59	0.0988	471.60	0.1408	308.69
90	0.1266	341.34	0.0961	436.01	0.1400	279.79
98	0.1283	358.93	0.0972	466.56	0.1436	339.18
99	0.1276	363.04	0.0977	476.52	0.1399	272.19
100	0.1283	353.94	0.0961	421.25	0.1399	280.60
108	0.1268	348.22	0.0973	452.87	0.1409	298.80
109	0.1296	375.71	0.0991	472.97	0.1416	332.27
110	0.1261	339.32	0.0960	406.74	0.1401	284.20
118	0.1242	283.50	0.0931	320.05	0.1385	261.29
119	0.1291	375.96	0.0970	470.20	0.1396	276.65
120	0.1257	313.99	0.0949	393.30	0.1389	271.47

Subject: C Board: Inclined Pickup: Centre

	----Deltoid-----		---Trapezius----		-Infraspinatus--	
Min	RMS	MPF	RMS	MPF	RMS	MPF
8	0.1381	239.31	0.1035	239.40	0.1543	240.34
9	0.1383	239.44	0.1033	240.47	0.1544	241.26
10	0.1383	239.11	0.1035	240.23	0.1545	240.39
18	0.1393	239.52	0.1034	239.97	0.1550	240.14
19	0.1394	239.51	0.1033	240.12	0.1552	242.87
20	0.1396	240.09	0.1033	239.60	0.1550	240.38
28	0.1403	239.62	0.1032	240.80	0.1554	240.83
29	0.1403	239.94	0.1032	239.24	0.1555	239.85
30	0.1404	240.35	0.1032	240.52	0.1555	239.91
38	0.1411	240.42	0.1031	240.70	0.1559	239.99
39	0.1412	241.26	0.1031	240.50	0.1560	240.77
40	0.1412	240.58	0.1032	239.25	0.1560	241.16
48	0.1418	240.11	0.1032	239.92	0.1562	239.58
49	0.1418	240.31	0.1032	239.71	0.1563	239.41
50	0.1419	240.49	0.1031	238.70	0.1563	239.61
58	0.1424	239.92	0.1031	240.71	0.1565	240.22
59	0.1425	240.28	0.1031	241.14	0.1567	239.90
60	0.1425	239.77	0.1031	240.05	0.1566	239.40
68	0.1429	239.80	0.1032	240.72	0.1568	239.39
69	0.1430	238.95	0.1032	240.30	0.1570	239.61
70	0.1432	240.74	0.1033	239.75	0.1571	240.64
78	0.1434	239.41	0.1033	240.02	0.1572	239.66
79	0.1435	239.47	0.1033	240.39	0.1572	241.01
80	0.1435	239.92	0.1033	241.86	0.1572	240.05
88	0.1437	241.57	0.1033	239.99	0.1574	241.78
89	0.1437	240.47	0.1034	239.85	0.1574	239.87
90	0.1437	240.25	0.1033	240.85	0.1574	240.00
98	0.1440	240.58	0.1034	241.96	0.1576	240.30
99	0.1441	239.04	0.1034	239.32	0.1575	239.91
100	0.1440	240.10	0.1034	241.08	0.1577	239.72
108			0.1034	241.85	0.1578	240.19
109			0.1034	242.18	0.1577	239.97
110			0.1034	240.56	0.1578	242.27
118	0.1443	239.25	0.1034	241.91	0.1578	239.58
119	0.1443	240.38	0.1035	241.28	0.1578	239.83
120	0.1451	254.10	0.1036	241.44	0.1579	241.18

Subject: D Board: Straight Pickup: Opposite

	----Deltoid-----		---Trapezius----		-Infraspinatus--	
Min	RMS	MPF	RMS	MPF	RMS	MPF
8	0.3023	1667.99	0.0799	352.55	0.1329	252.38
9	0.2205	1327.40	0.0794	339.60	0.1331	256.47
10	0.4869	1884.95	0.0790	338.53	0.1335	258.64
18	0.1681	801.01	0.0780	299.55	0.1351	280.02
19	0.3076	1621.36	0.0786	315.10	0.1382	327.40
20	0.2705	1600.86	0.0783	311.46	0.1396	360.41
28	0.1650	785.34	0.0786	310.45	0.1366	290.92
29	0.2602	1467.32	0.0781	296.56	0.1371	296.64
30	0.2059	1232.69	0.0777	297.13	0.1360	284.86
38	0.2353	1357.73	0.0775	301.10	0.1435	411.98
39	0.2928	1602.75	0.0783	312.61	0.1401	351.83
40	0.2040	1190.56	0.0778	309.00	0.1369	292.29
48	0.1844	888.89	0.0781	301.57	0.1753	819.53
49	0.1908	1059.69	0.0787	322.30	0.1910	1026.09
50	0.2680	1487.06	0.0782	306.12	0.2104	1174.36
58	0.2297	1392.98	0.0776	302.87	0.1705	764.55
59	0.1737	874.33	0.0784	305.24	0.1707	760.53
60	0.1786	955.59	0.0783	301.99	0.1690	790.12
68	0.2971	1572.16	0.0790	311.76	0.2137	1144.93
69	0.2099	1181.42	0.0788	306.98	0.1950	979.72
70	0.1886	987.58	0.0786	310.13	0.2217	1259.27
78	0.3180	1627.88	0.0790	317.62	0.2341	1298.41
79	0.2705	1491.71	0.0789	308.75	0.2392	1315.73
80	0.2078	1158.31	0.0787	296.23	0.2371	1327.22
88	0.1650	755.36	0.0785	297.27		
89	0.2014	1100.71	0.0787	291.29		
90	0.1974	1073.97	0.0790	300.46		
98	0.2724	1492.20	0.0805	347.32		
99	0.1970	1061.58	0.0802	331.56		
100	0.2360	1316.76	0.0795	300.18		
108	0.5366	1904.02	0.0806	355.65	0.1389	267.94
109	0.5576	1922.72	0.0803	332.50	0.1396	285.02
110	0.2335	1304.56	0.0807	323.42	0.1387	280.19
118	0.4197	1798.57	0.0801	326.98	0.1422	329.59
119	0.2307	1292.54	0.0793	300.92	0.1423	325.98
120	0.2397	1342.47	0.0787	281.13	0.1413	307.60

Subject: D Board: Straight Pickup: Centre

	----Deltoid-----		---Trapezius----		-Infraspinatus--	
Min	RMS	MPF	RMS	MPF	RMS	MPF
8	0.1341	283.65	0.1035	407.35	0.1484	254.13
9	0.1339	286.72	0.1021	387.25	0.1482	248.13
10	0.1338	281.59	0.1025	403.53	0.1483	251.27
18	0.1350	274.59	0.1046	454.74	0.1484	259.28
19	0.1342	270.81	0.1007	366.87	0.1486	256.62
20	0.1347	286.16	0.1022	401.94	0.1486	257.06
28	0.1344	278.75	0.1008	362.52	0.1487	264.21
29	0.1352	289.89	0.1026	410.89	0.1482	255.54
30	0.1352	294.41	0.1031	454.58	0.1487	257.72
38	0.1336	263.77	0.1015	382.62	0.1485	255.69
39	0.1342	264.24	0.1002	333.96	0.1485	257.44
40	0.1352	289.95	0.1006	361.21	0.1490	267.18
48	0.1341	269.87	0.1017	369.27	0.1494	266.27
49	0.1345	275.64	0.1021	428.36	0.1494	270.09
50	0.1342	269.37	0.1005	388.89	0.1490	265.52
58	0.1355	293.18	0.1011	378.05	0.1495	267.42
59	0.1345	264.45	0.1009	380.09	0.1495	271.27
60	0.1339	254.85	0.0994	335.32	0.1487	257.68
68	0.1344	272.41	0.1025	385.06	0.1484	252.08
69	0.1347	272.78	0.1007	371.38	0.1487	257.43
70	0.1341	266.64	0.0991	317.33	0.1485	251.85
78	0.1345	295.52	0.1051	500.46	0.1488	262.75
79	0.1367	308.71	0.1030	397.80	0.1492	264.77
80	0.1344	281.41	0.1018	399.59	0.1485	255.81
88	0.1340	269.49	0.1004	372.58	0.1480	246.40
89	0.1337	265.02	0.1001	347.28	0.1480	243.91
90	0.1331	252.30	0.0981	313.83	0.1480	244.61
98	0.1345	269.68	0.0996	346.16	0.1482	246.30
99	0.1344	270.09	0.0996	331.64	0.1482	249.77
100	0.1341	282.38	0.1008	366.82	0.1484	247.96
108	0.1340	261.68	0.1010	352.74	0.1481	245.54
109	0.1348	281.71	0.1003	374.18	0.1479	245.91
110	0.1338	274.40	0.1011	374.71	0.1483	245.44
118	0.1346	272.94	0.1004	380.72	0.1478	246.96
119	0.1347	265.15	0.1000	351.39	0.1479	245.81
120	0.1344	277.90	0.1016	393.01	0.1481	248.47

Subject: D Board: V-Shaped Pickup: Opposite

	----Deltoid-----		---Trapezius----		-Infraspinatus--	
Min	RMS	MPF	RMS	MPF	RMS	MPF
8	0.1414	334.36	0.0933	240.89		
9	0.1415	310.06	0.0934	239.72		
10	0.1416	316.18	0.0934	239.76		
18	0.1402	298.19	0.0935	239.75		
19	0.1416	325.33	0.0934	238.89		
20	0.1409	323.85	0.0934	239.17		
28	0.1409	296.31	0.0935	240.19	0.1493	242.84
29	0.1399	277.91	0.0935	239.65	0.1492	241.82
30	0.1432	323.78	0.0935	239.92	0.1493	243.40
38	0.1420	308.99	0.0935	240.05	0.1497	247.11
39	0.1405	288.76	0.0936	240.37	0.1494	244.58
40	0.1409	298.74	0.0936	239.75	0.1495	242.65
48	0.1404	283.02	0.0937	239.97	0.1495	243.41
49	0.1397	271.40	0.0936	240.18	0.1497	243.19
50	0.1413	293.06	0.0936	239.78	0.1496	243.15
58	0.1404	276.02	0.0937	238.53	0.1497	241.66
59	0.1420	296.74	0.0937	239.71	0.1498	245.60
60	0.1429	328.14	0.0936	239.80	0.1499	247.22
68	0.1400	274.46	0.0937	239.78	0.1499	241.92
69	0.1409	278.04	0.0937	239.36	0.1499	242.55
70	0.1402	271.89	0.0938	239.88	0.1502	248.29
78	0.1421	303.87	0.0939	240.16	0.1503	242.51
79	0.1427	304.75	0.0938	239.37	0.1500	243.01
80	0.1411	282.05	0.0937	239.62	0.1501	240.46
88	0.1423	298.85	0.0939	240.10	0.1504	245.47
89	0.1411	272.59	0.0939	240.78	0.1503	241.65
90	0.1422	307.40	0.0940	240.11	0.1507	245.28
98	0.1425	297.37	0.0940	240.55	0.1507	244.61
99	0.1426	285.11	0.0940	239.70	0.1506	244.10
100	0.1426	285.76	0.0941	240.06	0.1507	244.16
108	0.1434	298.22	0.0941	239.56	0.1507	245.50
109	0.1421	293.00	0.0940	239.42	0.1506	242.57
110	0.1432	310.55	0.0940	239.50	0.1510	243.05
118	0.1450	343.93	0.0941	240.26	0.1514	248.68
119	0.1430	291.45	0.0942	241.15	0.1508	243.23
120	0.1441	288.95	0.0942	240.04	0.1512	248.96

Subject: D Board: V-Shaped Pickup: Centre

	----Deltoid-----		---Trapezius----		-Infraspinatus--	
Min	RMS	MPF	RMS	MPF	RMS	MPF
8	0.1367	316.72	0.0943	239.54	0.1460	239.55
9	0.1362	356.09	0.0945	240.73	0.1461	239.60
10	0.1347	297.51	0.0945	240.10	0.1459	240.01
18	0.1358	314.32	0.0945	241.79	0.1461	239.79
19	0.1342	290.76	0.0945	240.26	0.1461	239.57
20	0.1328	287.65	0.0945	239.86	0.1461	239.14
28	0.1327	262.31	0.0945	240.19	0.1462	240.49
29	0.1351	322.95	0.0945	240.64	0.1462	239.83
30	0.1347	294.48	0.0946	239.33	0.1463	239.98
38	0.1337	282.07	0.0947	240.63	0.1463	239.44
39	0.1343	299.68	0.0947	239.81	0.1464	238.77
40	0.1340	279.76	0.0946	240.47	0.1464	239.98
48	0.1355	321.07	0.0948	239.39	0.1465	239.02
49	0.1342	271.65	0.0948	239.87	0.1465	239.77
50	0.1348	283.18	0.0949	239.81	0.1465	239.15
58	0.1373	347.92	0.0949	240.27	0.1467	240.72
59	0.1354	290.97	0.0948	239.81	0.1467	239.99
60	0.1360	289.69	0.0949	239.51	0.1467	239.70
68	0.1362	310.37	0.0950	240.70	0.1469	240.02
69	0.1346	290.31	0.0949	240.64	0.1468	239.50
70	0.1356	289.43	0.0950	240.19	0.1468	239.67
78	0.1347	276.54	0.0951	240.15	0.1469	239.50
79	0.1356	297.43	0.0950	240.97	0.1469	240.35
80	0.1343	283.87	0.0951	241.03	0.1469	239.99
88	0.1370	351.57	0.0952	239.58	0.1471	240.24
89	0.1362	321.27	0.0952	239.67	0.1472	239.58
90	0.1358	281.18	0.0952	240.59	0.1472	239.62
98	0.1360	305.44	0.0953	239.61	0.1472	240.45
99	0.1348	279.76	0.0953	239.85	0.1472	240.76
100	0.1360	308.19	0.0953	239.90	0.1473	239.95
108	0.1349	277.04	0.0953	241.05		
109	0.1343	278.19	0.0953	239.56		
110	0.1364	297.95	0.0954	240.34		
118	0.1347	266.07	0.0954	240.84		
119	0.1368	313.95	0.0955	240.26		
120	0.1351	310.70	0.0955	239.38	0.1474	238.84

Subject: D　　　Board: Inclined　　　Pickup: Opposite

Min	----Deltoid-----		---Trapezius----		-Infraspinatus--	
	RMS	MPF	RMS	MPF	RMS	MPF
8	0.1249	286.21	0.0900	289.74	0.1407	305.67
9	0.1256	301.53	0.0912	310.63	0.1419	338.89
10	0.1251	293.55	0.0904	300.02	0.1415	308.02
18	0.1363	565.83	0.0927	344.03	0.1387	272.32
19	0.1307	457.25	0.0919	323.31	0.1385	273.44
20	0.1452	621.18	0.0918	319.29	0.1392	278.84
28	0.1260	308.68	0.0910	324.56	0.1383	265.63
29	0.1249	291.22	0.0906	315.12	0.1387	274.05
30	0.1242	282.46	0.0910	311.76	0.1384	261.63
38	0.1259	312.67	0.0912	307.44	0.1385	269.79
39	0.1250	296.14	0.0920	337.60	0.1393	273.40
40	0.1248	282.81	0.0914	328.73	0.1381	258.90
48	0.1235	272.52	0.0917	320.49	0.1380	254.13
49	0.1231	261.53	0.0909	303.42	0.1383	263.99
50	0.1253	301.00	0.0919	341.00	0.1382	265.68
58	0.1237	281.66	0.0914	340.37	0.1382	260.52
59	0.1239	285.16	0.0922	346.92	0.1378	255.98
60	0.1246	294.34	0.0916	322.89	0.1384	263.03
68	0.1238	282.93	0.0932	362.37	0.1377	253.03
69	0.1244	274.59	0.0924	359.17	0.1378	259.09
70	0.1239	283.10	0.0926	348.91	0.1378	253.94
78	0.1233	264.13	0.0916	329.00	0.1377	254.03
79	0.1234	282.78	0.0919	357.06	0.1381	253.02
80	0.1230	259.24	0.0920	345.75	0.1379	252.29
88	0.1225	263.47	0.0918	321.29	0.1378	248.24
89	0.1225	256.97	0.0925	319.69	0.1377	250.43
90	0.1255	299.77	0.0987	501.74	0.1386	260.80
98	0.1255	312.55	0.0931	375.85	0.1383	256.68
99	0.1229	277.90	0.0931	339.17	0.1375	251.88
100	0.1224	279.14	0.0929	357.28	0.1374	250.49
108	0.1230	292.57	0.0936	371.75	0.1373	251.24
109	0.1225	266.96	0.0945	369.43	0.1372	251.48
110	0.1236	302.89	0.0939	376.02	0.1375	253.77
118	0.1228	295.27	0.0928	344.86	0.1371	250.33
119	0.1219	274.79	0.0925	329.54	0.1373	258.03
120	0.1227	284.69	0.0936	356.05	0.1375	253.15

Subject: D Board: Inclined Pickup: Centre

Min	Deltoid RMS	Deltoid MPF	Trapezius RMS	Trapezius MPF	Infraspinatus RMS	Infraspinatus MPF
8	0.1333	276.31	0.0863	240.86	0.1420	240.11
9	0.1337	280.79	0.0864	240.24	0.1419	239.58
10	0.1342	309.53	0.0864	239.22	0.1419	238.85
18	0.1342	288.40	0.0861	240.91	0.1418	239.83
19	0.1332	271.57	0.0862	240.79	0.1419	239.71
20	0.1342	308.21	0.0861	240.42	0.1418	239.00
28	0.1349	277.59	0.0860	239.84	0.1417	239.62
29	0.1343	281.87	0.0860	239.73	0.1417	240.30
30	0.1367	351.45	0.0859	239.01	0.1417	240.19
38	0.1337	296.12	0.0858	241.35	0.1416	239.10
39	0.1331	275.22	0.0857	242.03	0.1416	238.83
40	0.1343	299.70	0.0857	239.55	0.1416	239.94
48	0.1334	275.03	0.0855	240.29	0.1415	240.06
49	0.1334	276.78	0.0855	239.78	0.1416	239.59
50	0.1331	269.16	0.0855	240.03	0.1414	239.38
58	0.1338	295.35	0.0853	239.91	0.1414	238.83
59	0.1334	267.89	0.0852	239.78	0.1414	239.31
60	0.1361	328.94	0.0851	240.64	0.1413	239.45
68	0.1341	278.09	0.0850	240.42	0.1414	239.78
69	0.1341	270.89	0.0850	239.58	0.1414	240.26
70	0.1331	263.04	0.0850	239.22	0.1413	239.40
78	0.1342	274.34	0.0848	241.15	0.1414	241.09
79	0.1335	265.45	0.0847	241.43	0.1413	239.42
80	0.1332	259.40	0.0847	240.94	0.1412	239.66
88	0.1353	297.26	0.0846	241.04	0.1414	240.67
89	0.1345	298.73	0.0846	240.32	0.1414	242.96
90	0.1333	262.26	0.0844	238.31	0.1412	238.22
98	0.1363	312.36	0.0843	239.85	0.1413	241.79
99	0.1343	274.77	0.0843	240.64	0.1413	243.08
100	0.1334	261.80	0.0843	238.02	0.1411	239.81
108	0.1335	273.73	0.0839	239.96	0.1413	241.33
109	0.1343	273.30	0.0840	240.62	0.1411	239.98
110	0.1353	296.09	0.0840	240.54	0.1411	241.23
118	0.1354	283.70	0.0839	240.76	0.1412	243.78
119	0.1368	327.76	0.0839	239.81	0.1413	242.57
120	0.1361	313.55	0.0839	240.39	0.1412	242.28

L Confidence Intervals of Slopes for RMS and MPF Values

This appendix contains the calculated slopes of the RMS and MPF curves over the entire two hour period. Calculations were done for time periods from the start of the experiment to all time periods ending after thirty minutes. The charts printed here are for the time period ending at 120 minutes. The time periods ending from 30 to 119 minutes are not reproduced due to the enormous amount of space that would be required.

Each chart shows the subject number and the station and muscle being considered. The confidence intervals of the slopes are calculated at a 95% confidence level. They are calculated at a 99% confidence level only if significant at that level. If the slope is significant (ie. RMS slope is positive or MPF slope is negative), then a single star (*) is shown beside the confidence level. A double star (**) indicates that the particular muscle had statistical indications of muscle fatigue at that station over the two hour period.

Subject 1

Station & Muscle			RMS Slope * 10^3 Confidence Interval		MPF Slope Confidence Interval	
So	D	**	99*	(0.0040, 0.0053)	95*	(-0.0100,-0.0012)
So	T		99*	(0.0030, 0.0043)	95	(-0.0104, 0.0034)
So	I		99*	(0.0035, 0.0049)	95	(-0.0058, 0.0018)
Sc	D		99*	(0.0892, 0.1143)	95	(0.1026, 0.3073)
Sc	T		95	(-0.0419,-0.0104)	99*	(-1.0998,-0.1581)
Sc	I		99*	(0.0416, 0.0527)	95	(-0.0443, 0.0657)
Vo	D		99*	(0.1718, 0.2382)	95	(2.8470, 3.5731)
Vo	T		99*	(0.0063, 0.0173)	95	(0.3054, 0.5001)
Vo	I		99*	(0.0096, 0.0418)	95	(0.2489, 0.6606)
Vc	D		99*	(0.0087, 0.0235)	95	(-0.0910, 0.0723)
Vc	T		95	(-0.0074, 0.0024)	95	(-0.0411, 0.2113)
Vc	I	**	95*	(0.0007, 0.0072)	95*	(-0.0670,-0.0086)
Io	D		99*	(0.1112, 0.1421)	95	(-0.0114, 0.0203)
Io	T		99*	(0.0065, 0.0141)	95	(0.1108, 0.2374)
Io	I		99*	(0.0576, 0.0750)	95	(-0.0045, 0.0035)
Ic	D		99*	(0.0995, 0.1475)	95	(0.3301, 0.7679)
Ic	T		99*	(0.0076, 0.0151)	95	(0.1740, 0.2884)
Ic	I		99*	(0.0513, 0.0579)	95	(0.0484, 0.0786)

Subject 2

Station & Muscle			RMS Slope * 10^3 Confidence Interval		MPF Slope Confidence Interval	
So	D		99*	(0.0091, 0.0173)	95	(-0.0869, 0.0079)
So	T		99*	(0.0056, 0.0069)	95	(0.0008, 0.0124)
So	I		99*	(0.0102, 0.0118)	95	(-0.0043, 0.0113)
Sc	D		99*	(0.0600, 0.0943)	95	(0.2963, 0.7808)
Sc	T		99*	(0.0020, 0.0051)	95	(0.0667, 0.1148)
Sc	I		99*	(0.0233, 0.0255)	95	(-0.0005, 0.0147)
Vo	D	**	95*	(0.0005, 0.0722)	99*	(-2.5880,-0.6119)
Vo	T		95	(-0.0108, 0.0057)	95	(-0.2956, 0.0711)
Vo	I		99*	(0.0577, 0.0708)	95	(-0.0052, 0.0025)
Vc	D		95	(-0.0234, 0.0174)	95	(-0.4512, 0.2209)
Vc	T		95	(-0.0002, 0.0053)	95	(-0.0528, 0.0645)
Vc	I		99*	(0.0024, 0.0036)	95	(-0.0092, 0.0005)
Io	D		99*	(0.0170, 0.0238)	95	(0.1335, 0.2378)
Io	T		95	(-0.0025,-0.0012)	95	(-0.0051, 0.0076)
Io	I		95	(-0.0070, 0.0024)	99*	(-0.1838,-0.0028)
Ic	D		99*	(0.0147, 0.0407)	95	(0.0142, 0.3475)
Ic	T		95	(-0.0112, 0.0023)	95	(-0.1178, 0.1093)
Ic	I		95	(-0.0044, 0.0035)	99*	(-0.1954,-0.0265)

Subject 3

Station & Muscle			RMS Slope * 10^3 Confidence Interval		MPF Slope Confidence Interval	
So	D		95	(-0.0028, 0.0164)	95	(-0.1644, 0.1093)
So	T		99*	(0.0011, 0.0028)	95	(-0.0107, 0.0138)
So	I		99*	(0.0026, 0.0039)	95	(-0.0036, 0.0037)
Sc	D		99*	(0.0134, 0.0144)	95	(-0.0035, 0.0078)
Sc	T		95	(-0.0004, 0.0028)	95	(0.1167, 0.1803)
Sc	I		99*	(0.0049, 0.0062)	95	(-0.0014, 0.0037)
Vo	D		99*	(0.0944, 0.1147)	95	(0.2314, 0.3693)
Vo	T		95	(-0.0065,-0.0037)	95	(0.1132, 0.1780)
Vo	I		99*	(0.0297, 0.0540)	95	(-0.0586, 0.2528)
Vc	D	**	99*	(0.0801, 0.1029)	95*	(-0.1860,-0.0049)
Vc	T		99*	(0.0066, 0.0100)	95	(0.0666, 0.1148)
Vc	I		99*	(0.0473, 0.0572)	95	(0.0063, 0.0199)
Io	D		99*	(0.0226, 0.0251)	95	(-0.0090, 0.0039)
Io	T		95	(-0.0007, 0.0013)	95	(0.0277, 0.0602)
Io	I		99*	(0.0097, 0.0115)	95	(0.0012, 0.0154)
Ic	D	**	99*	(0.0795, 0.1041)	99*	(-0.4020,-0.0199)
Ic	T		95	(-0.0029,-0.0002)	95	(0.0120, 0.0560)
Ic	I		99*	(0.0462, 0.0560)	95	(0.0056, 0.0291)

Subject 4

Station & Muscle			RMS Slope * 10^3 Confidence Interval		MPF Slope Confidence Interval	
So	D		99*	(0.0125, 0.0153)	95	(0.0369, 0.0642)
So	T		95	(-0.0003, 0.0014)	95	(-0.0036, 0.0159)
So	I		99*	(0.0017, 0.0054)	95	(-0.0429, 0.0008)
Sc	D		95	(-0.0259, 0.0015)	95	(-0.4927, 0.0312)
Sc	T		95	(-0.0178, 0.0352)	95	(-0.4672, 0.5989)
Sc	I		99*	(0.0109, 0.0155)	95	(0.0758, 0.1263)
Vo	D		99*	(0.0329, 0.0432)	95	(0.2450, 0.3586)
Vo	T		99*	(0.0125, 0.0146)	95	(0.0012, 0.0124)
Vo	I		95	(-0.0228, 0.0035)	99*	(-0.7429,-0.1748)
Vc	D		99*	(0.0932, 0.1265)	95	(0.2698, 0.5584)
Vc	T		95	(-0.0007, 0.0005)	95	(0.0058, 0.0146)
Vc	I		99*	(0.0395, 0.0462)	95	(-0.0041, 0.0030)
Io	D	**	99*	(0.1009, 0.1214)	99*	(-0.0264,-0.0027)
Io	T		95	(-0.0044, 0.0147)	95	(-0.0532, 0.3315)
Io	I		99*	(0.0581, 0.0664)	95	(0.1212, 0.2206)
Ic	D		95	(-0.0177,-0.0155)	95	(-0.0153, 0.0104)
Ic	T		95	(-0.0217, 0.0188)	95	(-0.6826, 0.2256)
Ic	I		95	(-0.0037,-0.0029)	95	(-0.0044, 0.0012)

Subject 5

Station & Muscle			RMS Slope * 10^3 Confidence Interval		MPF Slope Confidence Interval	
So	D	**	99*	(0.1327, 0.1924)	99*	(-0.6969,-0.0671)
So	T		99*	(0.0094, 0.0296)	95	(-0.1990, 0.0352)
So	I	**	99*	(0.0519, 0.1067)	99*	(-0.8122,-0.0033)
Sc	D		95	(-0.0066, 0.0120)	95	(-0.1123, 0.2268)
Sc	T		95*	(0.0026, 0.0304)	95	(-0.2363, 0.5625)
Sc	I		99*	(0.0013, 0.0064)	95	(-0.0279, 0.0337)
Vo	D		99*	(0.1072, 0.1574)	95	(-0.1908, 0.5216)
Vo	T		95	(-0.0188,-0.0015)	99*	(-1.1285,-0.3064)
Vo	I		99*	(0.0513, 0.0662)	95	(-0.1198, 0.0459)
Vc	D	**	99*	(0.1156, 0.1682)	99*	(-0.8973,-0.1524)
Vc	T		99*	(0.0255, 0.0511)	95	(0.2531, 0.6862)
Vc	I	**	99*	(0.0823, 0.0972)	99*	(-0.2130,-0.0759)
Io	D		99*	(0.1093, 0.1458)	95	(-0.4149, 0.0227)
Io	T		99*	(0.0109, 0.0263)	95	(-0.2612, 0.0683)
Io	I		99*	(0.0707, 0.0887)	95	(-0.0121, 0.1453)
Ic	D		95	(-0.0273,-0.0088)	95	(-0.1030, 0.1969)
Ic	T		99*	(0.0073, 0.0521)	95	(0.1809, 1.0120)
Ic	I		95	(-0.0045,-0.0012)	95	(-0.0156, 0.0185)

Subject 6

Station & Muscle			RMS Slope * 10^3 Confidence Interval		MPF Slope Confidence Interval	
So	D	**	99*	(0.0661, 0.1009)	99*	(-1.0527,-0.1683)
So	T		95*	(0.0005, 0.0203)	95	(-0.3283, 0.2221)
So	I		99*	(0.0496, 0.0618)	95	(-0.1112, 0.0347)
Sc	D		95	(-0.0130,-0.0107)	95	(-0.0379, 0.0054)
Sc	T		95	(-0.0604, 0.0060)	95*	(-1.8501,-0.2406)
Sc	I		95	(-0.0058, 0.0001)	99*	(-0.1112,-0.0004)
Vo	D		99*	(0.0687, 0.0989)	95	(-0.4289, 0.0925)
Vo	T		95	(-0.0107, 0.0206)	95	(-0.7180, 0.1761)
Vo	I		99*	(0.0475, 0.0612)	95	(-0.0606, 0.0836)
Vc	D		99*	(0.0873, 0.1165)	95	(-0.1864, 0.1384)
Vc	T		95	(-0.0187, 0.0103)	95	(-0.4827, 0.3255)
Vc	I		99*	(0.0510, 0.0598)	95	(0.0016, 0.0139)
Io	D		99*	(0.0434, 0.3648)	95	(1.1030, 4.9645)
Io	T		99*	(0.0952, 0.1293)	95	(2.4300, 3.1487)
Io	I		95	(-0.0145, 0.0102)	95*	(-0.5460,-0.0558)
Ic	D		95	(-0.0832, 0.0022)	95*	(-1.6081,-0.1729)
Ic	T		95	(-0.0117, 0.0082)	99*	(-0.8107,-0.0141)
Ic	I		99*	(0.0043, 0.0082)	95	(-0.0549, 0.0001)

Subject 7

Station & Muscle			RMS Slope * 10^3 Confidence Interval		MPF Slope Confidence Interval	
So	D	**	99*	(0.0849, 0.1241)	99*	(-2.5278,-1.1102)
So	T		95	(-0.0556, 0.0115)	99*	(-3.9259,-1.3413)
So	I	**	99*	(0.0737, 0.0904)	99*	(-0.6040,-0.1200)
Sc	D	**	99*	(0.0165, 0.0762)	99*	(-3.5852,-1.7113)
Sc	T		95	(-0.0356, 0.0284)	99*	(-2.4217,-0.0513)
Sc	I		99*	(0.0609, 0.0816)	95	(-0.4794, 0.0279)
Vo	D	**	99*	(0.0313, 0.1025)	99*	(-2.0055,-0.1755)
Vo	T		95	(-0.0343, 0.0229)	99*	(-0.7333,-0.3229)
Vo	I		99*	(0.0948, 0.1971)	95	(1.2940, 3.6777)
Vc	D		99*	(0.1931, 0.2397)	95	(1.7341, 2.9344)
Vc	T	**	99*	(0.0324, 0.0388)	99*	(-0.3278,-0.0045)
Vc	I		99*	(0.2249, 1.5533)	95	(0.0069, 1.0160)
Io	D		99*	(0.1180, 0.1357)	95	(-0.0306, 0.0485)
Io	T	**	95*	(0.0038, 0.0462)	99*	(-1.5221,-1.1045)
Io	I	**	99*	(0.0419, 0.0883)	95*	(-1.2202,-0.1004)
Ic	D	**	99*	(0.0539, 0.0994)	99*	(-2.0684,-0.7409)
Ic	T		95	(-0.0405, 0.0052)	95*	(-0.0986,-0.0004)
Ic	I		99*	(0.2832, 0.5213)	95	(1.9281, 3.9880)

Subject 8

Station & Muscle			RMS Slope * 10^3 Confidence Interval		MPF Slope Confidence Interval	
So	D	**	99*	(0.0836, 0.1394)	99*	(-5.2815,-2.6997)
So	T		95	(-0.0011, 0.0260)	95	(1.9195, 2.8349)
So	I		99*	(0.1829, 1.0987)	95	(-0.0479, 1.2296)
Sc	D	**	99*	(0.0832, 0.1525)	99*	(-4.0498,-1.7784)
Sc	T		95	(-0.0750,-0.0178)	95	(0.2333, 0.5931)
Sc	I		99*	(0.0225, 0.9262)	95	(-0.6589, 1.9887)
Vo	D		95	(-0.0028, 0.0699)	99*	(-8.1396,-4.5523)
Vo	T		95	(-0.1155,-0.0447)	95	(-0.4567, 0.7685)
Vo	I		95	(-0.0182, 0.0652)	99*	(-5.8290,-2.2897)
Vc	D	**	99*	(0.0911, 0.2002)	99*	(-3.2385,-0.0931)
Vc	T		99*	(0.0040, 0.0550)	95	(2.1196, 3.0247)
Vc	I		95	(-0.0222, 0.0786)	99*	(-5.7869,-0.9725)
Io	D		95	(-0.0048, 0.7534)	95*	(-0.7807,-0.0134)
Io	T		95	(-0.0096, 0.0243)	95	(1.4862, 2.1563)
Io	I		99*	(0.4713, 1.0344)	95	(1.2565, 3.2104)
Ic	D	**	99*	(0.1097, 0.1499)	99*	(-2.3998,-0.7367)
Ic	T		95	(-0.0045, 0.0223)	95	(0.8178, 1.1457)
Ic	I	**	99*	(0.0350, 0.0806)	99*	(-3.2381,-1.0242)

Subject A

Station & Muscle			RMS Slope * 10^3 Confidence Interval		MPF Slope Confidence Interval	
So	D		99*	(0.0249, 0.0265)	95	(0.0140, 0.0311)
So	T		99*	(0.0096, 0.0375)	95	(0.5175, 1.0299)
So	I	**	99*	(0.0047, 0.0098)	95*	(-0.0639,-0.0063)
Sc	D		99*	(0.1093, 0.1660)	95	(-0.7470, 0.0413)
Sc	T		99*	(0.0460, 0.0948)	95	(0.3761, 1.6151)
Sc	I		99*	(0.0687, 0.0841)	95	(-0.1900, 0.0224)
Vo	D		99*	(0.0460, 0.0512)	95	(0.0040, 0.0174)
Vo	T		99*	(0.0082, 0.0139)	95	(0.1157, 0.2018)
Vo	I		99*	(0.0335, 0.0453)	95	(0.0820, 0.2508)
Vc	D		95	(-0.0132, 0.0044)	95	(-0.3018, 0.0106)
Vc	T		95	(-0.0106, 0.0290)	95	(-0.3638, 0.7674)
Vc	I		95	(-0.0015,-0.0006)	95	(0.0006, 0.0143)
Io	D		95	(-0.0121, 0.0041)	95	(-0.0918, 0.1509)
Io	T		99*	(0.0091, 0.0254)	95	(-0.1321, 0.1371)
Io	I		99*	(0.0055, 0.0123)	95	(0.0018, 0.0166)
Ic	D	**	99*	(0.1205, 0.1484)	99*	(-0.0170,-0.0022)
Ic	T		95	(-0.0021, 0.0095)	95	(-0.2417, 0.0532)
Ic	I	**	99*	(0.0605, 0.0750)	99*	(-0.0592,-0.0077)

Subject B

Station & Muscle			RMS Slope * 10^3 Confidence Interval		MPF Slope Confidence Interval	
So	D		95	(-0.0070, 0.0767)	99*	(-3.1974,-1.2163)
So	T		95	(-0.0219,-0.0211)	95	(-0.0303, 0.0037)
So	I		99*	(0.0306, 0.1075)	95	(-2.2305, 0.8631)
Sc	D	**	95*	(0.0042, 0.0781)	99*	(-6.5330,-3.5141)
Sc	T		95	(-0.0256,-0.0108)	95	(-0.3894, 0.4195)
Sc	I		99*	(0.6252, 1.1929)	95	(1.1308, 2.5468)
Vo	D		99*	(0.0026, 0.0716)	95	(-0.8307, 1.2130)
Vo	T		95	(-0.0096, 0.0374)	95	(-0.3942, 1.8724)
Vo	I		99*	(0.1131, 0.6314)	95	(2.2038, 6.8275)
Vc	D		95	(-0.0114, 0.0982)	99*	(-6.2534,-4.5105)
Vc	T		95	(-0.0345,-0.0205)	95	(-0.4856, 0.1034)
Vc	I	**	99*	(0.2119, 0.4815)	99*	(-0.9982,-0.2333)
Io	D	**	99*	(0.1073, 0.2046)	99*	(-7.7594,-2.9723)
Io	T		95	(-0.0410,-0.0312)	95	(-0.2429, 0.1273)
Io	I		95	(-0.0348, 0.2894)	99*	(-1.7105,-0.7289)
Ic	D		95	(-0.1105,-0.0101)	99*	(-7.8985,-5.1785)
Ic	T		95	(-0.0474,-0.0375)	95	(-0.1882, 0.2529)
Ic	I		95	(-0.0294, 0.0082)	99*	(-4.9051,-3.2793)

Subject C

Station & Muscle		RMS Slope * 10^3 Confidence Interval		MPF Slope Confidence Interval	
So	D	99*	(0.0140, 0.0615)	95	(0.1008, 0.6601)
So	T	99*	(0.0084, 0.0112)	95	(0.0544, 0.1028)
So	I	99*	(0.0097, 0.0106)	95	(-0.0014, 0.0054)
Sc	D	95	(-0.0106, 0.0219)	95	(0.0100, 0.6228)
Sc	T	99*	(0.0070, 0.0324)	95	(0.0659, 0.4923)
Sc	I	95	(-0.0048, 0.0008)	95	(0.0023, 0.0814)
Vo	D	99*	(0.0055, 0.0087)	95	(-0.0210, 0.0056)
Vo	T	99*	(0.0022, 0.0611)	95	(0.0676, 1.1866)
Vo	I	95	(-0.0005, 0.0080)	95	(-0.0301, 0.1061)
Vc	D	95	(-0.0380, 0.0210)	99*	(-1.2250,-0.1436)
Vc	T	99*	(0.0033, 0.0151)	95	(-0.1757, 0.0411)
Vc	I	95	(-0.3003, 1.5324)	95	(-0.2609, 2.6825)
Io	D	95	(-0.0259, 0.0181)	95	(-0.5971, 0.2145)
Io	T	95	(-0.0114, 0.0153)	95	(-0.2990, 0.3883)
Io	I	95	(-0.0175, 0.0075)	95	(-0.3219, 0.1045)
Ic	D	99*	(0.0502, 0.0637)	95	(0.0013, 0.0509)
Ic	T	99*	(0.0000, 0.0031)	95	(0.0068, 0.0206)
Ic	I	99*	(0.0277, 0.0337)	95	(-0.0104, 0.0050)

Subject D

Station & Muscle		RMS Slope * 10^3 Confidence Interval		MPF Slope Confidence Interval	
So	D	95	(-0.4510, 1.4046)	95	(-2.5862, 3.6562)
So	T	99*	(0.0044, 0.0227)	95	(-0.1981, 0.1408)
So	I	95	(-0.1380, 0.6291)	95	(-2.2026, 6.3981)
Sc	D	95	(-0.0067, 0.0055)	95	(-0.1995, 0.0251)
Sc	T	95	(-0.0317,-0.0059)	95*	(-0.7119,-0.0165)
Sc	I	95	(-0.0095,-0.0013)	99*	(-0.2066,-0.0298)
Vo	D	99*	(0.0088, 0.0341)	95	(-0.2972, 0.0528)
Vo	T	99*	(0.0067, 0.0079)	95	(-0.0021, 0.0077)
Vo	I	99*	(0.0170, 0.0223)	95	(-0.0087, 0.0475)
Vc	D	95	(-0.0012, 0.0190)	95	(-0.3082, 0.1238)
Vc	T	99*	(0.0091, 0.0101)	95	(-0.0064, 0.0046)
Vc	I	99*	(0.0131, 0.0146)	95	(-0.0032, 0.0083)
Io	D	95	(-0.0983,-0.0272)	99*	(-1.8104,-0.0238)
Io	T	99*	(0.0113, 0.0410)	95	(0.2458, 0.8243)
Io	I	95	(-0.0302,-0.0166)	99*	(-0.5493,-0.2211)
Ic	D	95*	(0.0005, 0.0199)	95	(-0.2303, 0.1819)
Ic	T	95	(-0.0237,-0.0227)	95	(-0.0094, 0.0066)
Ic	I	95	(-0.0075,-0.0058)	95	(0.0136, 0.0336)

M RMS and MPF Slopes

Subject	Station	Deltoid RMS[3]	Deltoid MPF	Trapezius RMS	Trapezius MPF	Infraspinatus RMS	Infraspinatus MPF
1	So	0.0047	-0.0056	0.0037	-0.0035	0.0042	-0.0020
1	Sc	0.1017	0.2049	-0.0262	-0.6289	0.0471	0.0107
1	Vo	0.2050	3.2100	0.0118	0.4028	0.0257	0.4547
1	Vc	0.0161	-0.0094	-0.0025	0.0851	0.0039	-0.0378
1	Io	0.1266	0.0044	0.0103	0.1741	0.0663	-0.0005
1	Ic	0.1235	0.5490	0.0113	0.2312	0.0546	0.0635
2	So	0.0132	-0.0395	0.0062	0.0066	0.0110	0.0035
2	Sc	0.0772	0.5386	0.0035	0.0908	0.0244	0.0071
2	Vo	0.0364	-1.5999	-0.0026	-0.1123	0.0643	-0.0014
2	Vc	-0.0030	-0.1152	0.0026	0.0059	0.0030	-0.0044
2	Io	0.0204	0.1857	-0.0018	0.0013	-0.0023	-0.0933
2	Ic	0.0277	0.1808	-0.0045	-0.0042	-0.0005	-0.1110
3	So	0.0068	-0.0275	0.0020	0.0016	0.0033	0.0000
3	Sc	0.0139	0.0021	0.0012	0.1485	0.0056	0.0012
3	Vo	0.1045	0.3004	-0.0051	0.1456	0.0419	0.0971
3	Vc	0.0915	-0.0955	0.0083	0.0907	0.0523	0.0131
3	Io	0.0239	-0.0025	0.0003	0.0440	0.0106	0.0083
3	Ic	0.0918	-0.2109	-0.0016	0.0340	0.0511	0.0173
4	So	0.0139	0.0506	0.0005	0.0062	0.0035	-0.0211
4	Sc	-0.0122	-0.2308	0.0087	0.0658	0.0132	0.1010
4	Vo	0.0380	0.3018	0.0135	0.0068	-0.0097	-0.4588
4	Vc	0.1098	0.4141	-0.0001	0.0102	0.0428	-0.0005
4	Io	0.1111	-0.0146	0.0051	0.1392	0.0622	0.1709
4	Ic	-0.0166	-0.0024	-0.0015	-0.2285	-0.0033	-0.0016

[3]All RMS Slopes, for all muscles, are 10^3

5	So	0.1625	-0.3820	0.0195	-0.0819	0.0793	-0.4077
5	Sc	0.0027	0.0573	0.0165	0.1631	0.0039	0.0029
5	Vo	0.1323	0.1654	-0.0102	-0.7174	0.0587	-0.0369
5	Vc	0.1419	-0.5248	0.0383	0.4696	0.0898	-0.1444
5	Io	0.1275	-0.1961	0.0186	-0.0965	0.0797	0.0666
5	Ic	-0.0180	0.0469	0.0297	0.5964	-0.0029	0.0015
6	So	0.0835	-0.6105	0.0104	-0.0531	0.0557	-0.0382
6	Sc	-0.0118	-0.0163	-0.0272	-1.0453	-0.0029	-0.0558
6	Vo	0.0838	-0.1682	0.0050	-0.2709	0.0544	0.0115
6	Vc	0.1019	-0.0240	-0.0042	-0.0786	0.0554	0.0078
6	Io	0.2041	3.0338	0.1122	2.7894	-0.0021	-0.3009
6	Ic	-0.0405	-0.8905	-0.0017	-0.4124	0.0062	-0.0274
7	So	0.1045	-1.8190	-0.0221	-2.6336	0.0820	-0.3620
7	Sc	0.0464	-2.6483	-0.0036	-1.2365	0.0712	-0.2257
7	Vo	0.0669	-1.0905	-0.0057	-0.5281	0.1460	2.4858
7	Vc	0.2164	2.3342	0.0356	-0.1662	0.8891	0.5114
7	Io	0.1268	0.0089	0.0250	-1.3133	0.0651	-0.6603
7	Ic	0.0766	-1.4047	-0.0177	-0.0495	0.4023	2.9580
8	So	0.1115	-3.9906	0.0124	2.3772	0.6408	0.5908
8	Sc	0.1179	-2.9141	-0.0464	0.4132	0.4743	0.6649
8	Vo	0.0335	-6.3459	-0.0801	0.1559	0.0235	-4.0594
8	Vc	0.1456	-1.6658	0.0295	2.5722	0.0282	-3.3797
8	Io	0.3743	-0.3971	0.0074	1.8213	0.7528	2.2334
8	Ic	0.1298	-1.5682	0.0089	0.9818	0.0578	-2.1312

A	So	0.0257	0.0225	0.0236	0.7737	0.0072	-0.0351
A	Sc	0.1377	-0.3528	0.0704	0.9956	0.0764	-0.0838
A	Vo	0.0486	0.0107	0.0110	0.1588	0.0394	0.1664
A	Vc	-0.0044	-0.1456	0.0092	0.2018	-0.0011	0.0075
A	Io	-0.0040	0.0296	0.0173	0.0025	0.0089	0.0092
A	Ic	0.1344	-0.0096	0.0037	-0.0943	0.0678	-0.0335
B	So	0.0348	-2.2069	-0.0215	-0.0133	0.0691	-0.6837
B	Sc	0.0411	-5.0236	-0.0182	0.0150	0.9091	1.8388
B	Vo	0.0371	0.1912	0.0139	0.7391	0.3722	4.5156
B	Vc	0.0434	-5.3820	-0.0275	-0.1911	0.3467	-0.6158
B	Io	0.1559	-5.3659	-0.0361	-0.0578	0.1273	-1.2197
B	Ic	-0.0603	-6.5385	-0.0425	0.0324	-0.0106	-4.0922
C	So	0.0378	0.3805	0.0098	0.0786	0.0101	0.0020
C	Sc	0.0056	0.3164	0.0197	0.2791	-0.0020	0.0419
C	Vo	0.0071	-0.0077	0.0317	0.6271	0.0038	0.0380
C	Vc	-0.0085	-0.6843	0.0092	-0.0673	0.6161	1.2108
C	Io	-0.0039	-0.1913	0.0019	0.0447	-0.0050	-0.1087
C	Ic	0.0569	0.0261	0.0016	0.0137	0.0307	-0.0027
D	So	0.4768	0.5350	0.0136	-0.0286	0.2455	2.0978
D	Sc	-0.0006	-0.0872	-0.0188	-0.3642	-0.0054	-0.1182
D	Vo	0.0214	-0.1222	0.0073	0.0028	0.0197	0.0194
D	Vc	0.0089	-0.0922	0.0096	-0.0009	0.0138	0.0026
D	Io	-0.0627	-0.9171	0.0262	0.5351	-0.0234	-0.3852
D	Ic	0.0102	-0.0242	-0.0232	-0.0014	-0.0066	0.0236

N Statistical Analysis of Fatigue

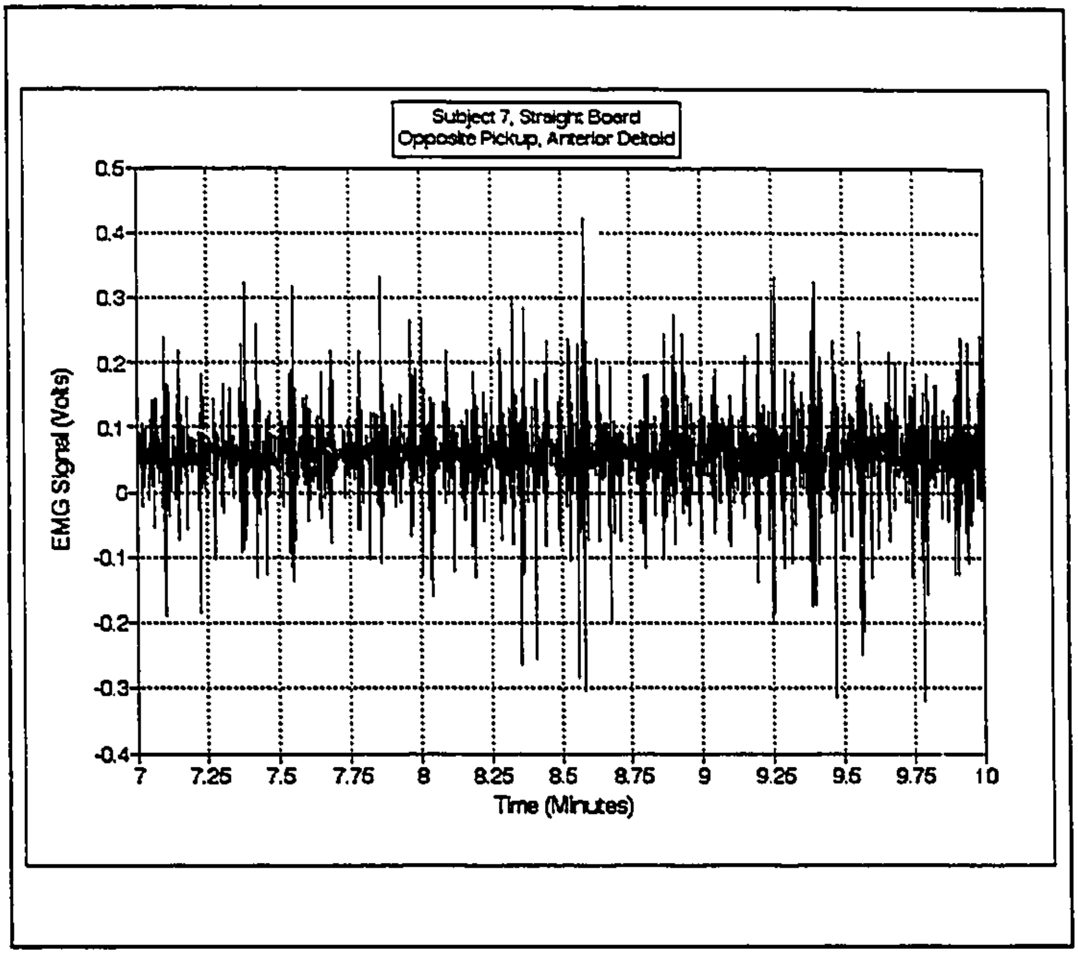
Analysis of Variance for fatigue score - Type III Sums of Squares

Source of variation	Sum of Squares	d.f.	Mean square	F-ratio	Sig. level
MAIN EFFECTS					
A:gender	0.6944444	1	0.6944444	2.732	0.1036
B:board	0.0416667	2	0.0208333	0.082	0.9214
C:pickup	0.0277778	1	0.0277778	0.109	0.7456
INTERACTIONS					
AB	0.4305556	2	0.2152778	0.847	0.4338
AC	0.0277778	1	0.0277778	0.109	0.7456
BC	0.9305556	2	0.4652778	1.831	0.1692
ABC	0.0972222	2	0.0486111	0.191	0.8264
RESIDUAL	15.250000	60	0.2541667		
TOTAL (CORRECTED)	17.944444	71			

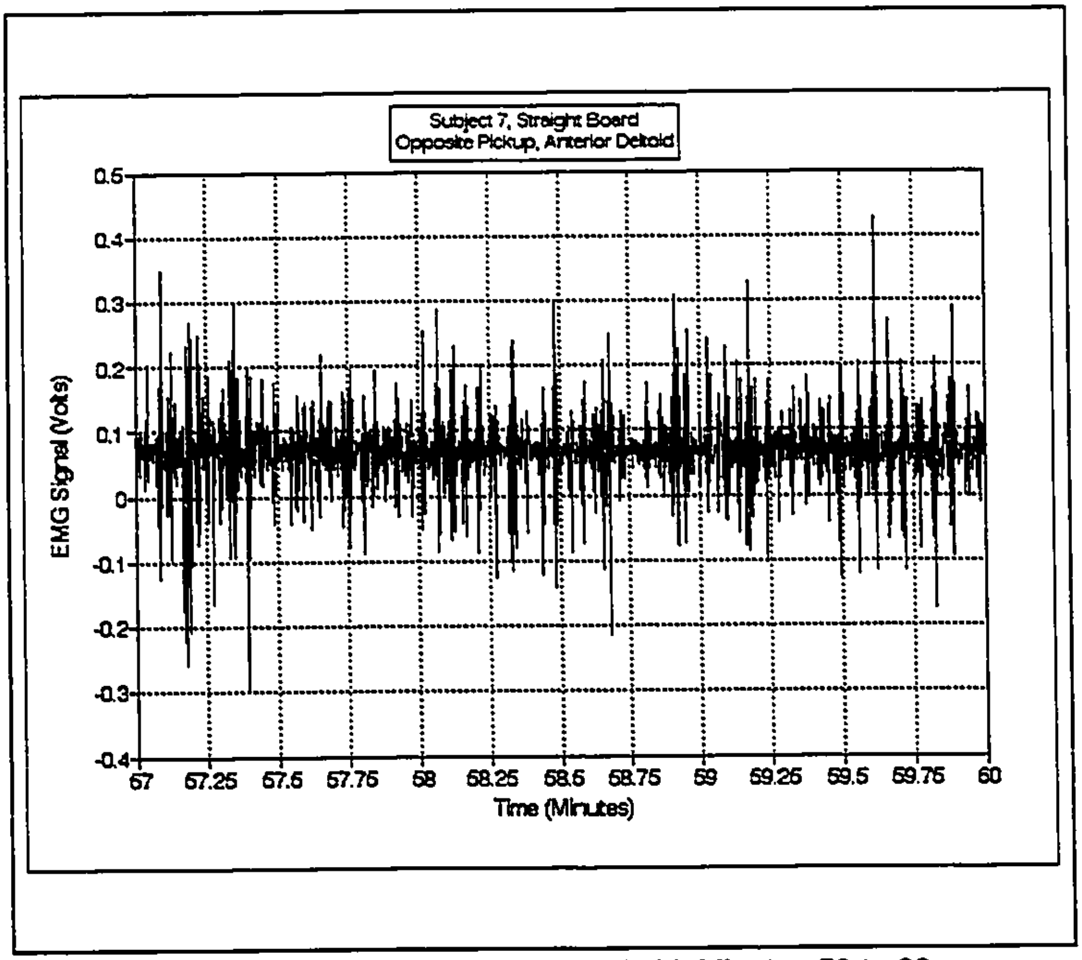
0 missing values have been excluded.

All F-ratios are based on the residual mean square error.

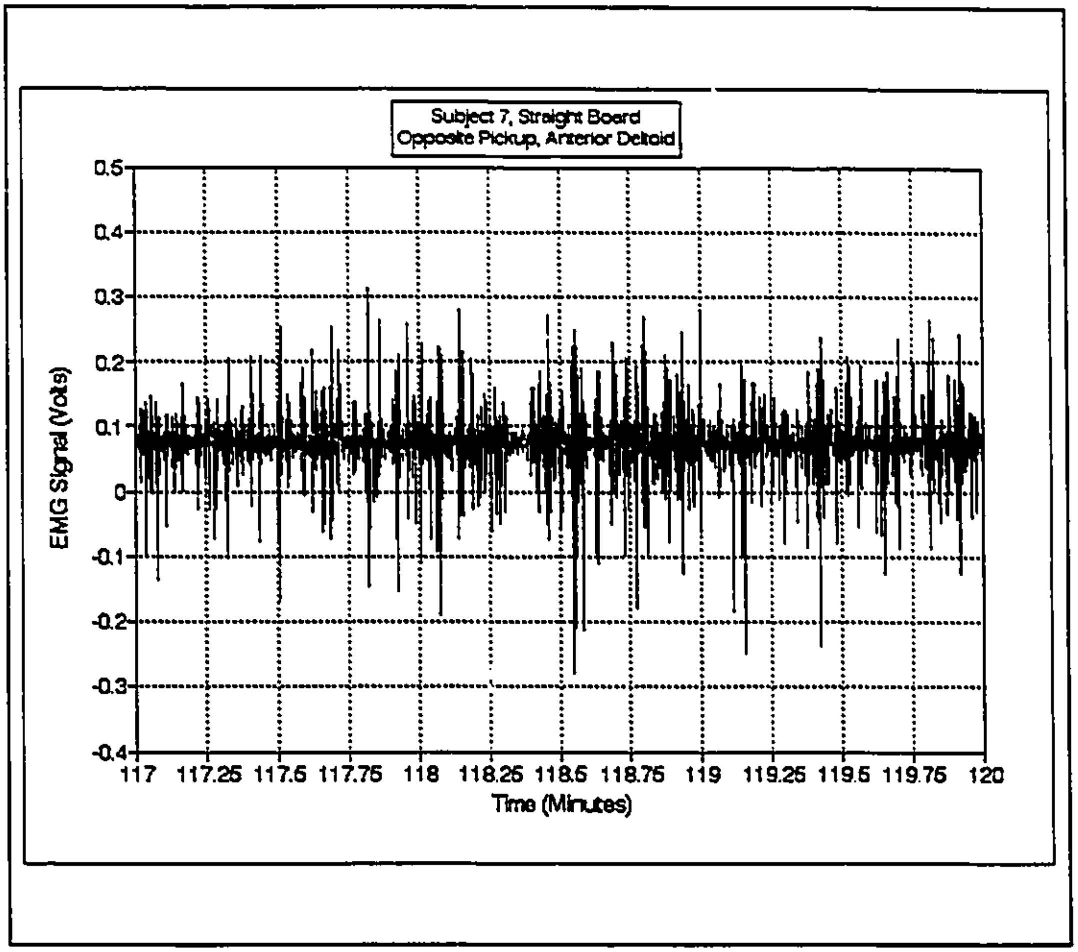
O EMG, RMS, MPF Graphs with Statistical Signs of Fatigue



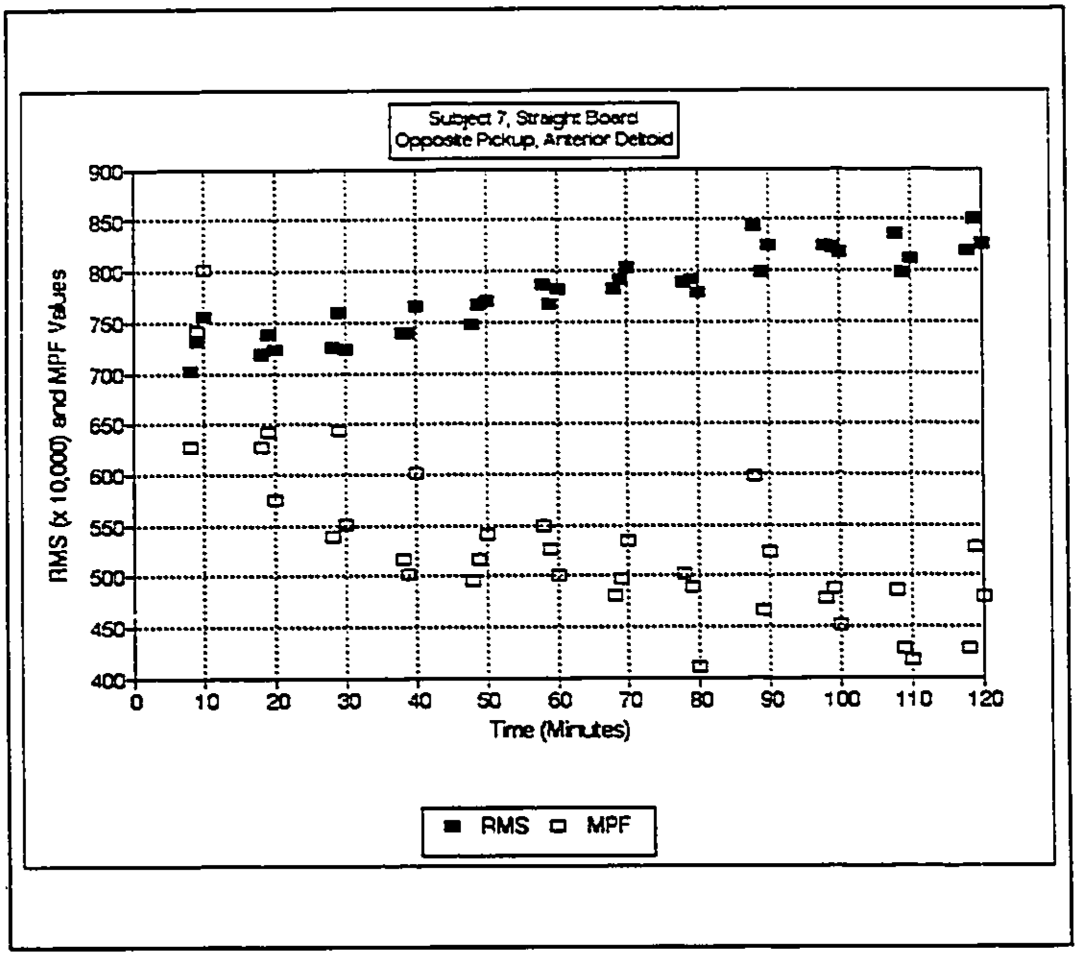
EMG Signal for Subject 7, So, Deltoid, Minutes 8 to 10



EMG Signal for Subject 7, So, Deltoid, Minutes 58 to 60



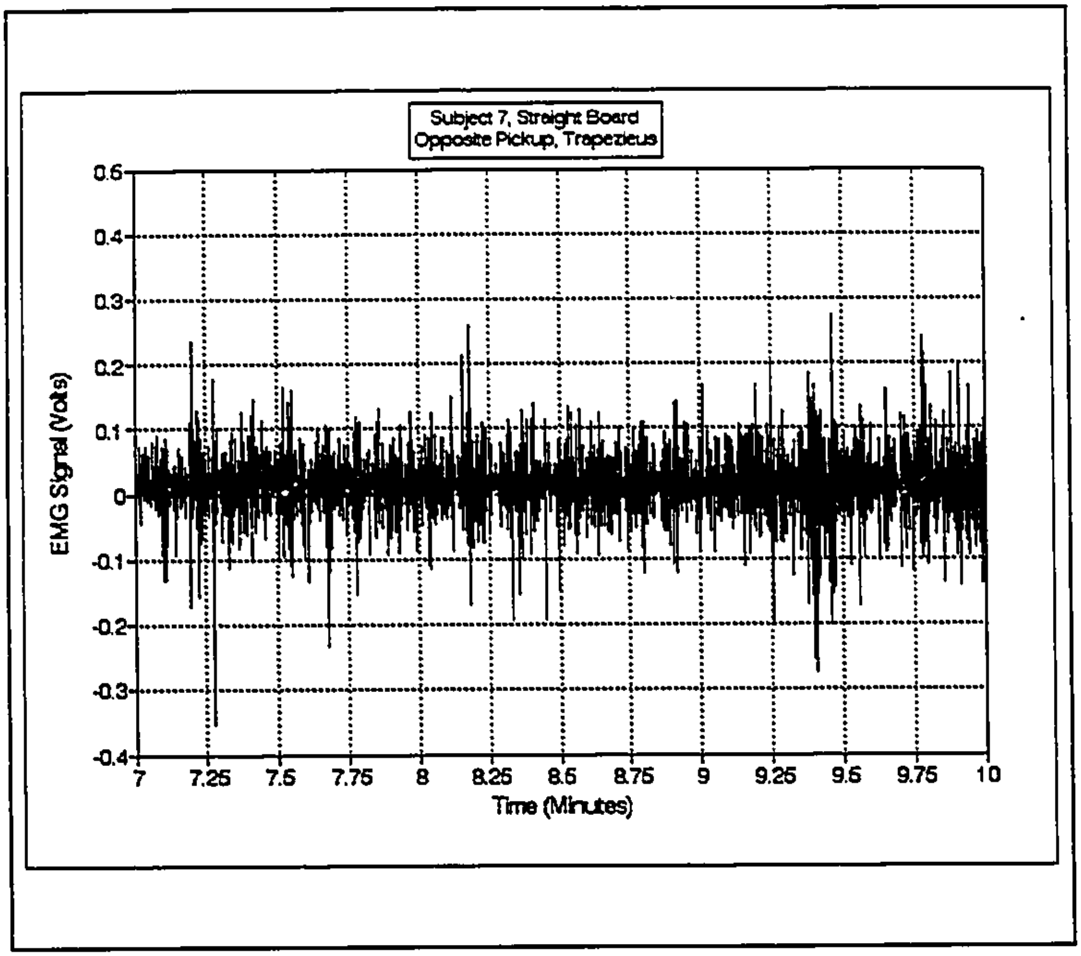
EMG Signal for Subject 7, So, Deltoid, Minutes 118 to 120



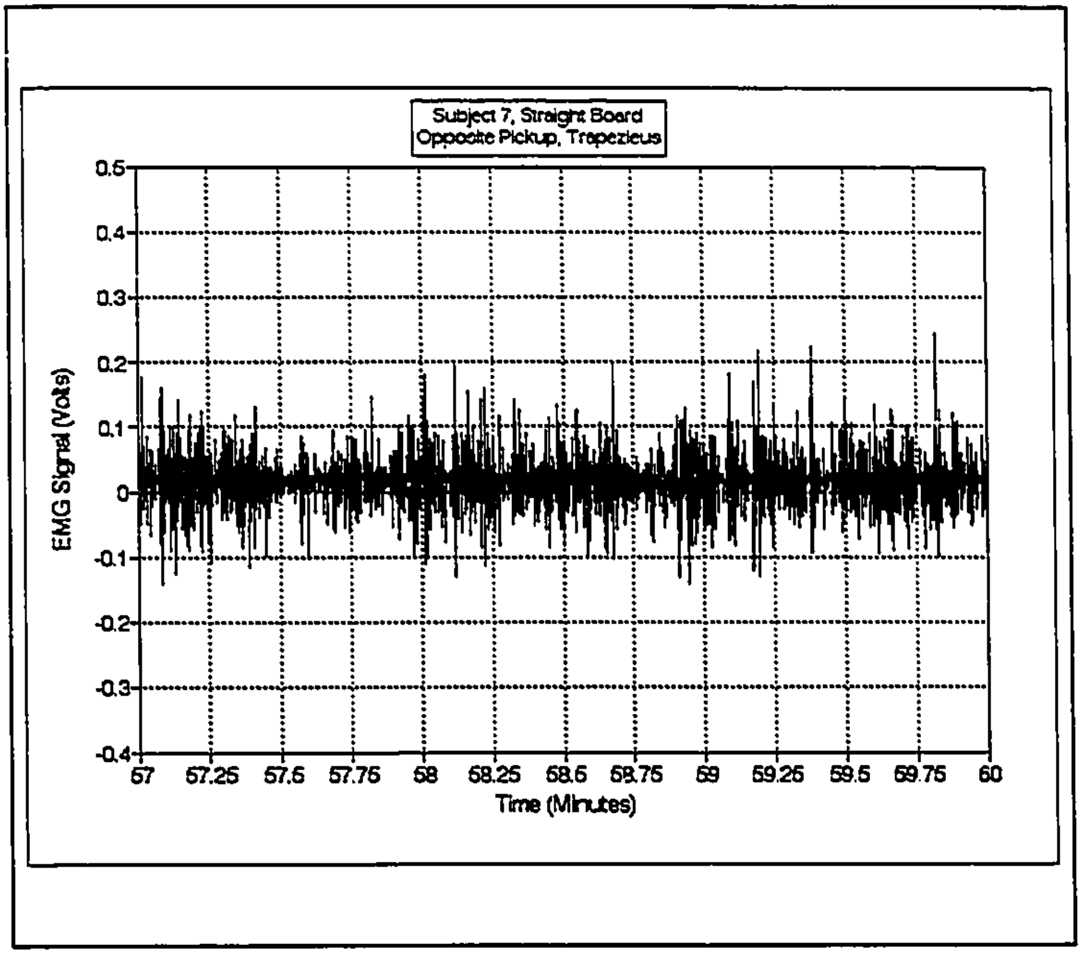
RMS and MPF Plots, Subject 7, So, Deltoid

RMS values are increasing and MPF values decreasing over time, indicating statistical signs of muscle fatigue.

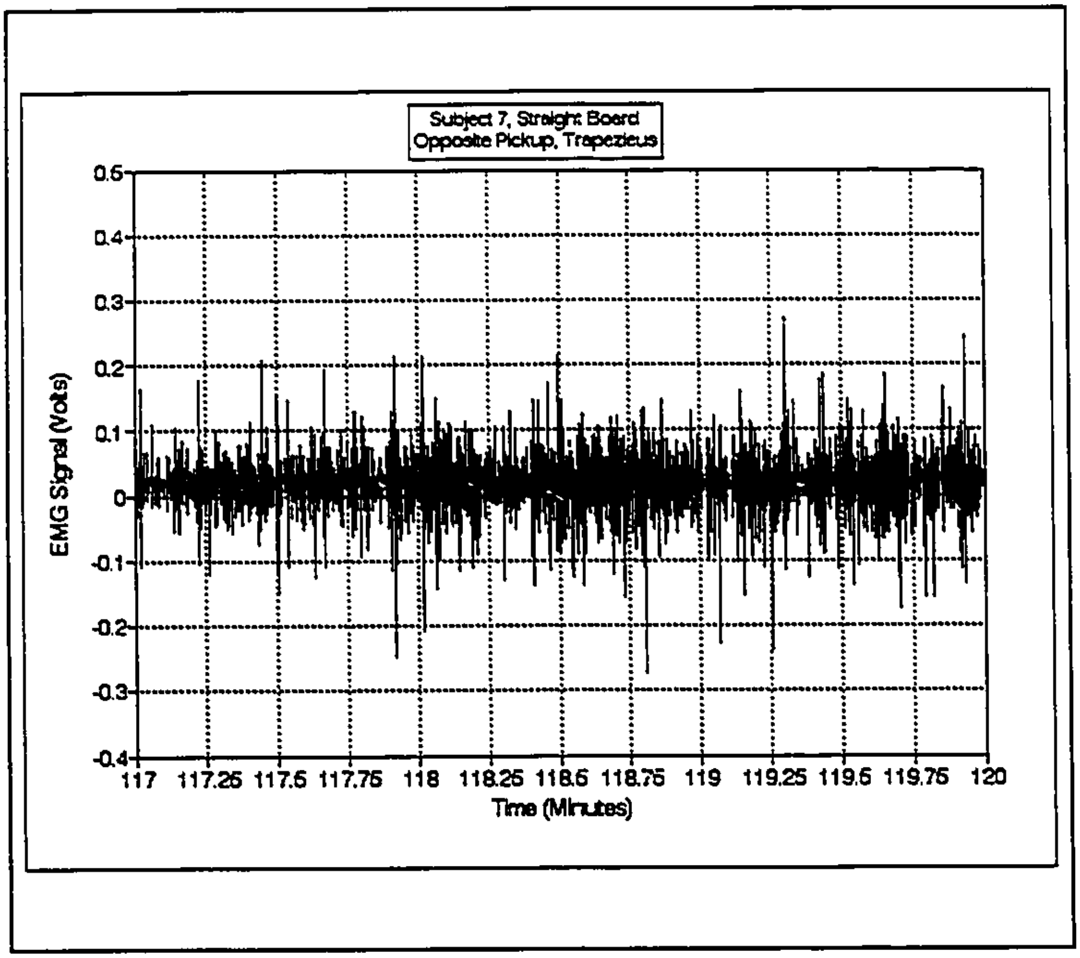
P EMG, RMS, MPF Graphs without Statistical Signs of Fatigue



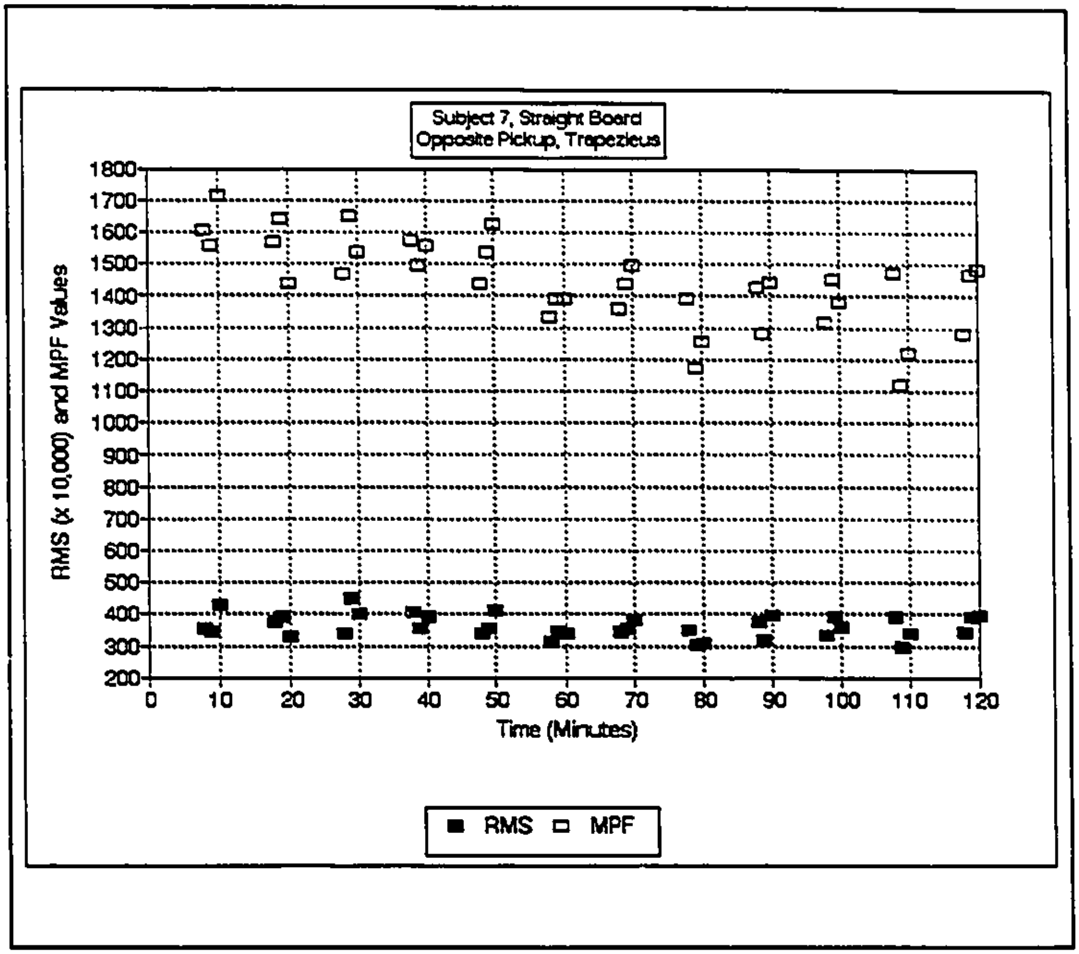
EMG Signal for Subject 7, So, Trapezius, Minutes 8 to 10



EMG Signal for Subject 7, So, Trapezius, Minutes 58 to 60



EMG Signal for Subject 7, So, Trapezius, Minutes 118 to 120



RMS and MPF Plots, Subject 7, So, Trapezius

RMS values do not increase over time, even though MPF values have a downward trend. This does not indicate signs of localised muscle fatigue during the trial.

Q Statistical Analysis of Envelope Count

Analysis of Variance for envelope count - Type III Sums of Squares

Source of variation	Sum of Squares	d.f.	Mean square	F-ratio	Sig. level
MAIN EFFECTS					
A:gender	2475.063	1	2475.063	0.017	0.8967
B:board	24089.431	2	12044.715	0.085	0.9186
C:pickup	7496.674	1	7496.674	0.053	0.8213
INTERACTIONS					
AB	24525.38	2	12262.69	0.087	0.9172
AC	91455.84	1	91455.84	0.645	0.4335
BC	37156.35	2	18578.17	0.131	0.8774
ABC	296717.18	2	148358.59	1.047	0.3574
RESIDUAL	8502822.9	60	141713.71		
TOTAL (CORRECTED)	9020138.0	71			

0 missing values have been excluded.
All F-ratios are based on the residual mean square error.

Analysis of Variance for envelope pickup - Type III Sums of Squares

Source of variation	Sum of Squares	d.f.	Mean square	F-ratio	Sig. level
MAIN EFFECTS					
A:gender	119.00417	1	119.00417	1.312	0.2544
B:pickup	37.60417	1	37.60417	0.415	0.5278
INTERACTIONS					
AB	203.50417	1	203.50417	2.243	0.1369
RESIDUAL	10522.825	116	90.714009		
TOTAL (CORRECTED)	10847.467	119			

0 missing values have been excluded.
All F-ratios are based on the residual mean square error.

Results of Envelope Pickup Trials

Males

Subject	Pickup Point	Trial				
		1	2	3	4	5
1	Centre	40	33	41	35	38
	Opposite	44	31	48	46	50
2	Centre	61	53	52	52	57
	Opposite	48	59	56	50	54
3	Centre	36	33	32	32	29
	Opposite	34	31	25	31	31
4	Centre	33	29	29	34	26
	Opposite	37	33	27	28	29
5	Centre	44	37	46	47	71
	Opposite	45	44	50	44	50
6	Centre	31	19	26	22	22
	Opposite	27	27	26	27	27
7	Centre	29	33	32	31	32
	Opposite	35	31	34	33	41
8	Centre	22	26	28	27	26
	Opposite	37	32	31	28	28

Results of Envelope Pickup Trials

Females

Subject	Pickup Point	Trial				
		1	2	3	4	5
A	Centre	41	43	40	45	38
	Opposite	36	36	40	35	33
B	Centre	22	27	22	27	30
	Opposite	23	27	27	22	21
C	Centre	41	43	40	45	38
	Opposite	36	36	40	35	33
D	Centre	37	41	41	31	34
	Opposite	34	35	33	30	35

R Subjective Scores

Subject 1

Body Part	Station					
	So	Sc	Vo	Vc	Io	Ic
Neck	9	8	7	8	8	8
Shoulders	11	9	10	10	10	11
Upper Back	13	11	10	13	12	11
Elbows	11	12	11	9	12	11
Lower Back	13	13	17	15	15	15
Wrists/Hands	11	12	14	13	13	12
Hips/Thighs	15	14	14	15	14	13
Knees	15	14	15	17	16	15
Ankles/Feet	18	15	18	18	18	17

Subject 2

Body Part	Station					
	So	Sc	Vo	Vc	Io	Ic
Neck	7	7	6	7	7	7
Shoulders	7	11	8	9	11	9
Upper Back	9	11	10	11	13	9
Elbows	9	12	10	11	9	11
Lower Back	14	13	13	13	13	13
Wrists/Hands	7	9	9	7	8	7
Hips/Thighs	13	14	14	13	14	14
Knees	14	14	14	14	15	14
Ankles/Feet	14	14	14	14	16	14

Subject 3

Body Part	Station					
	So	Sc	Vo	Vc	Io	Ic
Neck	9	10	8	10	11	11
Shoulders	10	12	9	12	12	10
Upper Back	9	10	8	10	9	10
Elbows	10	12	10	11	10	9
Lower Back	10	12	10	11	11	10
Wrists/Hands	9	10	9	10	9	10
Hips/Thighs	10	11	10	11	11	10
Knees	10	11	10	12	12	10
Ankles/Feet	11	13	11	12	12	11

Subject 4

Body Part	Station					
	So	Sc	Vo	Vc	Io	Ic
Neck	8	8	7	7	9	7
Shoulders	9	10	8	9	12	8
Upper Back	11	12	11	11	13	12
Elbows	13	14	13	11	13	13
Lower Back	15	15	15	14	16	15
Wrists/Hands	12	14	13	12	11	13
Hips/Thighs	15	15	16	15	14	15
Knees	14	17	17	16	15	17
Ankles/Feet	16	18	18	17	15	17

Subject 5

Body Part	Station					
	So	Sc	Vo	Vc	Io	Ic
Neck	10	8	8	8	8	9
Shoulders	11	13	10	12	12	11
Upper Back	12	11	11	11	11	10
Elbows	12	12	11	12	12	12
Lower Back	15	15	14	14	14	15
Wrists/Hands	13	12	11	12	14	12
Hips/Thighs	12	11	10	11	11	12
Knees	11	9	9	9	10	13
Ankles/Feet	12	10	10	9	10	13

Subject 6

Body Part	Station					
	So	Sc	Vo	Vc	Io	Ic
Neck	13	13	14	16	13	13
Shoulders	16	15	16	17	14	14
Upper Back	11	10	13	13	11	12
Elbows	12	8	11	11	9	8
Lower Back	13	12	11	12	12	10
Wrists/Hands	10	12	10	10	11	9
Hips/Thighs	12	11	12	13	14	15
Knees	14	9	15	15	14	15
Ankles/Feet	15	14	17	17	17	16

Subject 7

Body Part	Station					
	So	Sc	Vo	Vc	Io	Ic
Neck	14	12	13	16	12	13
Shoulders	16	15	14	12	13	16
Upper Back	18	17	15	17	13	15
Elbows	13	13	14	13	14	13
Lower Back	13	16	15	17	15	13
Wrists/Hands	11	12	16	11	14	12
Hips/Thighs	12	11	14	10	13	10
Knees	10	10	11	11	11	12
Ankles/Feet	12	14	14	17	11	11

Subject 8

Body Part	Station					
	So	Sc	Vo	Vc	Io	Ic
Neck	10	10	11	12	10	13
Shoulders	13	12	12	13	12	11
Upper Back	10	10	10	12	11	9
Elbows	12	13	13	12	11	9
Lower Back	17	15	16	15	15	15
Wrists/Hands	14	11	15	15	14	11
Hips/Thighs	12	13	10	12	12	13
Knees	15	14	14	16	13	15
Ankles/Feet	16	17	14	16	17	14

Subject A

Body Part	Station					
	So	Sc	Vo	Vc	Io	Ic
Neck	12	8	6	13	9	8
Shoulders	11	8	7	9	12	9
Upper Back	7	8	7	8	7	8
Elbows	9	8	9	8	9	7
Lower Back	7	10	9	10	7	8
Wrists/Hands	9	9	7	9	9	9
Hips/Thighs	7	7	7	7	6	10
Knees	7	8	7	8	7	11
Ankles/Feet	10	8	10	10	8	12

Subject B

Body Part	Station					
	So	Sc	Vo	Vc	Io	Ic
Neck	15	15	9	11	9	9
Shoulders	13	11	13	11	13	11
Upper Back	11	11	11	9	11	7
Elbows	9	13	15	9	11	13
Lower Back	9	9	11	11	11	13
Wrists/Hands	13	15	15	13	13	15
Hips/Thighs	11	9	9	11	11	11
Knees	9	11	11	9	9	13
Ankles/Feet	9	9	9	11	9	13

Subject C

Body Part	Station					
	So	Sc	Vo	Vc	Io	Ic
Neck	7	7	9	9	11	11
Shoulders	8	10	12	8	13	12
Upper Back	8	10	11	9	12	11
Elbows	8	7	10	7	9	13
Lower Back	9	11	10	10	12	13
Wrists/Hands	10	10	6	9	7	12
Hips/Thighs	8	7	6	6	7	7
Knees	8	11	7	7	6	7
Ankles/Feet	7	11	7	10	10	13

Subject D

Body Part	Station					
	So	Sc	Vo	Vc	Io	Ic
Neck	11	17	12	16	13	14
Shoulders	15	12	17	14	14	15
Upper Back	15	7	12	12	15	17
Elbows	13	7	9	10	9	8
Lower Back	16	20	12	17	13	16
Wrists/Hands	10	9	12	9	9	6
Hips/Thighs	10	7	10	9	9	14
Knees	15	12	10	9	10	9
Ankles/Feet	18	15	12	18	16	16

S Statistical Analysis of Subjective Scores

Analysis of Variance for neck score - Type III Sums of Squares

Source of variation	Sum of Squares	d.f.	Mean square	F-ratio	Sig. level
MAIN EFFECTS					
A:gender	16.673611	1	16.673611	1.992	0.1633
B:board	2.180556	2	1.090278	0.130	0.8781
C:pickup	10.562500	1	10.562500	1.262	0.2657
INTERACTIONS					
AB	4.347222	2	2.1736111	0.260	0.7721
AC	3.062500	1	3.0625000	0.366	0.5539
BC	16.625000	2	8.3125000	0.993	0.3764
ABC	3.791667	2	1.8958333	0.227	0.7980
RESIDUAL	502.12500	60	8.3687500		
TOTAL (CORRECTED)	553.27778	71			

0 missing values have been excluded.
All F-ratios are based on the residual mean square error.

Analysis of Variance for shoulder score - Type III Sums of Squares

Source of variation	Sum of Squares	d.f.	Mean square	F-ratio	Sig. level
MAIN EFFECTS					
A:gender	0.0069444	1	0.0069444	0.001	0.9746
B:board	5.3750000	2	2.6875000	0.407	0.6678
C:pickup	6.6736111	1	6.6736111	1.010	0.3190
INTERACTIONS					
AB	7.097222	2	3.548611	0.537	0.5874
AC	11.673611	1	11.673611	1.766	0.1889
BC	1.013889	2	0.506944	0.077	0.9263
ABC	3.180556	2	1.590278	0.241	0.7869
RESIDUAL	396.62500	60	6.6104167		
TOTAL (CORRECTED)	427.31944	71			

0 missing values have been excluded.
All F-ratios are based on the residual mean square error.

Analysis of Variance for upper back score - Type III Sums of Squares

Source of variation	Sum of Squares	d.f.	Mean square	F-ratio	Sig. level
MAIN EFFECTS					
A:gender	28.444444	1	28.444444	4.597	0.0361
B:board	3.597222	2	1.798611	0.291	0.7488
C:pickup	1.777778	1	1.777778	0.287	0.5996
INTERACTIONS					
AB	8.4305556	2	4.2152778	0.681	0.5099
AC	4.0000000	1	4.0000000	0.646	0.4331
BC	2.7638889	2	1.3819444	0.223	0.8005
ABC	3.0416667	2	1.5208333	0.246	0.7829
RESIDUAL	371.25000	60	6.1875000		
TOTAL (CORRECTED)	421.77778	71			

0 missing values have been excluded.
All F-ratios are based on the residual mean square error.

Multiple range analysis for upper back score by gender

Method: 95 Percent Duncan

Level	Count	LS Mean	Homogeneous Groups
female	24	10.166667	X
male	48	11.500000	X

contrast	difference
male - female	1.33333 *

* denotes a statistically significant difference.

Analysis of Variance for female upper back score - Type III Sums of Squares

Source of variation	Sum of Squares	d.f.	Mean square	F-ratio	Sig. level
MAIN EFFECTS					
A:board	8.5833333	2	4.2916667	0.465	0.6353
B:pickup	4.1666667	1	4.1666667	0.452	0.5171
INTERACTIONS					
AB	0.5833333	2	0.2916667	0.032	0.9689
RESIDUAL	166.00000	18	9.2222222		
TOTAL (CORRECTED)	179.33333	23			

0 missing values have been excluded.
All F-ratios are based on the residual mean square error.

Analysis of Variance for male upper back score - Type III Sums of Squares

Source of variation	Sum of Squares	d.f.	Mean square	F-ratio	Sig. level
MAIN EFFECTS					
A:board	0.8750000	2	0.4375000	0.090	0.9145
B:pickup	0.3333333	1	0.3333333	0.068	0.7980
INTERACTIONS					
AB	7.5416667	2	3.7708333	0.772	0.4687
RESIDUAL	205.25000	42	4.8869048		
TOTAL (CORRECTED)	214.00000	47			

0 missing values have been excluded.
All F-ratios are based on the residual mean square error.

Analysis of Variance for elbow score - Type III Sums of Squares

Source of variation	Sum of Squares	d.f.	Mean square	F-ratio	Sig. level
MAIN EFFECTS					
A:gender	58.777778	1	58.777778	16.499	0.0001
B:board	0.097222	2	0.048611	0.014	0.9865
C:pickup	2.777778	1	2.777778	0.780	0.3901
INTERACTIONS					
AB	3.0972222	2	1.5486111	0.435	0.6495
AC	2.7777778	1	2.7777778	0.780	0.3901
BC	7.2638889	2	3.6319444	1.019	0.3669
ABC	5.9305556	2	2.9652778	0.832	0.4400
RESIDUAL	213.75000	60	3.5625000		
TOTAL (CORRECTED)	290.61111	71			

0 missing values have been excluded.
All F-ratios are based on the residual mean square error.

Multiple range analysis for elbow score by gender

Method: 95 Percent Duncan

Level	Count	LS Mean	Homogeneous Groups
female	24	9.583333	X
male	48	11.500000	X

contrast	difference
male - female	1.91667 *

* denotes a statistically significant difference.

Analysis of Variance for female elbow score - Type III Sums of Squares

Source of variation	Sum of Squares	d.f.	Mean square	F-ratio	Sig. level
MAIN EFFECTS					
A:board	1.5833333	2	0.7916667	0.138	0.8717
B:pickup	4.1666667	1	4.1666667	0.728	0.4137
INTERACTIONS					
AB	9.0833333	2	4.5416667	0.794	0.4674
RESIDUAL	103.00000	18	5.7222222		
TOTAL (CORRECTED)	117.83333	23			

0 missing values have been excluded.
All F-ratios are based on the residual mean square error.

Analysis of Variance for male elbow score - Type III Sums of Squares

Source of variation	Sum of Squares	d.f.	Mean square	F-ratio	Sig. level
MAIN EFFECTS					
A:board	1.6250000	2	0.8125000	0.308	0.7365
B:pickup	0.0000000	1	0.0000000	0.000	1.0000
INTERACTIONS					
AB	1.6250000	2	0.8125000	0.308	0.7365
RESIDUAL	110.75000	42	2.6369048		
TOTAL (CORRECTED)	114.00000	47			

0 missing values have been excluded.
All F-ratios are based on the residual mean square error.

Analysis of Variance for lower back score - Type III Sums of Squares

Source of variation	Sum of Squares	d.f.	Mean square	F-ratio	Sig. level
MAIN EFFECTS					
A:gender	87.111111	1	87.111111	13.647	0.0005
B:board	0.013889	2	0.006944	0.001	0.9989
C:pickup	11.111111	1	11.111111	1.741	0.1921
INTERACTIONS					
AB	1.347222	2	0.673611	0.106	0.9000
AC	16.000000	1	16.000000	2.507	0.1186
BC	1.097222	2	0.548611	0.086	0.9178
ABC	0.541667	2	0.270833	0.042	0.9585
RESIDUAL	383.00000	60	6.3833333		
TOTAL (CORRECTED)	493.94444	71			

0 missing values have been excluded.
All F-ratios are based on the residual mean square error.

Multiple range analysis for lower back score by gender

Method: 95 Percent Duncan

Level	Count	LS Mean	Homogeneous Groups
female	24	11.416667	X
male	48	13.750000	X

contrast	difference
male - female	2.33333 *

* denotes a statistically significant difference.

Analysis of Variance for female lower back score - Type III Sums of Squares

Source of variation	Sum of Squares	d.f.	Mean square	F-ratio	Sig. level
MAIN EFFECTS					
A:board	0.583333	2	0.291667	0.024	0.9761
B:pickup	20.166667	1	20.166667	1.677	0.2117
INTERACTIONS					
AB	0.5833333	2	0.2916667	0.024	0.9761
RESIDUAL	216.50000	18	12.027778		
TOTAL (CORRECTED)	237.83333	23			

0 missing values have been excluded.
All F-ratios are based on the residual mean square error.

Analysis of Variance for male lowor back score - Type III Sums of Squares

Source of variation	Sum of Squares	d.f.	Mean square	F-ratio	Sig. level
MAIN EFFECTS					
A:board	0.8750000	2	0.4375000	0.110	0.8958
B:pickup	0.3333333	1	0.3333333	0.084	0.7763
INTERACTIONS					
AB	1.2916667	2	0.6458333	0.163	0.8502
RESIDUAL	166.50000	42	3.9642857		
TOTAL (CORRECTED)	169.00000	47			

0 missing values have been excluded.
All F-ratios are based on the residual mean square error.

Analysis of Variance for wrist/hand score - Type III Sums of Squares

Source of variation	Sum of Squares	d.f.	Mean square	F-ratio	Sig. level
MAIN EFFECTS					
A:gender	21.777778	1	21.777778	3.494	0.0665
B:board	0.930556	2	0.465278	0.075	0.9282
C:pickup	0.000000	1	0.000000	0.000	1.0000
INTERACTIONS					
AB	3.4305556	2	1.7152778	0.275	0.7604
AC	2.7777778	1	2.7777778	0.446	0.5141
BC	2.0416667	2	1.0208333	0.164	0.8493
ABC	3.7638889	2	1.8819444	0.302	0.7405
RESIDUAL	374.00000	60	6.2333333		
TOTAL (CORRECTED)	410.98611	71			

0 missing values have been excluded.
All F-ratios are based on the residual mean square error.

Analysis of Variance for hip/thigh score - Type III Sums of Squares

Source of variation	Sum of Squares	d.f.	Mean square	F-ratio	Sig. level
MAIN EFFECTS					
A:gender	261.36111	1	261.36111	71.361	0.0000
B:board	7.76389	2	3.88194	1.060	0.3529
C:pickup	0.25000	1	0.25000	0.068	0.7976
INTERACTIONS					
AB	2.9305556	2	1.4652778	0.400	0.6720
AC	0.6944444	1	0.6944444	0.190	0.6694
BC	9.3750000	2	4.6875000	1.280	0.2856
ABC	9.4305556	2	4.7152778	1.287	0.2835
RESIDUAL	219.75000	60	3.6625000		
TOTAL (CORRECTED)	504.44444	71			

0 missing values have been excluded.
All F-ratios are based on the residual mean square error.

Multiple range analysis for hip score by gender

Method: 95 Percent Duncan

Level	Count	LS Mean	Homogeneous Groups
female	24	8.583333	X
male	48	12.625000	X

contrast	difference
female - male	-4.04167 *

* denotes a statistically significant difference.

Analysis of Variance for female hip/thigh score - Type III Sums of Squares

Source of variation	Sum of Squares	d.f.	Mean square	F-ratio	Sig. level
MAIN EFFECTS					
A:board	7.5833333	2	3.7916667	0.881	0.4316
B:pickup	0.6666667	1	0.6666667	0.155	0.7027
INTERACTIONS					
AB	14.083333	2	7.0416667	1.635	0.2225
RESIDUAL	77.500000	18	4.3055556		
TOTAL (CORRECTED)	99.833333	23			

0 missing values have been excluded.
All F-ratios are based on the residual mean square error.

Analysis of Variance for male hip/thigh score - Type III Sums of Squares

Source of variation	Sum of Squares	d.f.	Mean square	F-ratio	Sig. level
MAIN EFFECTS					
A:board	0.8750000	2	0.4375000	0.129	0.8792
B:pickup	0.0833333	1	0.0833333	0.025	0.8778
INTERACTIONS					
AB	0.0416667	2	0.0208333	0.006	0.9939
RESIDUAL	142.25000	42	3.3869048		
TOTAL (CORRECTED)	143.25000	47			

0 missing values have been excluded.
All F-ratios are based on the residual mean square error.

Analysis of Variance for knee score - Type III Sums of Squares

Source of variation	Sum of Squares	d.f.	Mean square	F-ratio	Sig. level
MAIN EFFECTS					
A:gender	253.34028	1	253.34028	42.179	0.0000
B:board	1.72222	2	0.86111	0.143	0.8667
C:pickup	3.67361	1	3.67361	0.612	0.4456
INTERACTIONS					
AB	19.388889	2	9.6944444	1.614	0.2076
AC	1.173611	1	1.1736111	0.195	0.6648
BC	5.555556	2	2.7777778	0.462	0.6319
ABC	5.555556	2	2.7777778	0.462	0.6319
RESIDUAL	360.37500	60	6.0062500		
TOTAL (CORRECTED)	648.61111	71			

0 missing values have been excluded.
All F-ratios are based on the residual mean square error.

Multiple range analysis for knee score by gender

Method: 95 Percent Duncan

Level	Count	LS Mean	Homogeneous Groups
female	24	9.208333	X
male	48	13.187500	X

contrast	difference
male - female	3.97917 *

* denotes a statistically significant difference.

Analysis of Variance for female knee score - Type III Sums of Squares

Source of variation	Sum of Squares	d.f.	Mean square	F-ratio	Sig. level
MAIN EFFECTS					
A:board	11.083333	2	5.5416667	1.070	0.3639
B:pickup	3.375000	1	3.3750000	0.651	0.4386
INTERACTIONS					
AB	6.2500000	2	3.1250000	0.603	0.5577
RESIDUAL	93.250000	18	5.1805556		
TOTAL (CORRECTED)	113.95833	23			

0 missing values have been excluded.
All F-ratios are based on the residual mean square error.

Analysis of Variance for male knee score - Type III Sums of Squares

Source of variation	Sum of Squares	d.f.	Mean square	F-ratio	Sig. level
MAIN EFFECTS					
A:board	9.5000000	2	4.7500000	0.747	0.4800
B:pickup	0.5208333	1	0.5208333	0.082	0.7792
INTERACTIONS					
AB	4.1666667	2	2.0833333	0.328	0.7225
RESIDUAL	267.12500	42	6.3601190		
TOTAL (CORRECTED)	281.31250	47			

0 missing values have been excluded.
All F-ratios are based on the residual mean square error.

Analysis of Variance for ankles/feet score - Type III Sums of Squares

Source of variation	Sum of Squares	d.f.	Mean square	F-ratio	Sig. level
MAIN EFFECTS					
A:gender	160.44444	1	160.44444	18.284	0.0001
B:board	4.29167	2	2.14583	0.245	0.7838
C:pickup	13.44444	1	13.44444	1.532	0.2206
INTERACTIONS					
AB	8.180556	2	4.090278	0.466	0.6297
AC	11.111111	1	11.111111	1.266	0.2650
BC	8.180556	2	4.090278	0.466	0.6297
ABC	8.847222	2	4.423611	0.504	0.6066
RESIDUAL	526.50000	60	8.7750000		
TOTAL (CORRECTED)	729.31944	71			

0 missing values have been excluded.
All F-ratios are based on the residual mean square error.

Multiple range analysis for ankles/feet score by gender

Method: 95 Percent Duncan

Level	Count	LS Mean	Homogeneous Groups
female	24	11.291667	X
male	48	14.458333	X

contrast	difference
female - male	-3.16667 *

* denotes a statistically significant difference.

Analysis of Variance for female ankles/feet score - Type III Sums of Squares

Source of variation	Sum of Squares	d.f.	Mean square	F-ratio	Sig. level
MAIN EFFECTS					
A:board	8.333333	2	4.166667	0.367	0.6977
B:pickup	18.375000	1	18.375000	1.619	0.2194
INTERACTIONS					
AB	12.000000	2	6.0000000	0.529	0.5982
RESIDUAL	204.25000	18	11.347222		
TOTAL (CORRECTED)	242.95833	23			

0 missing values have been excluded.
All F-ratios are based on the residual mean square error.

Analysis of Variance for male ankles/feet score - Type III Sums of Squares

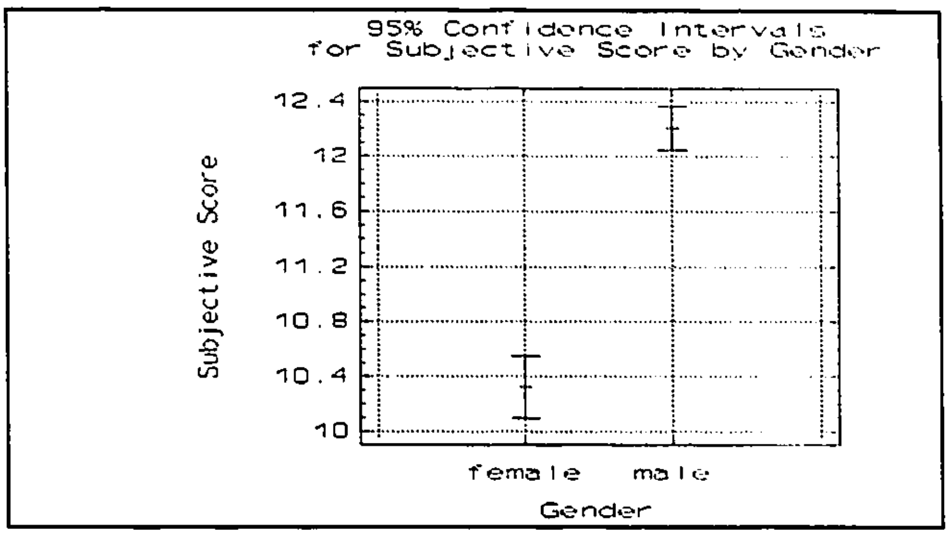
Source of variation	Sum of Squares	d.f.	Mean square	F-ratio	Sig. level
MAIN EFFECTS					
A:board	2.0416667	2	1.0208333	0.133	0.8758
B:pickup	0.0833333	1	0.0833333	0.011	0.9186
INTERACTIONS					
AB	1.5416667	2	0.7708333	0.100	0.9046
RESIDUAL	322.25000	42	7.6726190		
TOTAL (CORRECTED)	325.91667	47			

0 missing values have been excluded.
All F-ratios are based on the residual mean square error.

Analysis of Variance for all subjective scores - Type III Sums of Squares

Source of variation	Sum of Squares	d.f.	Mean square	F-ratio	Sig. level
MAIN EFFECTS					
A:gender	510.00694	1	510.00694	89.441	0.0000
B:body part	423.91821	8	52.98978	9.293	0.0000
INTERACTIONS					
AB	377.93056	8	47.241319	8.285	0.0000
RESIDUAL	3592.3542	630	5.7021495		
TOTAL (CORRECTED)	5091.9861	647			

0 missing values have been excluded.
All F-ratios are based on the residual mean square error.



Analysis of Variance for female subjective scores - Type III Sums of Squares

Source of variation	Sum of Squares	d.f.	Mean square	F-ratio	Sig. level
MAIN EFFECTS					
A:body part	213.14815	8	26.643519	3.628	0.0006
RESIDUAL	1520.1667	207	7.3438003		
TOTAL (CORRECTED)	1733.3148	215			

0 missing values have been excluded.
All F-ratios are based on the residual mean square error.

Multiple range analysis for female subjective scores by body part

Method: 95 Percent Duncan

Level	Count	LS Mean	Homogeneous Groups
hips	24	8.583333	X
knee	24	9.208333	XX
elbow	24	9.583333	XXX
uback	24	10.166667	XXXX
wrist	24	10.208333	XXXX
neck	24	10.875000	XXX
ankle	24	11.291667	XX
lback	24	11.416667	X
shoulder	24	11.583333	X

Abbreviations: "hips" for "hips/thighs"; "uback" for "upper back"; "wrist" for "wrist/hands"; "ankle" for "ankles/feet"; "lback" for "lower back"

contrast		difference	
neck	- shoulder	-0.70833	
neck	- uback	0.70833	
neck	- elbow	1.29167	
neck	- lback	-0.54167	
neck	- wrist	0.66667	
neck	- hips	2.29167	*
neck	- knee	1.66667	
neck	- ankle	-0.41667	
shoulder	- uback	1.41667	
shoulder	- elbow	2.00000	*
shoulder	- lback	0.16667	
shoulder	- wrist	1.37500	
shoulder	- hips	3.00000	*
shoulder	- knee	2.37500	*
shoulder	- ankle	0.29167	
uback	- elbow	0.58333	
uback	- lback	-1.25000	
uback	- wrist	-0.04167	
uback	- hips	1.58333	
uback	- knee	0.95833	
uback	- ankle	-1.12500	
elbow	- lback	-1.83333	*
elbow	- wrist	-0.62500	
elbow	- hips	1.00000	
elbow	- knee	0.37500	
elbow	- ankle	-1.70833	
lback	- wrist	1.20833	
lback	- hips	2.83333	*
lback	- knee	2.20833	*
lback	- ankle	0.12500	
wrist	- hips	1.62500	
wrist	- knee	1.00000	
wrist	- ankle	-1.08333	
hips	- knee	-0.62500	
hips	- ankle	-2.70833	*
knee	- ankle	-2.08333	*

* denotes a statistically significant difference.

Analysis of Variance for male subjective scores - Type III Sums of Squares

Source of variation	Sum of Squares	d.f.	Mean square	F-ratio	Sig. level
MAIN EFFECTS					
A:body part	776.47685	8	97.059606	19.813	0.0000
RESIDUAL	2072.1875	423	4.8987884		
TOTAL (CORRECTED)	2848.6644	431			

0 missing values have been excluded.
All F-ratios are based on the residual mean square error.

Multiple range analysis for male subjective scores by body part

Method: 95 Percent Duncan

Level	Count	LS Mean	Homogeneous Groups
neck	48	9.854167	X
wrist	48	11.375000	X
uback	48	11.500000	X
elbow	48	11.500000	X
shoulder	48	11.604167	X
hips	48	12.625000	X
knee	48	13.187500	XX
lback	48	13.750000	XX
ankle	48	14.458333	X

Abbreviations: "wrist" for "wrist/hands"; "uback" for "upper back"; "hips" for "hips/thighs"; "lback" for "lower back"; "ankle" for "ankles/feet"

contrast		difference	
neck	- shoulder	-1.75000	*
neck	- uback	-1.64583	*
neck	- elbow	-1.64583	*
neck	- lback	-3.89583	*
neck	- wrist	-1.52083	*
neck	- hips	-2.77083	*
neck	- knee	-3.33333	*
neck	- ankle	-4.60417	*
shoulder	- uback	0.10417	
shoulder	- elbow	0.10417	
shoulder	- lback	-2.14583	*
shoulder	- wrist	0.22917	
shoulder	- hips	-1.02083	*
shoulder	- knee	-1.58333	*
shoulder	- ankle	-2.85417	*
uback	- elbow	0.00000	
uback	- lback	-2.25000	*
uback	- wrist	0.12500	
uback	- hips	-1.12500	*
uback	- knee	-1.68750	*
uback	- ankle	-2.95833	*
elbow	- lback	-2.25000	*
elbow	- wrist	0.12500	
elbow	- hips	-1.12500	*
elbow	- knee	-1.68750	*
elbow	- ankle	-2.95833	*
lback	- wrist	2.37500	*
lback	- hips	1.12500	*
lback	- knee	0.56250	
lback	- ankle	-0.70833	
wrist	- hips	-1.25000	*
wrist	- knee	-1.81250	*
wrist	- ankle	-3.08333	*
hips	- knee	-0.56250	
hips	- ankle	-1.83333	*
knee	- ankle	-1.27083	*

* denotes a statistically significant difference.

T Correlation Coefficients for Subjective Ratings

Spearman Rank Correlations for Female Neck Scores

	score	fatigue	envelopes
score	1.0000	0.2066	-0.3468
	(24)	(24)	(24)
	1.0000	0.3219	0.0962
fatigue	0.2066	1.0000	0.2426
	(24)	(24)	(24)
	0.3219	1.0000	0.2446
envelopes	-0.3468	0.2426	1.0000
	(24)	(24)	(24)
	0.0962	0.2446	1.0000

Coefficient (sample size) significance level

Spearman Rank Correlations for Female Shoulder Scores

	score	fatigue	envelopes
score	1.0000	0.0837	-0.4445
	(24)	(24)	(24)
	1.0000	0.6882	0.0330
fatigue	0.0837	1.0000	0.2426
	(24)	(24)	(24)
	0.6882	1.0000	0.2446
envelopes	-0.4445	0.2426	1.0000
	(24)	(24)	(24)
	0.0330	0.2446	1.0000

Coefficient (sample size) significance level

Spearman Rank Correlations for Female Upper Back Scores

	score	fatigue	envelopes
score	1.0000	0.0389	-0.3529
	(24)	(24)	(24)
	1.0000	0.8520	0.0906
fatigue	0.0389	1.0000	0.2426
	(24)	(24)	(24)
	0.8520	1.0000	0.2446
envelopes	-0.3529	0.2426	1.0000
	(24)	(24)	(24)
	0.0906	0.2446	1.0000

Coefficient (sample size) significance level

Spearman Rank Correlations for Female Elbow Scores

	score	fatigue	envelopes
score	1.0000	0.1900	-0.0937
	(24)	(24)	(24)
	1.0000	0.3623	0.6532
fatigue	0.1900	1.0000	0.2426
	(24)	(24)	(24)
	0.3623	1.0000	0.2446
envelopes	-0.0937	0.2426	1.0000
	(24)	(24)	(24)
	0.6532	0.2446	1.0000

Coefficient (sample size) significance level

Spearman Rank Correlations for Female Lower Back Scores

	score	fatigue	envelopes
score	1.0000	-0.2832	-0.7188
	(24)	(24)	(24)
	1.0000	0.1744	0.0006
fatigue	-0.2832	1.0000	0.2426
	(24)	(24)	(24)
	0.1744	1.0000	0.2446
envelopes	-0.7188	0.2426	1.0000
	(24)	(24)	(24)
	0.0006	0.2446	1.0000

Coefficient (sample size) significance level

Spearman Rank Correlations for Female Wrist/Hand Scores

	score	fatigue	envelopes
score	1.0000	0.4738	0.0367
	(24)	(24)	(24)
	1.0000	0.0231	0.8601
fatigue	0.4738	1.0000	0.2426
	(24)	(24)	(24)
	0.0231	1.0000	0.2446
envelopes	0.0367	0.2426	1.0000
	(24)	(24)	(24)
	0.8601	0.2446	1.0000

Coefficient (sample size) significance level

Spearman Rank Correlations for Female Hip/Thigh Scores

	score	fatigue	envelopes
score	1.0000	0.4324	-0.0174
	(24)	(24)	(24)
	1.0000	0.0381	0.9335
fatigue	0.4324	1.0000	0.2426
	(24)	(24)	(24)
	0.0381	1.0000	0.2446
envelopes	-0.0174	0.2426	1.0000
	(24)	(24)	(24)
	0.9335	0.2446	1.0000

Coefficient (sample size) significance level

Spearman Rank Correlations for Female Knee Scores

	score	fatigue	envelopes
score	1.0000	0.0454	-0.2058
	(24)	(24)	(24)
	1.0000	0.8277	0.3237
fatigue	0.0454	1.0000	0.2426
	(24)	(24)	(24)
	0.8277	1.0000	0.2446
envelopes	-0.2058	0.2426	1.0000
	(24)	(24)	(24)
	0.3237	0.2446	1.0000

Coefficient (sample size) significance level

Spearman Rank Correlations for Female Ankle/Feet Scores

	score	fatigue	envelopes
score	1.0000	-0.0451	-0.5650
	(24)	(24)	(24)
	1.0000	0.8289	0.0067
fatigue	-0.0451	1.0000	0.2426
	(24)	(24)	(24)
	0.8289	1.0000	0.2446
envelopes	-0.5650	0.2426	1.0000
	(24)	(24)	(24)
	0.0067	0.2446	1.0000

Coefficient (sample size) significance level

Spearman Rank Correlations for Male Neck Scores

	score	fatigue	envelopes
score	1.0000	0.4675	-0.0535
	(48)	(48)	(48)
	1.0000	0.0013	0.7136
fatigue	0.4675	1.0000	-0.1388
	(48)	(48)	(48)
	0.0013	1.0000	0.3412
envelopes	-0.0535	-0.1388	1.0000
	(48)	(48)	(48)
	0.7136	0.3412	1.0000

Coefficient (sample size) significance level

Spearman Rank Correlations for Male Shoulder Scores

	score	fatigue	envelopes
score	1.0000	0.3808	-0.1673
	(48)	(48)	(48)
	1.0000	0.0090	0.2514
fatigue	0.3808	1.0000	-0.1388
	(48)	(48)	(48)
	0.0090	1.0000	0.3412
envelopes	-0.1673	-0.1388	1.0000
	(48)	(48)	(48)
	0.2514	0.3412	1.0000

Coefficient (sample size) significance level

Spearman Rank Correlations for Male Upper Back Scores

	score	fatigue	envelopes
score	1.0000	0.3573	0.0693
	(48)	(48)	(48)
	1.0000	0.0143	0.6349
fatigue	0.3573	1.0000	-0.1388
	(48)	(48)	(48)
	0.0143	1.0000	0.3412
envelopes	0.0693	-0.1388	1.0000
	(48)	(48)	(48)
	0.6349	0.3412	1.0000

Coefficient (sample size) significance level

Spearman Rank Correlations for Male Elbow Scores

	score	fatigue	envelopes
score	1.0000	0.1928	0.1268
	(48)	(48)	(48)
	1.0000	0.1863	0.3847
fatigue	0.1928	1.0000	-0.1388
	(48)	(48)	(48)
	0.1863	1.0000	0.3412
envelopes	0.1268	-0.1388	1.0000
	(48)	(48)	(48)
	0.3847	0.3412	1.0000

Coefficient (sample size) significance level

Spearman Rank Correlations for Male Lower Back Scores

	score	fatigue	envelopes
score	1.0000	0.0572	-0.1245
	(48)	(48)	(48)
	1.0000	0.6947	0.3934
fatigue	0.0572	1.0000	-0.1388
	(48)	(48)	(48)
	0.6947	1.0000	0.3412
envelopes	-0.1245	-0.1388	1.0000
	(48)	(48)	(48)
	0.3934	0.3412	1.0000

Coefficient (sample size) significance level

Spearman Rank Correlations for Male Wrist/Hand Scores

	score	fatigue	envelopes
score	1.0000	-0.0030	0.0025
	(48)	(48)	(48)
	1.0000	0.9833	0.9863
fatigue	-0.0030	1.0000	-0.1388
	(48)	(48)	(48)
	0.9833	1.0000	0.3412
envelopes	0.0025	-0.1388	1.0000
	(48)	(48)	(48)
	0.9863	0.3412	1.0000

Coefficient (sample size) significance level

Spearman Rank Correlations for Male Hip/Thigh Scores

	score	fatigue	envelopes
score	1.0000	-0.0979	-0.1486
	(48)	(48)	(48)
	1.0000	0.5020	0.3085
fatigue	-0.0979	1.0000	-0.1388
	(48)	(48)	(48)
	0.5020	1.0000	0.3412
envelopes	-0.1486	-0.1388	1.0000
	(48)	(48)	(48)
	0.3085	0.3412	1.0000

Coefficient (sample size) significance level

Spearman Rank Correlations for Male Knee Scores

	score	fatigue	envelopes
score	1.0000	-0.0443	-0.1908
	(48)	(48)	(48)
	1.0000	0.7612	0.1907
fatigue	-0.0443	1.0000	-0.1388
	(48)	(48)	(48)
	0.7612	1.0000	0.3412
envelopes	-0.1908	-0.1388	1.0000
	(48)	(48)	(48)
	0.1907	0.3412	1.0000

Coefficient (sample size) significance level

Spearman Rank Correlations for Male Ankle/Feet Scores

	score	fatigue	envelopes
score	1.0000	-0.0534	-0.1773
	(48)	(48)	(48)
	1.0000	0.7144	0.2242
fatigue	-0.0534	1.0000	-0.1388
	(48)	(48)	(48)
	0.7144	1.0000	0.3412
envelopes	-0.1773	-0.1388	1.0000
	(48)	(48)	(48)
	0.2242	0.3412	1.0000

Coefficient (sample size) significance level

U Statistical Analysis of RMS Values

Analysis of Variance for Deltoid RMS values - Type III Sums of Squares

Source of variation	Sum of Squares	d.f.	Mean square	F-ratio	Sig. level
MAIN EFFECTS					
A:gender	0.0073821	1	0.0073821	4.400	0.0360
B:board	0.0172089	2	0.0086045	5.128	0.0060
C:pickup	0.0299285	1	0.0299285	17.838	0.0000
INTERACTIONS					
AB	0.0969498	2	0.0484749	28.891	0.0000
AC	0.0057710	1	0.0057710	3.440	0.0638
BC	0.0141725	2	0.0070862	4.223	0.0148
RESIDUAL	4.2885285	2556	0.0016778		
TOTAL (CORRECTED)	4.4452201	2565			

0 missing values have been excluded.
All F-ratios are based on the residual mean square error.

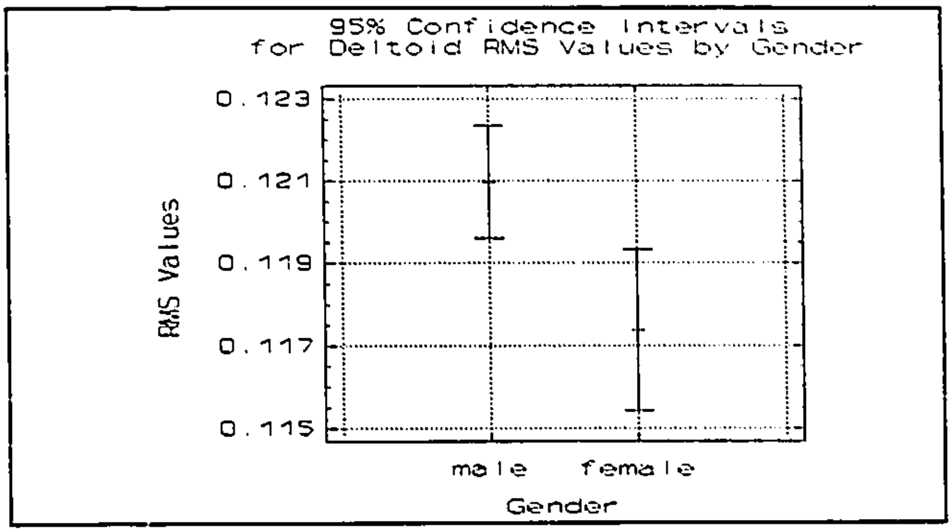
Multiple range analysis for Deltoid RMS values by gender

Method: 95 Percent Duncan

Level	Count	LS Mean	Homogeneous Groups
F	849	0.1173720	X
M	1717	0.1209773	X

contrast	difference
F - M	-0.00361 *

* denotes a statistically significant difference.



Analysis of Variance for Female Deltoid RMS values - Type III Sums of Squares

Source of variation	Sum of Squares	d.f.	Mean square	F-ratio	Sig. level
MAIN EFFECTS					
A:board	0.0655761	2	0.0327881	12.117	0.0000
B:pickup	0.0227395	1	0.0227395	8.403	0.0038
INTERACTIONS					
AB	0.0648215	2	0.0324108	11.977	0.0000
RESIDUAL	2.2811413	843	0.0027060		
TOTAL (CORRECTED)	2.4352415	848			

0 missing values have been excluded.

All F-ratios are based on the residual mean square error.

Multiple range analysis for Female Deltoid RMS values by board

Method: 95 Percent Duncan

Level	Count	LS Mean	Homogeneous Groups
I	285	0.1069797	X
V	276	0.1168794	X
S	288	0.1283546	X

contrast	difference
S - V	0.01148 *
S - I	0.02137 *
V - I	0.00990 *

* denotes a statistically significant difference.

Multiple range analysis for Female Deltoid RMS values by pickup

Method: 95 Percent Duncan

Level	Count	LS Mean	Homogeneous Groups
C	422	0.1122282	X
O	427	0.1225808	X

contrast	difference
O - C	0.01035 *

* denotes a statistically significant difference.

Table of Least Squares Means for Female Deltoid RMS values

Level	Count	Average	Stnd. Error	95% Confidence for mean	
GRAND MEAN	849	0.1174045	0.0017856	0.1138990	0.1209101
A:board					
S	288	0.1283546	0.0030653	0.1223368	0.1343723
V	276	0.1168794	0.0031313	0.1107320	0.1230267
I	285	0.1069797	0.0030815	0.1009300	0.1130294
B:pickup					
O	427	0.1225808	0.0025177	0.1176380	0.1275237
C	422	0.1122282	0.0025328	0.1072559	0.1172006
AB					
S O	144	0.1456540	0.0043349	0.1371436	0.1541644
S C	144	0.1110551	0.0043349	0.1025447	0.1195655
V O	139	0.1177350	0.0044122	0.1090729	0.1263971
V C	137	0.1160237	0.0044443	0.1072986	0.1247488
I O	144	0.1043535	0.0043349	0.0958431	0.1128639
I C	141	0.1096059	0.0043808	0.1010055	0.1182063

Analysis of Variance for Male Deltoid RMS values - Type III Sums of Squares

Source of variation	Sum of Squares	d.f.	Mean square	F-ratio	Sig. level
MAIN EFFECTS					
A:board	0.0394709	2	0.0197355	17.431	0.0000
B:pickup	0.0072158	1	0.0072158	6.373	0.0117
INTERACTIONS					
AB	0.0194865	2	0.0097432	8.605	0.0002
RESIDUAL	1.9372516	1711	0.0011322		
TOTAL (CORRECTED)	2.0029517	1716			

0 missing values have been excluded.
All F-ratios are based on the residual mean square error.

Multiple range analysis for Male Deltoid RMS values by board

Method: 95 Percent Duncan

Level	Count	LS Mean	Homogeneous Groups
V	570	0.1174408	X
S	576	0.1177510	X
I	571	0.1277704	X

contrast	difference
S - V	0.00031
S - I	-0.01002 *
V - I	-0.01033 *

* denotes a statistically significant difference.

Multiple range analysis for Male Deltoid RMS values by pickup

Method: 95 Percent Duncan

Level	Count	LS Mean	Homogeneous Groups
C	858	0.1189373	X
O	859	0.1230375	X

contrast	difference
O - C	0.00410 *

* denotes a statistically significant difference.

Table of Least Squares Means for Male Deltoid RMS values

Level	Count	Average	Stnd. Error	95% Confidence for mean	
GRAND MEAN	1717	0.1209874	0.0008121	0.1193943	0.1225806
A:board					
S	576	0.1177510	0.0014020	0.1150006	0.1205015
V	570	0.1174408	0.0014095	0.1146758	0.1202059
I	571	0.1277704	0.0014082	0.1250078	0.1305330
B:pickup					
O	859	0.1230375	0.0011481	0.1207852	0.1252899
C	858	0.1189373	0.0011488	0.1166836	0.1211910
AB					
S O	288	0.1175761	0.0019828	0.1136863	0.1214658
S C	288	0.1179260	0.0019828	0.1140363	0.1218158
V O	288	0.1169517	0.0019828	0.1130619	0.1208415
V C	282	0.1179300	0.0020037	0.1139991	0.1218609
I O	283	0.1345848	0.0020002	0.1306609	0.1385088
I C	288	0.1209560	0.0019828	0.1170662	0.1248457

Analysis of Variance for Trapezius RMS values - Type III Sums of Squares

Source of variation	Sum of Squares	d.f.	Mean square	F-ratio	Sig. level
MAIN EFFECTS					
A:gender	0.0039805	1	0.0039805	5.008	0.0253
B:board	0.0037375	2	0.0018688	2.351	0.0955
C:pickup	0.0041474	1	0.0041474	5.218	0.0224
INTERACTIONS					
AB	0.0120810	2	0.0060405	7.599	0.0005
AC	0.0000084	1	0.0000084	0.011	0.9193
BC	0.0029566	2	0.0014783	1.860	0.1559
RESIDUAL	2.0420519	2569	7.94882E-4		
TOTAL (CORRECTED)	2.0674240	2578			

0 missing values have been excluded.

All F-ratios are based on the residual mean square error.

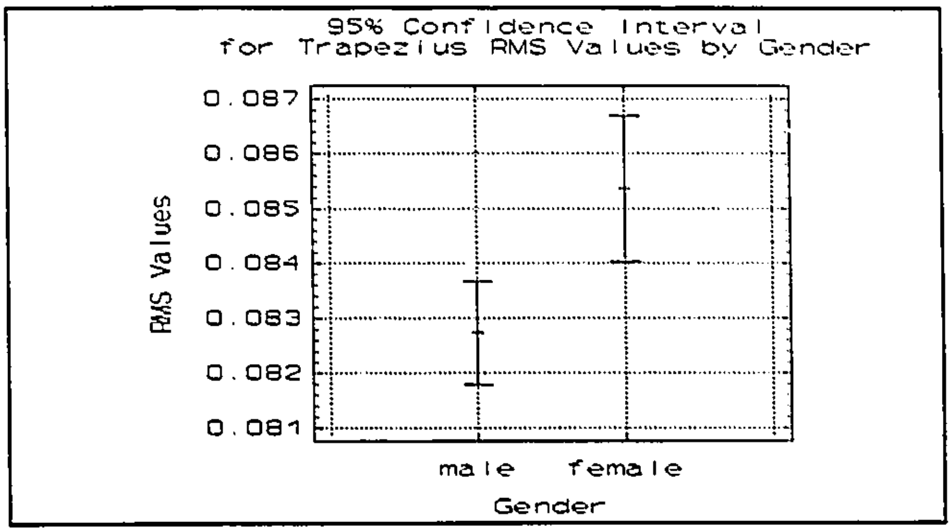
Multiple range analysis for Trapezius RMS values by gender

Method: 95 Percent Duncan

Level	Count	LS Mean	Homogeneous Groups
M	1715	0.0827329	X
F	864	0.0853650	X

contrast	difference
F - M	0.00263 *

* denotes a statistically significant difference.



Analysis of Variance for Female Trapezius RMS values - Type III Sums of Squares

Source of variation	Sum of Squares	d.f.	Mean square	F-ratio	Sig. level
MAIN EFFECTS					
A:board	0.0101421	2	0.0050710	11.341	0.0000
B:pickup	0.0014222	1	0.0014222	3.180	0.0749
INTERACTIONS					
AB	0.0014429	2	7.21449E-4	1.613	0.1998
RESIDUAL	0.3836575	858	4.47153E-4		
TOTAL (CORRECTED)	0.3966646	863			

0 missing values have been excluded.
All F-ratios are based on the residual mean square error.

Multiple range analysis for Female Trapezius RMS values by board

Method: 95 Percent Duncan

Level	Count	LS Mean	Homogeneous Groups
S	288	0.0805219	X
V	288	0.0876598	X
I	288	0.0879134	X

contrast	difference
S - V	-0.00714 *
S - I	-0.00739 *
V - I	-0.00025

* denotes a statistically significant difference.

Analysis of Variance for Male Trapezius RMS values - Type III Sums of Squares

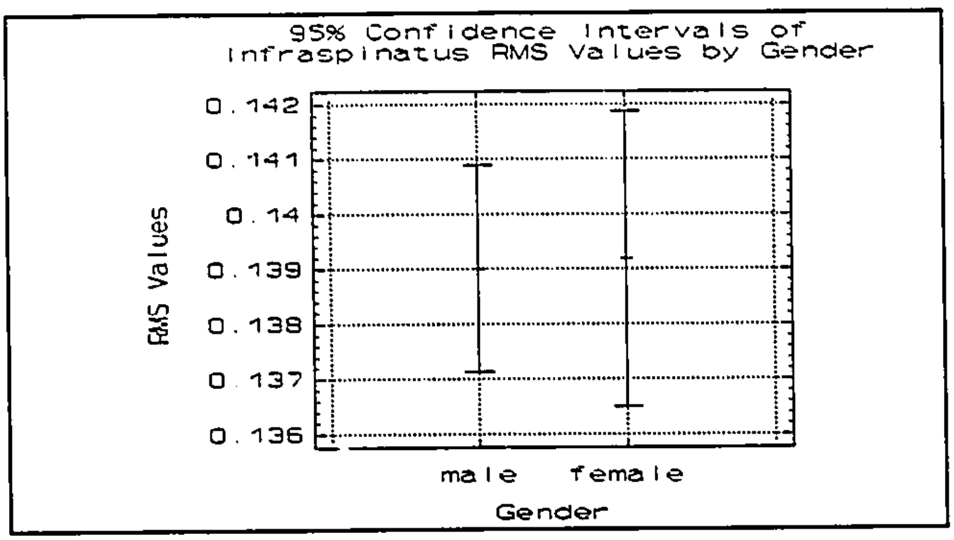
Source of variation	Sum of Squares	d.f.	Mean square	F-ratio	Sig. level
MAIN EFFECTS					
A:board	0.0034793	2	0.0017397	1.795	0.1665
B:pickup	0.0033888	1	0.0033888	3.496	0.0617
INTERACTIONS					
AB	0.0032539	2	0.0016270	1.678	0.1870
RESIDUAL	1.6566541	1709	9.69370E-4		
TOTAL (CORRECTED)	1.6667618	1714			

0 missing values have been excluded.
All F-ratios are based on the residual mean square error.

Analysis of Variance for Infraspinatus RMS values - Type III Sums of Squares

Source of variation	Sum of Squares	d.f.	Mean square	F-ratio	Sig. level
MAIN EFFECTS					
A:gender	0.0000181	1	0.0000181	0.006	0.9402
B:board	0.3511961	2	0.1755981	56.085	0.0000
C:pickup	0.1909843	1	0.1909843	61.000	0.0000
INTERACTIONS					
AB	0.2430428	2	0.1215214	38.813	0.0000
AC	0.0365700	1	0.0365700	11.680	0.0006
BC	0.2880467	2	0.1440234	46.000	0.0000
RESIDUAL	7.9024207	2524	0.0031309		
TOTAL (CORRECTED)	8.8226449	2533			

0 missing values have been excluded.
All F-ratios are based on the residual mean square error.



Multiple range analysis for Infraspinatus RMS values by board

Method: 95 Percent Duncan

Level	Count	LS Mean	Homogeneous Groups
I	855	0.1275531	X
S	856	0.1331116	X
V	823	0.1566313	X

contrast	difference
S - V	-0.02352 *
S - I	0.00556 *
V - I	0.02908 *

* denotes a statistically significant difference.

Multiple range analysis for Infraspinatus RMS values by pickup

Method: 95 Percent Duncan

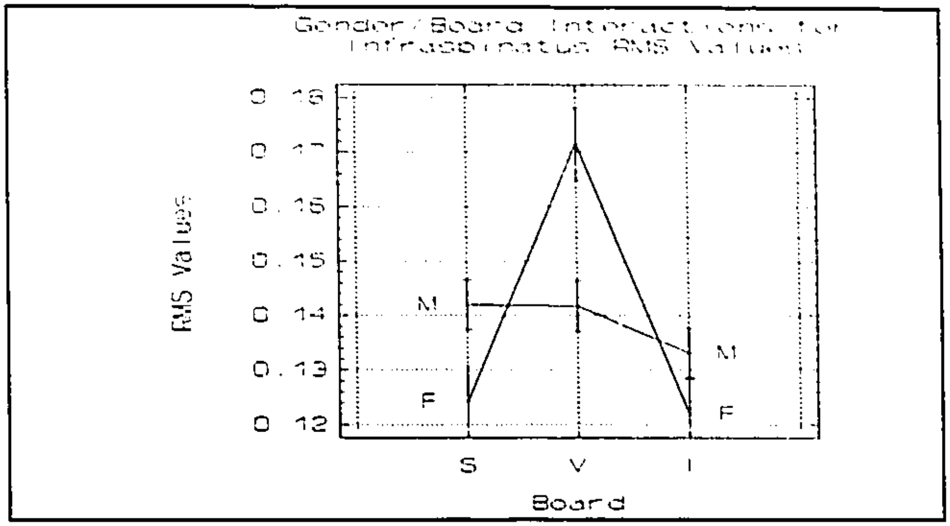
Level	Count	LS Mean	Homogeneous Groups
O	1270	0.1298615	X
C	1264	0.1483359	X

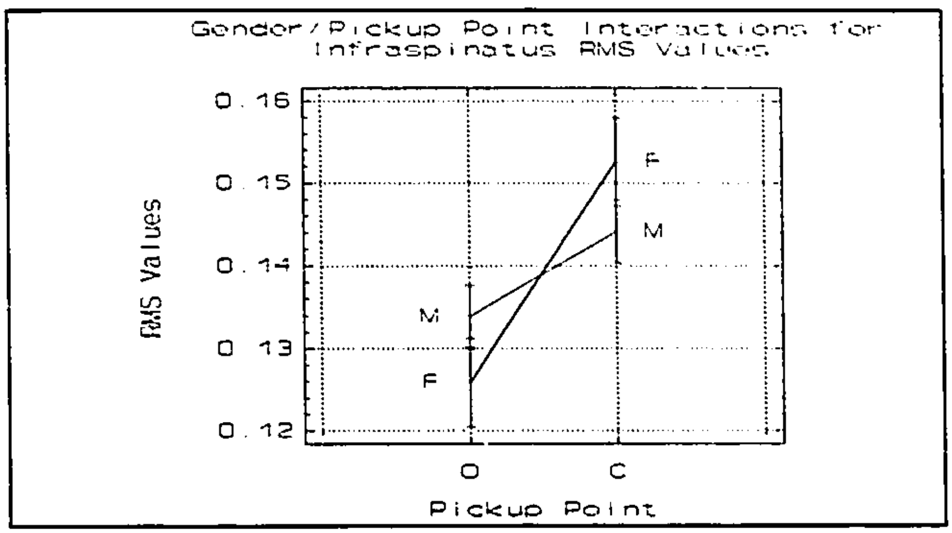
contrast	difference
O - C	-0.01847 *

* denotes a statistically significant difference.

Table of Least Squares Means for Infraspinatus RMS values

Level	Count	Average	Stnd. Error	95% Confidence for mean	
GRAND MEAN	2534	0.1390987	0.0011827	0.1367791	0.1414183
A:gender					
F	835	0.1391887	0.0019368	0.1353899	0.1429874
M	1699	0.1390087	0.0013577	0.1363457	0.1416717
B:board					
S	856	0.1331116	0.0020347	0.1291209	0.1371024
V	823	0.1566313	0.0020754	0.1525608	0.1607019
I	855	0.1275531	0.0020351	0.1235616	0.1315447
C:pickup					
O	1270	0.1298615	0.0016718	0.1265825	0.1331405
C	1264	0.1483359	0.0016733	0.1450539	0.1516179
AB					
F S	282	0.1242080	0.0033325	0.1176719	0.1307440
F V	271	0.1714299	0.0033993	0.1647627	0.1780971
F I	282	0.1219282	0.0033320	0.1153930	0.1284635
M S	574	0.1420153	0.0023355	0.1374346	0.1465960
M V	552	0.1418328	0.0023817	0.1371615	0.1465041
M I	573	0.1331780	0.0023376	0.1285933	0.1377628
AC					
F O	417	0.1259100	0.0027402	0.1205356	0.1312845
F C	418	0.1524673	0.0027379	0.1470975	0.1578372
M O	853	0.1338130	0.0019160	0.1300551	0.1375709
M C	846	0.1442044	0.0019242	0.1404305	0.1479784
BC					
S O	424	0.1310323	0.0028398	0.1254625	0.1366020
S C	432	0.1351910	0.0028032	0.1296929	0.1406890
V O	417	0.1322229	0.0028558	0.1266218	0.1378240
V C	406	0.1810398	0.0028975	0.1753569	0.1867227
I O	429	0.1263294	0.0028192	0.1207999	0.1318588
I C	426	0.1287769	0.0028254	0.1232353	0.1343186


Gender/Board Interactions for
Infraspinatus RMS Values
RMS Values
0.18
0.17
0.16
0.15
0.14
0.13
0.12
M
F
M
F
S
V
I
Board


Gender/Pickup Point Interactions for
Infraspinatus RMS Values
RMS Values
0.16
0.15
0.14
0.13
0.12
F
M
M
F
O
C
Pickup Point

V Linear Regression Model

Regression Analysis - Linear model: Y = a+bX

Dependent variable: Fatigue Score
Independent variable: MPF Slope for Deltoid Muscle

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	0.427549	0.0608475	7.02657	0.00000
Slope	-0.0746958	0.0328747	-2.27214	0.02615

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	1.2325276	1	1.2325276	5.162600	0.02615
Residual	16.711917	70	0.238742		
Total (Corr.)	17.944444	71			

Correlation Coefficient = -0.26208 R-squared = 6.87 percent

Stnd. Error of Est. = 0.488612

W Reliability Equations

The following equations are taken from Guttman et al. (1982).

The mean time to failure is calculated using Type I censoring, in which testing ends at a fixed time t_o. In the testing of n items, k failures will occur. The mean time to failure is calculated as follows:

$$\hat{\mu}=\frac{\sum_{i=1}^{k} t_i+(n-k)t_0}{k}$$

The 100(1-α)% confidence interval for the mean is:

$$\left[\frac{2k\hat{\mu}}{\chi^2_{2k,\alpha/2}},\frac{2k\hat{\mu}}{\chi^2_{2k,1-(\alpha/2)}}\right]$$

The reliability for a station, at a time t, can be calculated as:

$$\hat{R}(t)=e^{-t/\hat{\mu}}$$

VITA AUCTORIS

Chris Kourtis was born, much to his surprise, on 19 November 1961 in Toronto. He graduated from Royal York Collegiate Institute, in Etobicoke, in 1980. He obtained a B.A.Sc. in Industrial Engineering from the University of Toronto in 1984. From 1984 to 1992, he worked as a Programmer/Analyst, at Dot Plastics Ltd., Computer Methods, Human Services Informatics (HSI) Ltd. and Stone & Webster Canada Limited, all in the Metropolitan Toronto area. In 1992, he entered the University of Windsor in the Department of Industrial Engineering as a M.A.Sc. candidate. He is registered as a Professional Engineer (P.Eng.) in the Province of Ontario. He did very well in Grade 1 (he was brought to the front of the class as one of the three best students), but it has all been downhill ever since then.