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A Retrospective Analysis: Injured Youth Athletes' Imagery Use During Rehabilitation

Matthew David Miller
University of Windsor

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A RETROSPECTIVE ANALYSIS: INJURED YOUTH ATHLETES’ IMAGERY USE DURING REHABILITATION

by

Matthew D. Miller

A Thesis
Submitted to the Faculty of Graduate Studies through the Department of Human Kinetics in Partial Fulfillment of the Requirements for the Degree of Master of Human Kinetics at the University of Windsor

Windsor, Ontario, Canada

2017

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A Retrospective Analysis: Injured Youth Athletes’ Imagery Use During Rehabilitation

by

Matthew D. Miller

APPROVED BY:

______________________________________________
J. Casey
Department of Psychology

______________________________________________
T. Loughead
Department of Kinesiology

______________________________________________
K. Chandler, Advisor
Department of Kinesiology

April 24th, 2017
DECLARATION OF ORIGINALITY

I hereby certify that I am the sole author of this thesis and that no part of this thesis has been published or submitted for publication.

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ABSTRACT

The purpose of this study was to expand our breadth of knowledge and fill a gap in the literature regarding injured youth athletes’ imagery use during injury rehabilitation, using a retrospective qualitative approach. The participants were 12 young adults who had sustained an injury as an adolescent (during the previous five years) forcing them to miss time in their sport due to the injury. During the interviews, the participants described their use of imagery during sport injury rehabilitation including when, where, why and for what purpose they used imagery. They reported using imagery during sport rehabilitation for cognitive, motivational, pain management and healing purposes. Motivational imagery was used to set rehabilitative goals and develop confidence in returning to sport, while cognitive imagery was used to learn and rehearse sport and rehabilitation skills and strategies. Pain management imagery was used to distract from pain sensations, block the pain, and practice dealing with the pain, while healing imagery was used for internal physiological processes. With respect to what they imaged, participants commented on the timing, effectiveness, nature, modalities, and “other” details regarding their imagery use. Overall, implementing imagery in conjunction with physical rehabilitation may enhance the rehabilitative process for young injured athletes, thereby increasing the rates of physiological recovery.
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TABLE OF CONTENTS

DECLARATION OF ORIGINALITY ................................................................. iii
ABSTRACT ........................................................................................................ iv
ACKNOWLEDGEMENTS ................................................................................... v
LIST OF FIGURES ........................................................................................... ix
LIST OF TABLES ............................................................................................. x
LIST OF APPENDICES .................................................................................. xi

RESEARCH ARTICLE ................................................................................... 1

  Introduction ................................................................................................. 1
  Method .......................................................................................................... 7
    Participants ................................................................................................ 7
    Procedure .................................................................................................. 7
  Data Analysis .............................................................................................. 8

Results ........................................................................................................... 9

  When and Where Athletes Are Using Imagery ........................................... 9
  Why Athletes Are Using Imagery ............................................................... 10
  What Athletes Are Imaging ........................................................................ 18

Discussion ..................................................................................................... 23

  References ............................................................................................... 36
  Figures ......................................................................................................... 44
  Tables .......................................................................................................... 46

LITERATURE REVIEW .................................................................................. 47

  Introduction ............................................................................................... 47
  Imagery ....................................................................................................... 47
    Imagery Defined ...................................................................................... 48
    Imagery Theories .................................................................................... 48
      Psychoneuromuscular theory ................................................................. 48
      Bioinformational theory ........................................................................ 49
      Triple-code theory of imagery ............................................................... 50
      Theory of functional equivalence ......................................................... 50
      Dual code theory .................................................................................... 52
Youth Athletes’ Use of Imagery.................................................................56
Qualitative sport imagery research..........................................................56
Quantitative sport imagery research.........................................................60
Injury Rehabilitation..................................................................................63
Theories of psychological factors and injury occurrence..........................65
Stress-injury model....................................................................................65
Models of injury rehabilitation..................................................................66
Grief-loss models......................................................................................66
Cognitive appraisal models.......................................................................67
Injuries in Youth Sport................................................................................70
Strategies used during rehabilitation.........................................................70
Imagery in Injury Rehabilitation............................................................73
Imagery in Youth Rehabilitation............................................................78
References..............................................................................................81
Figures....................................................................................................92
APPENDICES.........................................................................................94
VITA AUCTORIS.....................................................................................101
LIST OF FIGURES

Figure 1  Types of imagery used by injured youth athletes during rehabilitation...............44
Figure 2  Content of injured youth athletes’ imagery during rehabilitation.........................45
Figure 3  Revised Analytic Framework of Imagery Effects in Sport.................................92
Figure 4  An Applied Model of Imagery Use in Sport......................................................93
LIST OF TABLES

TABLE 1  Participant Characteristics and Injury Details..........................................................46
LIST OF APPENDICES

<table>
<thead>
<tr>
<th>APPENDIX A</th>
<th>Letter of Information</th>
<th>94</th>
</tr>
</thead>
<tbody>
<tr>
<td>APPENDIX B</td>
<td>Audio Recording Consent Form</td>
<td>97</td>
</tr>
<tr>
<td>APPENDIX C</td>
<td>Interview Guide</td>
<td>98</td>
</tr>
</tbody>
</table>
RESEARCH ARTICLE

Introduction

In 2009, 35% of the injuries experienced by Canadians occurred during sport or exercise (Statistics Canada, 2010). Within the United States in 2012, 1.35 million youth (19 years or younger) visited a hospital emergency department for a sport-related injury (Ferguson, Green, & Hansen, 2013). Moreover, Statistics Canada (2010) found that adolescents (12-19 years) had the highest incidence rate of injury among any age group with 26.4% of adolescents experiencing an injury, of which 66% were related to sport. Injuries can lead to a great deal of stress, thereby playing a pivotal role in an athlete’s life. With these high rates of injury among youth, many adolescents undergo extensive rehabilitative treatment to return to their sport. One tool that has been found to enhance the rehabilitative experience and perhaps even increase the rate of physiological recovery is imagery (Cupal & Brewer, 2001; Ievleva & Orlick, 1991).

Imagery is a skill that develops in the minds of young children (Piaget & Inhelder, 1971). In the early stages of development, imagery is linked to the enhancement of cognitive and motor skills (Atienza, Balaguer, & Garcia-Merita, 1998; Hall, 2001; Kosslyn, 1980). More specifically, imagery has a positive effect on skill acquisition and performance (Li Wei, Qi Wei, Orlick, & Zizelsberger, 1992; Weiss, 1991), motivation (Martin & Hall, 1995), concentration (White & Hardy, 1998), as well as self-confidence and self-efficacy (Callow, Hardy, & Hall, 2001; Munroe-Chandler & Hall, 2004; Munroe-Chandler, Hall, & Fishburne, 2008) in youth athletes. The use of imagery to enhance motor skills has contributed to the widespread use of imagery in the sport domain. Athletes of all ages (Munroe-Chandler, Hall, Fishburne, O, & Hall, 2007) and competitive levels (Hall, Rodgers, & Barr, 1990; Strachan & Munroe-Chandler, 2006) use
imagery in both individual and team environments (Munroe-Chandler, Hall, Fishburne, O, & Hall, 2007). Imagery is defined as:

…an experience that mimics real experience. We can be aware of ‘seeing’ an image, feeling movements as an image, or experiencing an image of smells, tastes, or sounds without actually experiencing the real thing…It differs from dreams in that we are awake and conscious when we form an image. (White & Hardy, 1998, p. 389)

Much of the current understanding of imagery use in sport has stemmed from Paivio’s (1985) analytic framework of imagery use. Paivio asserted that imagery serves both a cognitive and motivational function that operates at either a specific or general level, yielding four main types of imagery use. This framework was later expanded upon to include a fifth type of imagery use (Hall, Mack, Paivio, & Hausenblas, 1998). Cognitive specific (CS) imagery refers to the mental rehearsal of motor skills such as a free throw in basketball, while cognitive general (CG) imagery involves the mental rehearsal of strategies, routines or game plans (e.g., a gymnastics routine). Motivational specific (MS) imagery refers to imaging success or goal achievement such as winning a game. Motivational-general arousal (MG-A) imagery involves images associated with the emotion or arousal linked to performing, while motivational-general mastery (MG-M) imagery entails images of being mentally tough, or confident in the performance.

Until the last decade, much of the existing literature on imagery use in sport has focused on adult athletes’ use of imagery, leaving a gap regarding children and youth athletes’ use of imagery. Accordingly, a greater focus has been placed on investigating imagery use across all ages of sport competitors, including young athletes (Munroe-Chandler, Hall, Fishburne, & Strachan, 2007).
To better understand youth athletes’ use of imagery, Munroe-Chandler, Hall, Fishburne and Strachan (2007) examined potential developmental differences in imagery use across four different age groups that closely map onto those identified by Piaget and Inhelder (1971) to be integral stages in understanding cognitive development (i.e., 7-8, 9-10, 11-12, 13-14). All four age groups were found to use imagery for both cognitive and motivational purposes at the specific and general levels, in line with Paivio’s (1985) analytic framework. In addition to this, developmental differences were noted across the age groups, such that the breadth of imagery use and ability increased with age, leading to the assertion that youth athletes use imagery in a similar manner to that of their adult counterparts within sport (for the five main types as proposed by Hall et al., 1998).

Despite the efforts to better understand young athletes’ use of imagery, limited research has been conducted in regard to adolescent athletes’ use of imagery. In one of the few studies assessing adolescents’ imagery use, Vadocz, Hall, and Moritz (1997) investigated the relationships between imagery use and anxiety and self-confidence in elite roller skaters between the ages of 12 and 18 years. These researchers found that motivational imagery use was related to both competitive state anxiety and self-confidence, which coincided with the framework of imagery use provided by Hall et al. (1998). Furthermore, athletes who used MG-M imagery were found to be more confident, again following what Hall et al. (1998) found in adult athletes. These findings, in addition to that of Munroe-Chandler, Hall, Fishburne and Strachan (2007) provide evidence that healthy adolescent athletes may use imagery in a similar manner to that of their adult counterparts during training and competition. As of yet, developmental differences have not been assessed among injured adolescent athletes in a rehabilitative setting.
Martin, Moritz, and Hall (1999) proposed an applied model of imagery use in sport. In it, they suggested there were three distinct situations within sport that athletes may use imagery; during training (Hall et al., 1990), prior to or during competition (Munroe, Giacobbi, Hall, & Weinberg, 2000), and during injury rehabilitation (Green, 1992). Within sport injury rehabilitation, mental skills have been deemed to be important in several ways: acting as a mediating factor that influences the occurrence of injury, a personal factor influencing cognitive appraisals, and a behavioral response that may alter both the emotional response and cognitive appraisal of the injury (Arvinen-Barrow et al., 2015). One mental skill that has been found to be efficacious within sport injury rehabilitation, is imagery (Driediger, Hall, & Callow, 2006; Green, 1999). Although imagery has been found to be used for both cognitive and motivational functions within a training or competitive environment, imagery use differs somewhat when in a rehabilitative setting (Sordoni, Hall, & Forwell, 2002).

In one of the first studies of its kind, Ievleva and Orlick (1991) examined the relationship between psychological variables (e.g., positive self-talk, goal setting, imagery) and the temporal component of recovery. Using an open-ended retrospective survey, the researchers found that athletes spontaneously used imagery. Additionally, they found that athletes specifically imaged their injuries physiologically healing, marking a new type of imagery outside of the cognitive and motivational types. Furthermore, athletes who used imagery were found to have faster recovery rates than those who did not utilize imagery throughout the rehabilitative process, thereby providing evidence for the benefits of imagery use within sport injury rehabilitation.

Following the results of Ievleva and Orlick (1991), Sordoni et al. (2002) examined both self-efficacy and adult athletes’ use of imagery during injury rehabilitation. Participants indicated similar frequencies of imagery use within all three types of imagery (cognitive, motivational, and
healing), while healing imagery was the only type of imagery found to be significantly related to self-efficacy. This result was especially important in providing evidence for the impact of healing imagery on enhancing the rehabilitative process. Healing imagery may not only enhance the rate of physiological recovery, but may also promote feelings of control and serve to empower the athlete, thereby enhancing the rehabilitative process (Sordoni et al., 2002).

Furthermore, the adult athletes reported using cognitive imagery to rehearse sport specific skills and strategies instead of rehabilitation exercises or strategies, while motivational imagery was found to be used in a similar manner to that of the competitive sport domain to manage arousal and increase self-confidence.

Building on the findings of Sordoni et al. (2002), Dreidiger et al. (2006) assessed adult athletes’ use of imagery during injury rehabilitation. Similar to Sordoni et al., these researchers found that adult athletes used the three types of imagery (cognitive, motivational and healing), but also a new type of imagery labelled pain management imagery. Specifically, athletes reported using imagery to practice dealing with pain, to distract from pain sensations, to imagine the pain dispersing, and to block the pain. This finding subsequently established pain management imagery as an important type of imagery in injury rehabilitation. Taken together, it is clear that injured adult athletes report using four types of imagery: cognitive, motivational, pain management, and healing imagery (Driediger et al., 2006).

Despite the prevalence of research regarding adult athletes’ use of imagery during injury rehabilitation, there is scant literature regarding that of youth athletes. No study to date has examined adolescent athletes’ use of imagery in an athletic injury rehabilitative setting. Despite this, there is research supporting adolescents’ use of imagery within hospital rehabilitative settings (Huth, Broome, & Good, 2004; Lambert, 1996). More specifically, there are some
studies that have demonstrated adolescents’ postoperative pain in a hospital setting can be significantly reduced using guided imagery (Huth et al., 2004; Lambert, 1996; Pölkki, Pietila, Vehvilainen-Julkunen, Laukkala, & Kiviluoma, 2008).

To assess the clinical applicability of using imagery to reduce postoperative pain in adolescents, Lambert (1996) analyzed the effects of guided imagery on postoperative outcomes of pediatric surgical patients. Lambert found that those patients who were taught how to utilize guided imagery experienced lower postoperative pain and a shorter duration of hospital stay than those who did not receive the guided imagery intervention. One caveat to this result was that Lambert failed to control for analgesic intake of the patients.

To rectify the limitations of Lambert (1996), Huth et al. (2004) controlled for analgesic administration while assessing the efficacy of an imagery intervention in reducing postoperative pain within adolescents. These researchers found that the patients who received the imagery intervention had significantly lower pain at one to four hours post-surgery, but not at 22-27 hours after discharge. This discrepancy over time in the effectiveness of imagery use in reducing postoperative pain was attributed to lowered pain and anxiety scores while at home, suggesting somewhat of a floor effect in which the pain scores were already at low levels, thereby limiting the need for pain management imagery. The researchers suggested that imagery may be most effective when pain and anxiety are at moderate levels, such as immediately after surgery.

This postoperative pain literature clearly shows the clinical applicability of imagery in reducing postoperative pain within pediatric surgery patients in a hospital setting. Although adult athletes’ use of imagery in sport injury rehabilitation has been studied extensively, resulting in the four main types of imagery use in rehabilitation (cognitive, motivational, healing, pain management; Driediger et al., 2006; Sordoni et al., 2002), no research to date has analyzed
adolescents’ use of imagery within an athletic rehabilitative domain. The present study will attempt to fill this gap in the research by investigating, when, where, why, and what injured youth athletes are imaging during athletic injury rehabilitation.

Method

Participants

The participants were 12 (n = 3 males, n = 9 females) formerly injured athletes (See Table 1). Injury rates have been found to rise when specialization in one specific sport and adolescent growth spurts tend to occur (>12 years), resulting in 13-17 year old adolescents being susceptible to injury (Caine, Maffulli, & Caine, 2008; Law, Driediger, Hall, & Forwell, 2006). To qualify for the current study, participants must have been injured within the past five years and have experienced their injury between the ages of 13-17, placing their current age between 18-20 years. The athletes represented five separate sports: basketball (n = 1), hockey (n = 4), volleyball (n = 4), softball/baseball (n = 2), and boxing (n = 1). The athletes’ responses were centred around the rehabilitation of their most recent injury during the ages of 13-17, but several athletes did comment on past injuries as well. The sample consisted of athletes with varying severities of injury ranging from dislocated thumbs to patellofemoral syndrome (See Table 1).

Procedure

Participants were recruited from the University of Windsor. For those who contacted the lead researcher and met the participant requirements, they were provided with the letter of information (Appendix A) and the audio-recording consent form (Appendix B), to disseminate the information regarding the study. A scheduled time in which the participant would be a part of a semi-structured interview was arranged. All participants took part in a face-to-face semi-structured interview (see Appendix C for interview guide) at the University of Windsor in the
Sport and Exercise Psychology Laboratory (Room 212 of the Human Kinetics Building). The interview consisted of the athlete and the interviewer (the lead author). The audio was recorded using a Sony™ ICD-UX533 recording device. The interview structure resulted in three sections. At the beginning of the interview, the interviewer provided a brief description of the study as well as a definition of imagery and participants were asked to provide a brief description of past sport experiences. Next, focused questions regarding the athlete’s use of mental imagery during rehabilitation (or while injured), where they use it, when they use it, why they use it, and the content of their images were asked. Finally, the interviewer verbally outlined the key points discussed in the interview and provided the participant the opportunity to expand upon or clarify should they wish. The interviews were transcribed verbatim resulting in 130 pages of double spaced transcribed interviews.

The interview guide was developed based on the procedures outlined by several authors (i.e., Gould, Eklund, & Jackson, 1993; Hanton & Connaughton, 2002). Open ended questions were created based on the findings of Sordoni et al. (2002), Driediger et al. (2006) to explore previously identified types of imagery in rehabilitation, and the literature on the four W’s of imagery use to explore any novels uses of imagery in rehabilitation (e.g., Munroe et al., 2000). Additionally, the flexibility of the interview guide was increased by including probes and allowing the researcher to deviate from an absolute sequence of questions as would be found in a standardized interview based on the recommendations of Patton (2002).

Data Analysis

The procedure for data collection followed two steps. First, a bracketing interview using guidelines by Gearing (2004) was undertaken with the lead researcher. A bracketing interview is intended to identify the researcher’s biases in advance of data collection so they become more
self-reflective. Second, a semi-structured interview guide approach (Patton, 2002) was used allowing for the inclusion or exclusion of any ideas as the sessions progress.

The data was then qualitatively analyzed following Sparkes and Smith’s (2013) recommendations and the Constant Comparative Method as outlined by Patton (2002). The constant comparative method was chosen over other qualitative analyses as it has been suggested to be an effective tool when developing theory that is grounded in the data, as the comparisons made while coding the data would help facilitate setting boundaries for the categories, and to ensure that the coding remained consistent throughout (Tesch, 1990). The audio recorded interviews were transcribed verbatim and imported into the QSR NVivo 11 program, a data management computer program. Subsequently, the transcribed interviews were divided into text units. The text units were then organized into categories by using both inductive and deductive approaches (Patton, 2002). Theoretical saturation was reached (Miles & Huberman, 1994), and the result was a description of what, when, where, and why adolescent athletes are imaging during rehabilitation.

Results

Thematic analysis revealed that all athletes used imagery during injury rehabilitation. The athletes recounted details regarding why (See Figure 1), what (See Figure 2), when and where, they were imaging.

When and Where Athletes Are Using Imagery

Athletes reported using imagery both within the rehabilitative setting and outside of rehabilitation including: at home in bed, watching television, eating, and while watching practices.
Within the rehabilitative facility. Within rehabilitation, athletes mentioned using imagery most times they had a therapy appointment. When asked about when and where they were using imagery while injured, one athlete commented, “I tried to do it every time I went to the rehabilitation place.” Athletes also reported using imagery while performing their rehabilitation exercises at the clinic as well as a preparatory technique before doing their exercises, or after their exercises to review their technique. One athlete described their use of imagery during their exercises by saying, “It would be during the exercises that I would be doing the imagery during rehabilitation.”

Outside of the rehabilitative facility. When analyzing imagery outside of rehabilitation, athletes described using imagery at home in bed, watching television, eating, and while watching practices. Most athletes reported that their imagery remained targeted toward the rehabilitative process, while a few athletes mentioned using imagery to stay up to date in their sport. Maintaining imagery targeted at the rehabilitative process is evident in a quote by one athlete speaking about their use of imagery for their rehabilitative exercises at home, “Well, I had to do my exercises at home, so when I did them at home, I would do a little bit of imagery.” In the following quote, an athlete described using imagery to rehearse strategies in their sport, without using their game sheet (outlining plays and strategies) to stay up to date in their sport, by saying:

I would go to practice and I would watch us do drills and stuff and then I’d go home and kind of do the same thing throughout the day. I’d kind of do the same thing like study up but I didn’t actually have the papers to read and stuff.

Why Athletes Are Using Imagery

Athletes reported using imagery for the five main types (i.e., CS, CG, MS, MG-M, MG-A) plus the additional healing and pain management types during rehabilitation (See Figure 1).
Athletes frequently reported using the cognitive and motivational functions of imagery, while also briefly discussing their use of healing and pain management imagery.

**Cognitive.** Athletes frequently reported using imagery pertaining to the cognitive imagery, including both cognitive specific and cognitive general imagery.

**CS.** Comments referring to athletes’ use of CS imagery were categorized into two separate themes. Athletes cited using imagery for the rehearsal of both sport skills and rehabilitation exercises. Additionally, athletes described using imagery to rehearse rehabilitation exercises, but would then relate these exercises back to sport specific skills in which they would image.

*CS for sport skill rehearsal.* All athletes ($N = 12$) mentioned using CS imagery to rehearse skills in their sport during the rehabilitative process. In reference to the rehearsal of images associated with their sport skills one athlete noted, “I would picture myself in hockey, how I’d have to quick start off a face off or something,” while another athlete commented, “Track season started and I was late coming into that and I was a hurdler so I kind of had imaged me going over the hurdles.”

*CS for rehearsal of rehabilitation exercises.* Like CS imagery for sport specific skill rehearsal, athletes also reported using CS imagery for rehabilitation exercise rehearsal either before, during or after execution of the exercises. Over half of the athletes ($n = 7$) reported using imagery during the initial execution of their exercises while only a few athletes ($n = 3$) reported using CS imagery before their exercises to prepare, or after their rehabilitative exercises ($n = 3$) to analyze their performance. The following quote from one athlete illustrated their use of CS imagery for the rehearsal of rehabilitation exercises, “When the doctors cleared me, I didn’t automatically start walking. I imagined myself walking and then slowly like getting back. I had
the crutches, and I started walking. . . so sort of like that.” Again, with respect to using CS imagery for rehabilitation exercise rehearsal one athlete noted, “I would take the jumping scenario when I was in rehabilitation and imagine me being able to do it successfully.”

**Relationship between sport skill and rehabilitation exercise rehearsal.** Athletes reported transferring their imagery use for rehabilitative exercises to similar skills in their sport. This evident from a quote by one of the athletes, “At physio, I was thinking how this exercise would help me- like what movements I would be doing in hockey that would relate to my exercise.” Another athlete spoke about this concomitant use of CS imagery by saying:

So I did it [imagery] during rehabilitation and then it actually transferred to when I was in volleyball games, so I would take the jumping scenario when I was in rehabilitation and imagine me being able to do it successfully. And then once I was able to do it in rehab, I transferred over the feelings of how I got my feet underneath, how I was actually able to stand from it I was able to jump and play volleyball again.

**CG.** Images relating to CG were subdivided into two categories, CG imagery for sport strategy rehearsal, and for rehabilitation strategy rehearsal. Most athletes commented on their use of CG imagery for sport strategy rehearsal \((n = 9)\) as well as for rehabilitation strategy rehearsal \((n = 8)\).

**CG imagery for sport strategy rehearsal.** Athletes’ use of CG imagery to rehearse sport strategies is evident in the following quote from an athlete, “Because I was a defenseman I would imagine my other defense partner on the other side. . . and knowing where everyone was on the ice and stuff.”

When asked about using imagery pertaining to their sport while injured another athlete touched on using CG imagery at home after watching their team practice, “I would go to practice
and I would watch us do drills and stuff and then I’d go home and kind of do the same thing [image the drills].”

*CG imagery for rehabilitation strategy rehearsal.* Athletes also noted using CG imagery to rehearse rehabilitative strategies. This is exemplified in the following quote from an athlete, “Before bed and in the mornings when I was eating breakfast, I’d be imaging what I was going to be doing in physio.” Another athlete commented on her use of CG imagery to image her rehabilitative strategies while her physical therapist described the process necessary to fully recover, “I applied the visualizing to the actual physio process of me sitting in the clinic and me actually going through the motions with them and talking about how we’re going to get back on track [what exercises are necessary].”

**Motivational.** Comments referring to the use of imagery for motivational purposes were reported by the athletes. In particular, athletes reported using MS, MG-M imagery, and MG-A imagery.

**MS.** With respect to MS imagery, athletes mentioned some form of hope or outcome goal to becoming fully recovered and being able to return to play their sport. This is illustrated by the following quote from an athlete who mentioned commented on using MS imagery throughout the rehabilitative process to stay motivated toward his outcome goal of recovery, “The purpose behind it, just returning honestly [to sport], I wanted to return. . . you are imaging yourself when you do come back, you’ll be better, more mentally strong.” Despite many athletes mentioning the use of outcome goals (*n* = 10), over half the athletes (*n* = 7) also reported using MS imagery for process goals associated with their rehabilitation, which is demonstrated by the following quote from a hockey player describing imaging the necessary steps toward recovery:
I found that since I’ve been injured and went through rehab and actually take the time to do the little steps in between, I see a little reflection [of the benefits of imagery], and it’s not just the big picture, it’s like every little step leading up to what I want to accomplish [full recovery].

Additionally, when asked about their use of imagery surrounding goals in their sport, one athlete mentioned using MS imagery to image a combination of process and outcome goals to motivate themselves while in rehabilitation:

A national championship…I definitely imagined that, and I went and saw a women’s World game… It was almost inspirational to see that. You set a goal for that, but it’s not that realistic so then you bring it down to university and varsity championships and stuff like that.

**MG-M.** Most of the images relating to MG-M imagery on which the athletes commented referred to images of self-confidence or self-efficacy in their rehabilitation and their ability to execute the exercises. When referring to their use of imagery and how it influenced their execution of the rehabilitative skills such as jumping, a volleyball player disclosed, “When I did have a successful landing, I was able to imagine it better because I was actually able to do it. . . . it gave me confidence that I could be able to do it.” Furthermore, athletes also mentioned using MG-M imagery to help them get through difficult situations associated with their rehabilitation and to motivate them to execute their rehabilitation program. This is exemplified in the following quote from an athlete who commented on using imagery to overcome the tough aspects of recovery and stay motivated to adhere to their rehabilitative plan:
I looked on the bright side when I was using it [imagery] in physio, I was getting back into it. She [the therapist] helped me a lot, like it’s going to be better. . . . So then I finally was like, ‘I’m going to get back and I can do it.

**MG-A.** Athletes also commented on using MG-A imagery within rehabilitation.

In the following quote, an athlete touched on the nature of their MG-A imagery use and its relationship with their rehabilitative outlook.

So I guess in the beginning of the rehabilitation phase the imagery was more positive. It was more like okay yeah it’s going to get better. I image myself going into these positions and it’s not hurting. But more towards the end [of the rehab] . . .[the imagery] was kind of more negative, more like okay I guess I can’t go into these positions without it hurting.

Finally, another athlete who has been completely removed from sport due to their injury, reported using MG-A imagery to help cope with this removal from sport, as is illustrated in the following quote:

Because I’m not really able to do any sports anymore, I really miss it and so I just remember all the times that I have been playing and then whenever I watch a game or someone else doing it, I can see myself in that position again but I can’t [play the sport], so I just pretend that I’m in the game but I’m not.

**Healing.** Comments referring to imaging the physiological healing process during rehabilitation were divided into two separate lower level themes; internal (e.g., imaging a torn ligament healing) and external (e.g., imaging strength or mobility returning to the injured area). Regarding internal healing imagery, many athletes ($n=7$) mentioned the use of analogies that were either self-directed, or suggested by the physiotherapists/doctors. This is evident in the
following quote from one athlete who described using healing imagery by virtue of an analogy given to him by his doctor:

He [the doctor] described it well, this image stuck with me. He described it as a golf ball size hole in the ground and picture a tile floor over this golf ball sized hole and this is what you have. What they did is they put two screws in there so it didn’t float around in my knee which is good. I want that. So I was picturing that, this is what is happening with my knee, I need to be careful with it.

One athlete illustrated the integral role of the physiotherapist/doctors for facilitating their use of healing imagery by saying, “They definitely sparked it [imagery use] though. After they would say it, it was like okay this is what I have to do to get better.” Another athlete noted the importance of their doctor in facilitating the use of healing imagery, by explaining what he did during surgery, “I found that when he was explaining what he did in the surgery, I would picture that so I could see him like actually going in and fixing it and how that’s going to affect later on, but then kind of more feeling it once I’m in rehab.”

With respect to external healing imagery, athletes described images of strengthening and mobilizing the injured area. This is exhibited by the following quote from an athlete who described using external healing imagery in conjunction with kinesthetic imagery to feel and strengthen their muscles:

There was a lot of swelling especially when I took off my bootcast, and when I noticed how weak my muscles were because of having it on all the time and then it [Imagery] was getting the feeling back of like moving around and strengthening those muscles. Then that helped me think like oh I’m going to get through it.
**Pain management.** Images relating to managing pain associated with their injury were reported by all but one participant (n = 11). Athletes commented on using imagery to: block the pain, practice dealing with the pain, and distract from pain sensations. Regarding blocking the pain, an athlete said:

> When I’m using imagery in that situation it’s like the imagery, what I’m picturing isn’t a painful action, so I wasn’t thinking about pain that much. I wasn’t thinking it was going to hurt. It hurt a lot obviously, but I didn’t think it was going to hurt so that really pushed me over the top that day.

When using imagery to practice dealing with the pain, athletes reported imaging past experiences with injuries and the pain that was associated with it. This is evident in the following quote from an athlete who mentioned imaging details associated with past injuries to prepare themselves for their current injury, “I was well prepared for the pain from other injuries and stuff.” Another athlete mentioned using imagery to “switch” their current injury (broken ankle) with a previous more painful injury (dislocated knee), to practice dealing with the pain from the current injury, by saying:

> I dislocated my knee when I was younger and I remember that and all the exercises that I did, like each one helped me and like the pain for those ones was almost more than my ankle because my knees do a big job. I imagined my knee was my ankle but it was less pain. I almost switched my situations around so I could get through it I guess- because my knee recovered pretty well.

When using imagery to distract from pain sensations, one athlete commented, “I think I just tried to ignore it in a way, just kind of forget about it and put my mind on something else [using imagery].”
What Athletes Are Imaging

The participants reported details about what they were imaging, including the timing, effectiveness, nature, modalities used, and “other” details (See Figure 2).

**Timing.** Athletes commented on the timing of their imagery use by recounting the duration of their imagery sessions, the frequency in which they would create these images, and changes in their imagery use.

**Duration.** Athletes described either brief sessions lasting anywhere from five to 30 seconds, or longer sessions ranging from 10-30 minutes. An athlete offered the following comment regarding the timing and duration of their imagery sessions, “Usually it [imagery session] was at the beginning of the activity, so if it was like a five-minute activity like the first 30 seconds or something and then after concentrate on the activity.” Another athlete touched on using imagery during convenient times when she would be alone, such as walking to the physiotherapy clinic:

I think for me, I used imagery going into physio, the 15-minute walk from my dorm to physio. Right now, I always think about it because there’s nothing better to do almost. Going in prepared, knowing it’s going to be painful and they’ve said that but that I come out better each time I go in.

One athlete even mentioned having imagery sessions last up until a half an hour while doing rehabilitation activities such as pedaling on a bicycle:

A lot of the time I would find myself imaging I would be in physiotherapy itself because I would be on the bike so I would image probably half hour at a time at the most. After the injury, especially closer to when I was able to play again, it wasn’t as much imaging so it would probably be like 5 minutes.
**Frequency.** Half the athletes \((n = 6)\) described using imagery every time they were scheduled for a rehabilitation appointment, which was generally two or three times per week as is evident in the following quote, “Well I tried to do it [imagery] every time I went to the rehabilitation place so that was about like maybe 2-3 times a week.” Despite this, some athletes \((n = 5)\) did comment on using imagery daily, which is evident in the following quote:

Daily, just because if you can’t walk, you want to image everything that you do basically, if you’re dreaming, if you’re just thinking, you’re always walking so I was thinking a lot about specifically basketball a lot too because I was starting to really love the game, I was playing every day so I was thinking about basketball, how and if I would ever play.

**Change in imagery use.** Many athletes \((n = 9)\) reported that their use of imagery increased significantly from pre-injury to post-injury. One athlete commented on their use of imagery being non-existent prior to their injury, to being frequent during their injury, “I used imagery pretty much anytime I was in physio or chiro so once or twice a week. . . .I don’t think I really did imagery beforehand.” Another mentioned, “I never really did imagery, but I found it really helped a lot after [recovering from their injury]...I used it a lot for figure skating afterwards.” While another said, “In the beginning I did not really image that much...and then the more I got closer to being recovered then I imaged a lot more, more frequently.”

**Effectiveness.** Athletes commented on the effectiveness of their imagery use, with the overarching view that imagery was beneficial in their rehabilitative process. One athlete mentioned:

Well I definitely think it [imagery] was a positive experience because I used it a lot for figure skating afterwards. Before my competitions, I would imagine myself doing my routine perfectly and once I started visualizing I actually started winning a lot of
competitions too. So I noticed a change there. I think it was a really positive experience and helped a lot.

In addition to athletes holding positive views about the efficacy of imagery, athletes also reported being influenced by others such as a parent or coach, who held positive views about using imagery. This is described in the following quote from an athlete:

My parents said it [imagery] would be a good idea. They said visualization and that kind of stuff helps, so I was young at the time so I was like ‘ok I’ll try it I guess.’ I found that it did help.

**Nature.** Athletes reported their images as being both positive and negative in nature.

**Positive.** Many of the positive images reported by athletes referred to themselves in a healthy or improved state, which they described as motivational. For example, one athlete said, “If I was in a more positive mood it [the imagery] would be more motivational. I’d be picturing myself being way better than I was before—improvement, more strength, showing that I had been working on it for so long.” In the following quote another athlete described using positive imagery to motivate them to adhere to their rehabilitative program:

The imagery was positive because it definitely kept me on track and I was always motivated to recover but it kind of helped with that motivation and kind of sped up the process. I wasn’t going to physio thinking ‘oh I have another physio appointment.’ I went in and was like, ‘okay we’re going to go, we’re going to get ready, like going to get back.’

**Negative.** Most negative images that were reported by participants seemed to come early in the rehabilitative process when they were limited by their injury to the point in which they could not complete tasks that they were asked to do or in which they were accustomed.
This is illustrated in the following quote by one athlete discussing the negative impact of not being able to walk:

Especially early on in the injury when I couldn’t even walk, it [the image] was a lot of bad. It’s not even positive too, as much as it was negative, because it really weighs down on you if you are injured and can’t do what you want to do. So it wasn’t exactly positive all the time, it would be a lot of anger mixed in.

In addition to negative images being reported early in the rehabilitative process, athletes recounted imaging the moment in which they were injured, and described this as negative. For example, one athlete said:

I do look back on actually imagining the injury and what I could change which I find is probably not a good idea to do because I get stuck on if I just moved a little bit this wouldn’t have happened, which is a negative. But then also I get thinking that I wouldn’t do that skill again because I would put myself in harm again knowing not to actually side step the slide tackle which is what eventually led to it [the injury]. So knowing the change movements or like how to manipulate my body in a different way so that it doesn’t happen again.

**Modalities.** Athletes in the current study reported using both visual and kinesthetic imagery during the rehabilitative process.

**Visual.** Athletes commented on using visual imagery in which they would actively see themselves performing a task using internal (i.e., looking out as if you were seeing it yourself) or external (i.e., looking at yourself from afar) perspectives. This is apparent in the proceeding quote from an athlete describing what their images would consist of while at the rehabilitative facility, “Actually seeing my arm do it and pick things up, how I’m actually going to apply that
to a hand or two.” Another athlete mentioned using visual imagery that was directed by their
surgeon, “I found that when he was explaining what he did in the surgery, I would picture that so
I could see him like actually going in and fixing it.”

**Kinesthetic.** Many of the athletes (*n* = 8) reported using kinesthetic imagery in which
they would feel the movements that they were imaging. Furthermore, the kinesthetic images
were created from the vantage point of a healthy athlete with no mobility, strength or pain issues,
which is clear in the following quotes from athletes, “When I imagined jumping it was a just
feeling the floor, like I felt my feet underneath like there was no pain associated with it,” and
“The feeling of going flexion and extension of your ankle or like plantar flexion or whatever like
I just pictured that as my knee doing flexion and extension.”

**Other.** Comments referring to aspects of the athletes’ health, or past events were
categorized as “other”. Many of the participants (*n* = 9) recalled images of past injuries as well as
motivational images comprising a healthy version of themselves in the future, while they were
injured.

**Health.** Athletes cited imaging themselves as a healthy athlete in the future. When asked
about why an athlete was imaging they responded with, “The purpose behind that, just returning
honestly, I wanted to return. Even though the doctor says you can’t do it, you are imaging
yourself when you do come back, you’ll be better, more mentally strong.” Athletes also
discussed images that would be centered around worrying that they may not return to their pre-
injury form, which is made evident in the following quote:

I think I was more scared than anything because I was, kind of holding myself back
because I didn’t want it [the injury] to get worse because I wanted to play more. . . I
would just tell myself not to hurt myself because I know that if I keep doing it that I wouldn’t be able to play.

*Past events.* The athletes commented on imaging past experiences with injuries, to provide an example of what to expect with their current injury and rehabilitation. This is illustrated in the following two quotes from athletes describing their use of imagery regarding past injuries to prepare themselves for various aspects of their current rehabilitation, “I was well prepared for the pain from other injuries and stuff,” and, “Well it’s not my first one, so seeing that I will be able to get back to it, even though it will be a hard road kind of thing and it kind of got worse but seeing that I will be back to it.”

**Discussion**

The purpose of the present study was to qualitatively investigate injured youth athletes’ use of imagery during rehabilitation through a retrospective lens. Injured young athletes reported using the five main types of imagery as is used in sport (Munroe-Chandler, Hall, Fishburne, & Strachan, 2007), as well as the additional types of healing and pain management, which have been identified among injured adult athletes in rehabilitation (Driediger et al., 2006). This suggests that injured young athletes use imagery similarly to their adult counterparts during rehabilitation (Driediger et al., 2006; Sordoni, Hall, & Forwell, 2000; Sordoni et al., 2002). Educating therapists on the benefits of imagery use during rehabilitation as well as encouraging injured athletes to use imagery in conjunction with their rehabilitative protocol could enhance their rehabilitative experience.

When asked about when and where they used imagery during rehabilitation, athletes provided accounts about their use of imagery both within and outside of the rehabilitative setting (i.e., while watching practices and while at home). Similar to Driediger et al. (2006), athletes
commonly reported using imagery while at their rehabilitative appointments. This is not surprising, as imagery that is used to serve a rehabilitative purpose should be used more frequently within that setting, than outside. Levin and Divine-Hawkins (1974) found that within educational settings imagery may be used spontaneously throughout the day in response to image provoking situations. The rehabilitative environment would likely be an image provoking situation for these injured athletes, as being surrounded by rehabilitative practitioners, tools, and images may result in athletes utilizing imagery directed at rehabilitation, rather than at home where there may be many contextual cues that will lead to other types of imagery being used (e.g., sports posters at home may elicit CS sport skill rehearsal). Despite this, while using imagery outside of the rehabilitative setting, athletes’ imagery remained targeted toward mostly rehabilitative purposes. Considering the physical and psychological impact of injuries (Bauman, 2005; Crossman, 1997; Milne, Hall, & Forwell, 2005), an injury may play a pivotal role in a young athletes’ life and thereby may be pervasive in their thoughts, leading to a heightened focus on their rehabilitative process (even when outside of the rehabilitative setting). Additionally, many athletes reported using imagery during the execution of their rehabilitative exercises, while only a few athletes mentioned using imagery as a preparatory technique or to review their execution after completion of the exercise. This finding coincides with that of Salmon, Hall and Haslam (1994) who found that athletes tend to use imagery during practice, not before or after practice, therefore suggesting that athletes may treat their rehabilitative appointments in a similar manner to that of their normal practices. Athletes also reported using imagery in various settings outside of rehabilitation including; at home in bed, watching television, eating, and watching practices while out of the sport. The identified settings were related to times when the athlete would be in solitude and would have time to image, thus supporting previous research by
Driediger et al., (2006) who found that many injured adult athletes reported using imagery while alone. In sum, athletes should utilize imagery while at their rehabilitative appointments, but also outside of these appointments at a time in which they will be alone and can focus on their imagery.

When examining why the young injured athletes were using imagery, they reported using imagery across the five main types (CS, CG, MS, MG-A, MG-M) as well as the additional types of pain management and healing imagery. Previous findings regarding CS imagery use in injury rehabilitation have been mixed. Sordoni et al. (2000) found that adult athletes rarely used imagery to rehearse rehabilitation specific exercises, and instead rehearsed sport specific skills. Contrastingly, Driediger et al. (2006) found that athletes did use imagery to rehearse rehabilitation specific exercises (either before or during the execution of the exercises). The results from the current study merge these two previous findings, in that young athletes reported using CS imagery for both rehabilitation exercise rehearsal (before, during and after execution of the movement), as well as CS imagery for sport skill rehearsal. Regarding CS imagery for sport specific skill rehearsal, athletes reported specific instances in which they would spend time imaging exactly how to perform a previously automated skill in their sport even though they may not be able to physically complete the skill while injured. This is not surprising as CS imagery has been found to increase the accuracy and overall technical skills of athletes (Li-Wei et al., 1992; Veraksa & Gorovaya, 2012). Rehabilitation exercises are also skills which can be improved (either by increased efficiency or accuracy of the movement) through both physical and mental practice (CS imagery; Driediger et al., 2006). This improvement in the execution of rehabilitative exercises should then benefit the athlete in their recovery from their injury. It makes intuitive sense that athletes would rehearse their rehabilitative exercises, as many injured
athletes tend to set outcome goals of being fully recovered (Driediger et al., 2006), and one potential avenue to attain this goal is through effective execution of their rehabilitative exercises.

Unique to the current study, athletes reported using CS imagery to rehearse rehabilitation exercises but then transferred their imagery to the rehearsal of sport specific skills that were similar in nature to the rehabilitative skill. This transferability can again be explained by the tendency for injured athletes to set outcome goals in rehabilitation (usually a full healthy recovery and reintegration into their sport, Driediger et al., 2006). When an athlete is focused on recovering from their injury to get back to their sport, they may combine their use of CS imagery across both the sport skills and rehabilitation exercises. Combining these two functions of imagery may aide in athletes reaching their outcome goal of full recovery and reintegration into their sport, by facilitating their rehabilitation exercise performance (which should subsequently increase their speed of recovery). At the same time, this will prepare them for a return to sport by linking these rehabilitation exercises back to sport skills. As such, this transferability of images from the rehabilitative to sport skills should be encouraged in these injured young athletes.

Much like that of CS imagery, athletes used CG imagery for two purposes; sport strategy rehearsal, and rehabilitation strategy rehearsal. This result again merges the findings of previous research which has indicated that injured adult athletes use CG imagery to; rehearse sport specific strategies during rehabilitation (Driediger et al., 2006), and to rehearse rehabilitation specific strategies (Sordoni et al., 2000; Sordoni et al., 2002). Athletes who mentioned using CG imagery for rehabilitation strategy rehearsal, either reported imaging past experiences in rehabilitation to give them an indication of what to expect, or, broke their rehabilitation down into a stepwise process in which each exercise played a role in the larger aspect of recovery. This use of CG imagery for rehabilitative strategies could be a direct result of physical therapists’
perceptions of imagery, as the ultimate effectiveness of imagery may be a result of how imagery is viewed (Brewer, Jeffers, Petitpas, & Van Raalte, 1994). In fact, physical therapists view imagery as less effective than other mental skills such as goal setting (Brewer et al., 1994). Take for example a physical therapist who views imagery as beneficial to the rehabilitative process. They may outline a stepwise process in which their athlete will progress through a series of exercises while taking ample time to show or explain how the exercise should be completed (thereby facilitating the use of imagery to rehearse these exercises). In contrast, a therapist who does not view imagery as beneficial may simply breeze through their explanation of the progression of exercises to be completed prior to full recovery. Resulting from this, the athlete who received a sufficient explanation of the rehabilitative strategy that will be employed would likely be able to image these strategies, whereas without an effective explanation of the rehabilitative strategy, an athlete may not be able to use CG imagery for this purpose. As such, physical therapists should be taught the benefits and efficacy of imagery use in rehabilitation to best facilitate imagery use of this type.

With respect to MS imagery, athletes mentioned setting outcome goals to become fully recovered and able to return to play their sport again, which is consistent with past research (Driediger et al., 2006; Sordoni et al., 2000). Additionally, a few athletes in the current study also mentioned using process goals to keep their hopes up and gauge their progress in rehabilitation. Research within the sporting domain has indicated that a combination of both process and outcome goals are most beneficial for athletes (Jones & Hanton, 1996; Kingston & Hardy, 1997). Considering the pervasive nature of injuries (both psychologically and physically; Milne et al., 2005), athletes may overemphasize the outcome goal of a full recovery for them to return to their sport, thereby overlooking the processes necessary in which to reach that outcome goal. In light
of this, injured young athletes should emphasize both process and outcome goals in rehabilitation.

In support of previous research, many athletes in the current study reported using MG-M imagery for the need to recover from their injury (Evans, Hare, & Mullen, 2006). Athletes also touched on the use of MG-M imagery to facilitate their execution of rehabilitation exercise by increasing confidence on these tasks. This result differs from past research in which injured adult athletes rarely reported using MG-M imagery to build confidence (Driediger et al., 2006). This may be a result of the athletes using other types of imagery in rehabilitation to increase their confidence. Previous work by Hare, Evans and Callow (2008) also showed that injured athletes may use different types of imagery to achieve different outcomes. This is noted in the revised applied model of imagery use for sport, dance, exercise and rehabilitation, which suggests the function of imagery use does not necessarily always have to match the outcome (Cumming & Williams, 2013). Considering this, it may be that athletes in the current study used CS imagery instead of MG-M imagery to increase their confidence on a certain sport or rehabilitative skill. As such, these athletes should be encouraged to use imagery for the rehearsal of sport skills in addition to that of rehabilitative skills, as this may facilitate confidence in the injured athlete.

Athletes reported using MG-A imagery to manage their anxiety surrounding their injury and not being able to participate in sport, which follows suit with past research by Driediger et al. (2006). Those who did mention using MG-A imagery commented on benefitting from it, such that it would help keep them “sane”, and may have viewed it as facilitative to their rehabilitation. As such, injured young athletes should be encouraged to use MG-A imagery to manage any anxiety associated with their injury.
When taking a closer look at the novel functions of young athletes’ use of imagery in rehabilitation, athletes reported using both pain management and healing imagery, but did not report using imagery for re-injury prevention purposes. This former finding is similar to that of Driediger et al. (2006) who found that adult athletes use the three pain management techniques noted above, as well as imaging the pain dispersing. Interestingly, young athletes in the current study did not report using pain management imagery to image the pain dispersing. This may be a result of younger athletes having fewer coping strategies to rely on than their older counterparts (Molton et al., 2008). Researchers found older adults used significantly more coping strategies when dealing with chronic pain, than both younger and middle aged adults (Molton et al., 2008). Despite potentially having fewer coping mechanisms, the young athletes in the current study who used pain management imagery still identified it as being beneficial in the rehabilitative process. As such, injured young athletes should be encouraged to use pain management imagery when experiencing pain during rehabilitation.

Similar to the results with adult injured athletes (Driediger et al., 2006), young athletes from the current study reported using both internal (e.g., imaging a torn ligament healing) and external (e.g., imaging strength or mobility returning to the injured area) healing imagery. Specific to internal healing imagery, and unique to the current sample, athletes mentioned the use of analogies that were either self-directed, or suggested by their physiotherapists or doctors. Although never identified in injured adult athletes, this result is unsurprising as imaging internal physiological healing processes requires a baseline anatomical and physiological knowledge (Heil, 1993), that would be far above that of most adolescents. As such, athletes commonly reported that physiotherapists and doctors gave them analogies relating to their injury, which allowed them to easily understand the anatomy and physiology of their injury and subsequently
facilitate their use of healing imagery. Further, athletes reported external healing images that were targeted at strengthening or mobilizing their injured area. Again, this finding is expected as mobility and strength are often assessed within rehabilitative programs (Wilk, Meister, & Andrews, 2002). Considering the efficacious nature of healing imagery (Ievleva & Orlick, 1991), perhaps a larger emphasis should be placed on external healing images rather than simply internal healing images driven by analogies, to ensure that athletes are reaping the benefits of healing imagery.

Contrary to that of Driediger et al. (2006) who found that injured adult athletes use imagery for re-injury prevention purposes, injured young athletes in the current study did not report using imagery for this purpose. Researchers have suggested that this type of imagery may be used by athletes to reduce re-injury anxiety by imaging their physical limit. It is important to note that the participants in Driediger et al. were athletes with “severe injuries” and therefore may have experienced significant re-injury anxiety and subsequently used injury prevention imagery to return to play. Athletes in the current study may not have used this type of imagery either because their injury was not severe enough, or simply that they did not experience significant re-injury anxiety. This lack of anxiety regarding re-injury was evident within the current study as athletes reported feeling “invincible” prior to their injury. Despite this, athletes of all ages may benefit from using injury prevention imagery to be able to make an efficient and safe return to play. As such, young athletes should be encouraged to use this type of imagery during injury rehabilitation.

Athletes commented on using imagery a few times per week (two or three), for anywhere from 30 seconds to 15 minutes in duration while at their rehabilitative appointments. This finding was expected, as the goals associated with the athletes’ rehabilitation would be most
salient while at the rehabilitative facility. Contrary to the findings of the current study, Driediger et al. (2006) found that athletes’ imagery sessions would last a duration of five to 30 seconds, a much shorter period than what was found in the current study. This longer duration of imagery sessions could be due to an emphasis placed on recovery, that is driven by the negative social impact that many young athletes experience when they are injured. Within physical activity and sporting contexts, significant others in youths’ lives serve as primary socializing agents, and when young athletes are not able to play their sport because of an injury, they may miss out on this socialization (Smith, 2003). This socialization within youth athletes may be of utmost concern to them, as social acceptance and affiliation have been found to be sources of enjoyment (Scanlan et al., 1989) and have been correlated with both perceived and actual physical competence (Evans & Roberts, 1987; Weiss & Duncan, 1992). As such, these injured young athletes should place importance on any technique in which they feel may speed up their recovery (e.g., imagery), to return to their sport and gain these social benefits of sport. Athletes also commented on a change in their imagery use from pre-injury to post-injury such that athletes tended to place an emphasis on their imagery use while they were injured, as well as after recovery in comparison to before their injury. As rehabilitation progresses, athletes get closer to returning to their sport, as such, somatic anxiety levels have found to increase. To combat this, athletes should use more imagery targeted toward this anxiety, such as MG-A imagery (Monsma, Mensch, & Farrol, 2009).

Many athletes also commented on the efficacious nature of imagery during rehabilitation. It was expected that the injured athletes would hold positive views of the effectiveness of imagery in rehabilitation similar to what has been documented with adult athletes (Brewer et al., 1994), as well as youth athletes in sport (Munroe-Chandler, Hall, Fishburne, O, & Hall, 2007).
Athletes in the current study provided descriptions of positive images which contained a healthy version of themselves in the future, usually participating in their sport much like what was found with injured adult athletes (Driediger et al., 2006). Athletes also described negative images associated with their injury, including, imaging the injury itself, or being demotivated by the injury. Consistent with Evans et al. (2006) athletes reported “re-living” their injury through their images, which seems likely given injuries can be a traumatic experience for young athletes (McDonald & Hardy, 1990). As such, athletes should avoid these negative images if at all possible by consciously focusing on images associated with more positive aspects of their rehabilitation (e.g. MS imagery for goals, CS imagery for rehabilitation exercise rehearsal).

Athletes in the current study reported using both visual and kinesthetic modalities of imagery during the rehabilitative process. This result differs slightly from that of Driediger et al. (2006), as they found that injured adult athletes used visual, kinesthetic, and auditory modalities within their images, while Munroe-Chandler, Hall, Fishburne, O, and Hall (2007) found that young athletes use visual, auditory, kinesthetic, and tactile modalities in sport. However, it should be noted that Driediger et al. found only occasional references to athletes incorporating sound into their images, and could have been a function of individual differences within their participants. Regarding their use of visual imagery, athletes reported actively seeing themselves performing a task using internal (i.e., looking out as if you were seeing it yourself) and external (i.e., looking at yourself from afar) perspectives. Considering the physical impact that injuries have on athletes, it is not surprising that athletes would focus on the physical components of their images such as how certain movements would feel (i.e., kinesthetic) or look (i.e., visual). Athletes should seek to combine these modalities in order to facilitate the creation of a detailed image.
The current study provides a novel addition to the literature regarding when, where, why, and what young athletes are imaging during injury rehabilitation. Considering imagery has been shown to be beneficial in enhancing the rehabilitative process among injured adult athletes, the results of present study also support the notion that young athletes use imagery in rehabilitation, and, moreover, find it to be beneficial in enhancing the rehabilitative process. Furthermore, injured young athletes image similarly to their adult counterparts during rehabilitation, with only subtle differences as indicated above. Considering the effects of healing imagery, future research should seek to tease out the mechanism behind the physiological benefits of a psychological tool such as healing imagery. Emerging research has proposed a new theory regarding mind-body interaction in healing, which posits that psychological interventions create a conflict between the perceptual modalities of the immune system and vision (or touch) (Bedford, 2012). It is then this conflict which is thought to result in a change in the immune system as a compensatory response to realign the modalities (Bedford, 2012). This immune response may explain the physiological benefits of psychological tools such as healing imagery.

The current study is not without limitations. The participants’ previous experience with imagery as well as their imagery ability was not assessed prior to the interviews and therefore may have influenced the results. Some participants may have had more experiences to draw upon when creating images, as well as some participants may have been more effective at creating vivid images to recall upon. Another limitation to this research was the retrospective nature of the study. Considering the criteria to participate included being injured within the last five years, there may be some natural interference and decay in the accuracy of memories during such a lengthy period (Bahrick, Bahrick, & Wittinger, 1975; Greene, 1992). Despite this, emotional events have been shown to increase arousal levels and subsequently this has been shown to
improve memory for central information (Heuer & Reisberg, 1990). Considering injuries may cause a great deal of stress and elicit an emotional response for these young athletes, their recall of their imagery use during rehabilitation may have been somewhat preserved (Green, Green, & Walters, 1979). Subsequently, the emotional and stress response of the athlete may be influenced by the severity of the injury considering more severe injuries may cause a greater emotional response (Mainwaring, Bisschop, Comper, Richards, & Hutchison, 2010). The current study did not control for the severity of the athletes’ injuries and as such, is limited by the potential for improved recall of more severe injuries. Moreover, due to the use of inductive and deductive techniques, questions in the interview guide were created specifically to assess images relating to when, where, why and what athletes were imaging in injury rehabilitation. As such, it is possible that these questions may have primed participants to respond in a manner similar to that of previous research and may not have revealed any differences in imagery use during athletic injury rehabilitation.

Another limitation of the current study was that a convenience sampling methodology was used to obtain the participants. This limitation may explain the findings regarding CS and CG types of imagery in rehabilitation merging that of previous research. Considering participation in the current study was volitional, the athletes in the current study may represent a sample of motivated individuals who valued their rehabilitative experience, and as such, adhered to their rehabilitative plan. Sordoni et al. (2000) rationalized their finding that injured adult athletes used cognitive imagery use for sport specific functions and not rehabilitative specific functions, as a by-product of lesser importance placed on the rehabilitative exercises than their sport skills. If the current participants were motivated to recover and believed their rehabilitative exercises and strategies were important in their recovery (as the results of this study would
indicate), then this limitation may explain why athletes reported using CS and CG imagery for rehabilitation skills/strategies and sport specific skills/strategies.

Despite these limitations, the present study provides an overview of when, where, why and what young athletes are imaging during injury rehabilitation. The practicality of these results must be assessed through future intervention based research examining the exact effect of each type of imagery in rehabilitation. Additionally, these findings will be beneficial in educating athletes on different types of imagery than what they are familiar with, to enhance rehabilitative outcomes. In applied settings, these findings may also benefit physical therapists in that they can use this information to target certain types of imagery in rehabilitation, to enhance the rehabilitative process for younger athletes (with an emphasis on using analogies to facilitate healing imagery use). Overall, implementing imagery in conjunction with physical rehabilitation should enhance the rehabilitative process for young injured athletes, thereby increasing the rates of physiological recovery.
References


Figure 1. The functions served by the imagery use of injured youth athletes during rehabilitation.
Figure 2. The content of imagery among injured youth athletes during rehabilitation.
### Table 1

**Participant Characteristics and Injury Details**

<table>
<thead>
<tr>
<th>Participant Number</th>
<th>Age at time of injury</th>
<th>Gender</th>
<th>Sport</th>
<th>Injury</th>
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*Note.* Athletes’ current age ranged from 18-20 years.
LITERATURE REVIEW

Introduction

In 2010 Statistics Canada found that adolescents, age 12-19 years, had the highest incidence rate of injury among any age group, with 26.4% of adolescents experiencing an injury in 2009 alone. Injuries play a pivotal role in an athlete’s life, potentially causing high levels of stress and unease (Milne, Hall & Forwell, 2005). With these high rates of injury among youth athletes, many have to undergo extensive rehabilitative treatment to return to their sport. One tool that has been found to enhance the rehabilitative experience and perhaps even increase the rate of physiological recovery in adult athletes is imagery (Cupal & Brewer, 2001; Ievleva, & Orlick, 1991). The overall purpose of this study was to qualitatively examine injured youth athletes’ use of imagery during rehabilitation. The review of the relevant literature is divided into five general parts (a) imagery, (b) injury rehabilitation, (c) strategies used in rehabilitation, (d) imagery in rehabilitation, and (e) imagery in youth rehabilitation.

Imagery

Imagery is a mental skill that has been shown to benefit motor performance in both children and adult populations (Hall, 2001). More specifically, imagery has been found to have a positive effect on skill acquisition (Hall, Schmidt, Durand, & Buckolz, 1994), motivation (Beauchamp, Halliwell, Fournier, & Koestner, 1996; Martin & Hall, 1995), concentration (White & Hardy, 1998), as well as self-confidence and self-efficacy (Callow, Hardy, & Hall, 2001; Evans, Jones, & Mullen, 2004; Munroe-Chandler, Hall, & Fishburne, 2008).

Despite the numerous definitions of imagery that have been proposed over the years, Morris, Spittle and Watt (2005) acknowledge that imagery is simply creating or recreating
experiences mentally. A more encompassing definition, provided by White and Hardy (1998) define imagery as:

an experience that mimics real experience. We can be aware of ‘seeing’ an image, feeling movements as an image, or experiencing an image of smell, taste or sounds without experiencing the real thing… it differs from dreams in that we are awake and conscious when we form an image. (p. 389)

Important within this definition is the notion that individuals are consciously aware and in control of their images, which differentiates imagery from dreaming. Furthermore, imagery has been found to be the result of spontaneous mental processing, suggesting that individuals of all ages including children are capable of imaging and in fact, do so (Kosslyn, Margolis, Barrett, Goldknopf, & Daly, 1990; Piaget & Inhelder, 1971). In fact, Weiss (1991) noted that imagery is a beneficial mental skill for young athletes, and one that can improve significantly with practice.

**Imagery Theories**

A theory is defined as “a systematic arrangement of fundamental principles that provides a basis for explaining a phenomenon” (Martin, Moritz, & Hall, 1999, p. 248). Important within this definition is the fundamental nature of theories such that they provide a base of knowledge that must be understood before researching a concept any further. It is especially important to understand the basic theories of imagery as Morris et al. (2005) posited that imagery itself may be the result of several individual or combined processes which may include psychoneuromuscular or cognitive explanations.

**Psychoneuromuscular theory.** Carpenter (1894) was the first to develop the ideo-motor principle, in which he suggested that localized muscular activity occurs during mental imagery. This ideo-motor principle would later form the basis of Jacobson’s (1930) psychoneuromuscular
theory, in which the muscular activity that results from mental imagery is identical in pattern to
the muscular activation seen during physical performance of a task, albeit weaker in magnitude
(Hale, 1994; Richardson, 1967). Despite the imaged event not resulting in an overt movement of
the muscles, efferent signals are sent from the brain to the muscles, resulting in this weakened
activity within the musculature. It is suggested that this muscular activity provides subsequent
kinesthetic feedback to the brain, which in turn is used to adjust future trials, therefore improving
performance through a mental blueprint of sorts (Richardson, 1967). Suinn (1984) provided
evidence for this when he observed that electromyogram (EMG) recordings coincided with
actual turns when a downhill skier had been instructed to think about racing.
Psychoneuromuscular theory also hypothesizes that a relationship should exist between the
magnitude of EMG activity during mental imagery, and the magnitude of subsequent
improvements in performance (Smith, Collins, & Holmes, 2003).

**Bioinformational theory.** Lang’s (1979) bioinformational theory merges three domains
of research: psychophysiology, cognitive psychology’s information processing theory, and
behavioral therapy. Lang posits that the brain’s information processing is a direct result of
mental images and that these mental images are composed of a specific set of propositions in the
brain. Propositions represent the structure behind mental images. These propositions fall into two
basic categories, stimulus and response. Stimulus propositions relay information regarding
details of imaged environmental conditions or characteristics, while response propositions
transmit information pertinent to the physiological and behavioral reactions that result from the
evoked image. Therefore, Lang proposed that mental images are the result of assessing stimulus
propositions and reacting to them with response propositions. Further, the vividness and intensity
of mental images is dependent upon the stimulus and response propositions. Response
propositions mimic actual behaviors that would be displayed based on a person’s physiological reactions to stimuli (e.g., arousal) and, as such, are modifiable. Due to this, imagery scripts that contain a larger number of response propositions in relation to stimulus propositions result in greater physiological reactions (Bakker, Boschker, & Chung, 1996). Important within this theory, is that images are composed of not only environmental characteristics, but also physiological and behavioral responses.

**The triple-code theory.** Ahsen (1984) developed a cognitive model that sets out three components, which are integral to understanding how imagery affects performance. The first component is the image itself, which Ahsen described as the internal sensation that encompasses all the attributes of an actual sensation. The second component is the somatic response, which outlines that an image evokes a psychophysiological arousal within one’s body. The third component within the model is the meaning of the image. Given this last component, it is suggested that despite identical imagery scripts, the experience with each individual will differ. Although the first two components of Ahsen’s theory are similar to the response and stimulus propositions identified by Lang (1979), it is this last component of the model (i.e., meaning) that differentiates Ahsen’s triple code theory from other theories of imagery. In fact, Ahsen suggested that the meaning of the image should be significant enough to result in a behavioral response, thus enhancing performance.

**Theory of functional equivalence.** When imagery activates similar areas of the brain that are working when an individual physically engages in a task, this is referred to as functional equivalence (Decety, 1996; Johnson, 1982). Evidence for this theory is found within the neurophysiological and behavioral brain imaging studies such that areas of co-activation within imaging and observing a task correspond to the areas of neural activity seen when engaging in a
task (Buccino et al., 2001; Ehrsson, Geyer, & Naito, 2003). Therefore, with respect to the theory of functional equivalence, imagery can strengthen the neural activity that would occur during execution of a task, consequently facilitating the learning of skills through imitation (Jeannerod, 2001). This theory also provides detail that is useful in the practical application of imagery to enhance performance, as it suggests that incorporating imagery before executing a task will allow for preparation and planning of a movement, therefore enhancing the performance of that movement (Murphy, Nordin, & Cumming, 2008). The benefits associated with the effectiveness of imagery in priming task execution and outcome success have been well documented, therefore solidifying the importance of this theory (Nordin & Cumming, 2005; Short et al., 2002).

To provide an empirical and theoretical base for scientific studies and applied work with imagery use, Holmes and Collins (2001) developed the PETTLEP model. This model is based strongly on the findings from research within the neuroscience domain, such as the theory of functional equivalence, which provides performance enhancing benefits through priming and imitational learning (Jeannerod, 2001; Murphy et al., 2008). In light of this, the PETTLEP model was designed to help with the practical application of producing this functional equivalence.

The PETTLEP model is an acronym relating to recommendations and considerations for sport psychology professionals when implementing motor based imagery interventions (Smith, Wright, Allsopp, & Westhead, 2007). The Physical component relates to an athlete’s physical responses in the sporting situation. More specifically manipulating the physical aspects of the imagery to closely represent the actual execution of the task being imaged, is suggested to be beneficial. The Environmental component proposes that motor imagery is most effective when the environment imaged closely matches the actual environment that the task will be performed in. Building upon the environmental component, Holmes and Collins (2001) suggested that the
Task being imaged should also closely match the actual task being performed, and the same thoughts, feelings, and actions associated with the task, should be imaged. With respect to Timing, it is recommended that the temporal characteristics of the image, should match the temporal characteristics of the action. Simply put, the task should be imaged at real time. The learning component refers to the idea that as the skill level of the imager increases, the imagery content should change to accurately reflect their new skill level. As one learns how to more effectively execute the task, regular reviewing of their image content is essential to gain the benefits of functional equivalence. The Emotional component of the model proposes that the emotional meaning that one attaches to a situation must be considered when imaging that situation. Finally, the Perspective component of the model relates to the way that the imagery is being used Holmes and Collins (2001) posited that for an image to be effective it is most beneficial to create the image from a variety of perspectives such as internal visual (i.e., first person) or external visual (i.e., third person). Overall the PETTLEP model for imagery use has been found to provide accurate advice, across a diverse range of tasks and populations to athletes in how to best use imagery for its performance enhancing benefits (Smith et al., 2007).

**Dual code theory:** First described by Paivio (1971) dual code theory implies that there are two cognitive subsystems (i.e., mental structures and processes) that are specialized to represent and process information. The mental structures refer to networks of verbal and non-verbal representations, while the processes relate to the activation of these structures. The first cognitive subsystem was suggested to be used when processing non-verbal objects or events (i.e., imagery), while the second subsystem was posited to help process language. Considering this, Paivio also identified two different representational units: “imagens”, which are used to represent mental images, and “logogens”, that are used to describe verbal entities/ information that
underlies our use of language. Paivio proposed that the non-verbal and language systems work together simultaneously in that language deals with processing both the input and output of linguistic information, as well as spontaneously evoking a symbolic meaning. Further, logogens work in sequence such that one word comes after another with proper syntax, while imagens work in a simultaneous fashion such that all parts of the image are available at the same time. More specifically, three separate types of cognitive processing: representational, referential, and associative were identified (Paivio, 1971). Representational processing refers to the verbal or non-verbal symbolic images. Referential processing involves the activation of the verbal system by the non-verbal system or vice-versa, while associative processing refers to representations being activated within the same verbal or non-verbal system. As a whole, dual code theory gave rise to the idea of imagery serving a cognitive function.

Much of the performance imagery research in the last 30 years is a result of Paivio’s (1985) analytic framework, which expanded upon his earlier dual code theory, such that imagery serves both a cognitive and motivational function that operates at either a specific or general level (See Figure 3). Cognitive specific (CS) imagery refers to the mental rehearsal of motor skills such as a free throw in basketball, while cognitive general (CG) imagery involves mental rehearsal of strategies, routines, or game plans (e.g., a gymnastics routine). Motivational specific (MS) imagery refers to imaging success or goal achievement such as winning a game, while motivational general (MG) imagery refers to imaging the anxiety or arousal associated with performance (e.g., rapid heart rate).

Paivio’s (1985) analytic framework served as a comprehensive description of the various functions of imagery. In subsequent years, Hall, Mack, Paivio, and Hausenblas (1998) expanded the MG function of imagery into two sub-categories; arousal and mastery (See Figure 3).
Motivational general-arousal (MG-A) imagery continued to refer to images associated with the emotion or arousal linked with performance, while motivational general-mastery (MG-M) imagery referred to images of being mentally tough, or confident in the performance. Despite this framework being widely used within sport imagery research, it does not acknowledge either situational or personal influences on the type (function) of imagery used (Martin, Moritz, & Hall, 1999).

As a response to the criticisms of Paivio’s (1985) analytic framework, Martin et al. (1999) developed an applied model of imagery use in sport emphasizing that images will evoke a distinct meaning to individuals (See Figure 4). Martin et al. suggested that these differing meanings between individuals is paramount in determining not only what type of imagery a person uses, but also how they respond to these images in their behaviors, cognitions, and emotions. To account for these personal and situational differences, Martin et al. identified four key constructs that affect the use of imagery, including the sport situation, imagery type, imagery ability, and the outcomes of the imagery use.

In relation to the sport situation, athletes use imagery during practice (Hall, Rogers, & Barr, 1990), just prior to or during competition (Munroe-Chandler, Giacobbi, Hall, & Weinberg, 2000), and during rehabilitation (Green, 1992). Moreover, research has found that athletes tend to use imagery most often during competition, and to a less degree in practice (Munroe-Chandler, Hall, Fishburne, & Strachan, 2007). When assessing the type of imagery used, the model focuses on the five types of imagery (i.e., CS, CG, MS, MG-A, MG-M) identified by Paivio (1985) and Hall et al. (1998). Martin et al. (1999) proposed that athletes can independently or simultaneously use each type of imagery, suggesting they are not mutually exclusive. To conceptualize the relationship between the type of imagery used and the outcome
of the imagery use, Martin et al. outlined the importance of imagery ability. An individual’s ability to use kinesthetic and visual imagery moderates the relationship between the type of imagery used and the outcome of that imagery. Kinesthetic imagery has been described as the feelings of force and motion or the mental sensations associated with bodily movement (Moran & MacIntyre, 1998), while visual imagery refers to the perception of seeing and the visual processing of information (Morris et al., 2005). Keeping in mind the type of imagery used and an individual’s ability to use visual and kinesthetic imagery, Martin et al. posited that different types of imagery are used to achieve different outcomes, and that the type of imagery used should match the outcome.

This model has been widely used in the applied domain and much research has supported its effectiveness (Cumming & Ramsey, 2009). Despite this, a criticism of this model is that it does not represent a comprehensive account of the types of imagery used across various domains outside of sport (i.e., dance, exercise and rehabilitation; Cumming, & Williams, 2013). For example, outside of the five main types of imagery, research has identified within rehabilitative settings that individuals may use imagery for healing or pain management purposes (Driediger, Hall, & Callow, 2006). Furthermore, this applied model has been criticized for suggesting that the type of imagery employed should always match the desired outcome, as recent research has shown that imagery can bring about other unintentional outcomes and serve more than one function (Nordin & Cumming, 2005).

To provide a more inclusive model based on recent research, a revised model of Martin et al.’s (1999) applied model, was presented by Cumming and Williams (2013). This revised model expanded upon the consideration of individual characteristics (i.e., who is imaging), as well as differentiating between what is imaged and why individuals image. Additionally, Cumming and
Williams’ (2013) revised model was more lenient regarding the relationship between the type of imagery used and the functional outcome of its use. These authors suggested that the types of imagery may be combined to achieve a goal that may be prevalent across categories which is in concert with recent research published since Martin et al.’s (1999) applied model. As imagery research continues to gain popularity, a better understanding of imagery will arise, which assuredly will lend further revisions to these models and theories.

**Youth Athletes’ Use of Imagery**

Over the past 30 years much research has focused on adult athletes’ use of imagery, leaving a large gap regarding children and youth athletes’ use of imagery. Research assessing imagery use within youth athletes plays an integral role in understanding potential developmental differences in imagery use. In addition to this, knowledge regarding young athletes’ (of various age cohorts) use of imagery is imperative when designing imagery interventions (Munroe-Chandler, Hall, Fishburne, O, & Hall, 2007). As of late, there has been an increasing amount of research assessing youth athletes’ imagery use and as such, qualitative and exploratory research will be discussed first, followed by quantitative research focusing on both cognitive and motivational imagery.

**Qualitative sport imagery research.** To provide qualitative information regarding youth athletes’ imagery use, Munroe-Chandler, Hall, Fishburne and Strachan (2007) utilized a focus group methodology following the four W’s framework (Munroe et al., 2000) to assess young athletes’ use of imagery (7-14 years). The four W’s framework provided by Munroe et al. (2000) is an interview guide that is structured around the four main concepts of where, when, why, and what athletes are imaging. The age range of 7-11 years was examined with the purpose of assessing possible developmental differences in imagery use based on Piaget and Inhelder’s
(1971) concrete operations stage of cognitive development. Once children reach the age of seven years, a key stage occurs such that children can represent static images but do not have the ability to produce dynamic moving images (Piaget & Inhelder, 1971). It was further suggested that this difficulty in producing dynamic moving images can impede children’s ability to judge outcomes resulting from physical transformations. Despite this, as children grow older (8-12 years) their ability to produce transformational images improves. After the age of 12, youth can make hypothetical deductions, and after age 14 adolescents maintain imagery ability that is similar to their adult counterparts (Piaget & Inhelder, 1971).

Munroe-Chandler et al.’s qualitative study (2007) with young athletes was the first of its kind to consider age differences in imagery use. Emerging from the focus groups, young athletes reported using imagery in both training and competition for all five types of imagery (i.e., CS, CG, MS, MG-M, MG-A), much like their adult counterparts. Despite many similarities between youth and adult athletes’ use of imagery, age differences were noted within the youth. For example, all athletes, save the 7-8 year olds, reported using imagery outside of practice and post-competition. Munroe-Chandler, Hall, Fishburne, and Strachan (2007) suggested that this may be a result of young athletes sampling different sports and as such these athletes may not place enough importance on one sport to use imagery outside of practice or after competition, and may be motivated by fun or enjoyment (Baker, 2003). Furthermore, age differences were also noted within the motivational types of imagery. Older youth (ages 11-14 years) used more subcategories of the motivational types (MG-A and MG-M) than their younger counterparts (7-10 years). This result was attributed to the fact that many younger athletes may have yet to experience anxiety provoking sport situations, or those that require mental toughness (Munroe-Chandler, Hall, Fishburne, & Strachan, 2007).
In addition to differences being found between the age groups, gender differences were also noted. Female athletes reported using MG-A imagery to control their arousal as well as MG-M imagery to enhance their confidence, while male athletes did not report using imagery for either of these purposes. Munroe-Chandler, Hall, Fishburne, and Strachan (2007) suggested that this may be a result of the type of sports in which the male and female participants were recruited (i.e., dance or gymnastics versus soccer or volleyball) as well as the socialization that may occur within these sports. Sports such as gymnastics and dance may lead to higher levels of arousal and anxiety than some of the more popular sports in which young boys participate (i.e., volleyball or soccer). The authors suggested females in this study may have felt the need to use the motivational types of imagery to enhance their confidence and perceived ability to match that of their male peers (Gill, 2004). Finally, none of the male athletes reported using MG-M to enhance their mental toughness. The authors suggested that this may have been a result of the social desirability bias as many male athletes regard mental toughness as an inherent male characteristic and that they may have withheld their responses on this topic as a means to not appear mentally weak.

With respect to the cognitive types of imagery, the results indicated that males ages 7-10 years did not report using images related to sport specific skills (i.e., CS). Again, Munroe-Chandler, Hall, Fishburne, and Strachan (2007) posited that young male athletes may have less developed information processing skills than their female peers who reported using more controlled and conceptual images.

In an extension of Munroe-Chandler, Hall, Fishburne and Strachan’s (2007) study, Munroe-Chandler, Hall, Fishburne, O, and Hall (2007) assessed the content of what young athletes (7 to 14) were imaging. Using the same age cohorts (i.e., 7-8, 9-10, 11-12, 13-14)
responses from the young athletes indicated that the content of what they were imaging could be grouped into five general categories: imagery session, effectiveness of imagery, nature of the imagery, the surroundings, and the type of imagery employed matching what was found by Munroe et al. (2000) with an adult sample. Within these general findings, the younger age groups (ages 7 to 10) did not report using all of the aforementioned five categories, while the older age groups (11-14) did. This result provides some support for previous research by Kosslyn et al. (1990) that had suggested that imagery ability is fully developed by 14 years of age. Furthermore, the present result builds upon this notion by asserting that athletes as young as 11 years of age may have image content similar to their adult counterparts. Finally, participants reported spontaneously using imagery, henceforth suggesting that imagery may be an innate skill.

Overall Munroe-Chandler, Hall, Fishburne, O, and Hall (2007) effectively illustrated that athletes as young as age seven report using imagery, similar to its use in an adult population, and that developmental differences are present and integral in the understanding of youth athletes’ imagery use. The following will address various cognitive and motivational outcomes associated with youth populations through the scope of both qualitative and quantitative research.

In a qualitative study examining youth athletes’ understanding of psychological skills including, imagery, goal setting, self-talk, and relaxation, McCarthy, Jones, Harwood, and Olivier (2010) asked athletes (ages 10-15) what mental imagery meant to them. Responses from the athletes indicated that imagery was found to be one of the best understood psychological skills and as a whole, the older athletes reported a better understanding of the psychological skills than their younger counterparts. In relation to imagery, the athletes reported understanding only three of the five main types of imagery as presented by Hall et al. (1998). Athletes reported
conceptualizing mental imagery as MS imagery (e.g., I see myself winning the match), MG-M imagery (e.g., imagining myself doing well), and CG imagery (e.g., seeing in my head what I want to happen). Interestingly, MG-A and CS imagery were not reported by any of the athletes, but this may have been due to a lack of probing in the open-ended questionnaires. Overall, McCarthy et al. further solidified the concept of developmental differences in imagery use, and understanding of imagery across youth athletes.

**Quantitative sport imagery research.** Evidence for the efficacy of cognitive imagery use was first provided by Li-Wei, Qi-Wei, Orlick, & Zitzelsberger (1992). These researchers examined the effects of a CS imagery intervention on youth table tennis players (7-10 years) and found that extra focus on CS imagery improved the athletes’ accuracy and overall technical skills. Building upon the notion that cognitive imagery may enhance sport performance in youth, Munroe-Chandler, Hall, Fishburne, and Shannon (2005) assessed the effects of a 7-week CG imagery intervention designed to improve three different soccer strategies (e.g., defending a corner kick, and both attacking and defending direct free kicks) with a competitive Under-13 female soccer team. Out of the three soccer strategies, only one strategy (defending a corner kick) yielded sufficient data to analyze the intervention. Although the results showed no significant changes in this strategy, expert raters found a small increase in the mean rating of performance, therefore suggesting that CG imagery interventions may be beneficial in improving performance.

In one of the few studies examining the relationship between imagery use, self-confidence, and anxiety in youth athletes, Vadocz, Hall and Moritz (1997) found no relationship between cognitive imagery and either anxiety or self-confidence in elite roller skaters (ages 12-18 years). In relation to this finding, the researchers noted the importance of assessing youth
under the age of 12, as differences in cognition have been found to be present across youth ages 7-11 (Piaget & Inhelder, 1971).

To fill this gap in the research left by Vadocz et al. (1997), a series of studies were conducted by Veraksa and Gorovaya (2012). They found that in sport young athletes ages 10-13 years, used motivational imagery most often, while older athletes (ages 14-18) used cognitive imagery in combination with motivational imagery, therefore suggesting that developmental differences may influence cognitive imagery use. Furthermore, the researchers suggested that as athletes age, they tend to follow a shift in the dominating type of imagery use from primarily motivational, to cognitive. In addition to noting these developmental differences in imagery use, Veraksa and Gorovaya (2012) found that a CS imagery intervention significantly increased performance on a soccer task involving dribbling and shooting on goal by 33% above and beyond that of the control group. Further evidence toward the benefit of CS imagery use within youth athletes is provided by Strachan and Munroe-Chandler (2006) as they found significant positive correlations between CS imagery and self-confidence in athletes ages 7-11 years.

A significant body of research has been dedicated to assessing MG-M imagery use, as it is strongly related to Bandura’s (1997) self-efficacy (i.e., situation specific confidence) theory. Bandura proposed that mental imagery was an effective tool to increase self-confidence and self-efficacy. More specifically, Bandura’s theory proposed a mechanism for this through which seeing yourself, or others (vicariously), performing a task will lead to increased self-efficacy with that task. Overall, youth MG-M imagery has been associated with increases in self-confidence (Munroe-Chandler et al., 2008; O, Munroe-Chandler, Hall, & Hall, 2014) as well as decreases in cognitive and somatic anxiety (Strachan & Munroe-Chandler, 2006). The other motivational type of imagery, MG-A, has been found to predict cognitive anxiety (Vadocz, Hall,
Furthermore, youth athletes who report higher sport confidence have been found to use MG-M imagery more frequently than their less confident peers (Moritz, Hall, Martin, & Vadocz, 1996).

To provide evidence for this link between MG-M imagery and self-efficacy in youth athletes, Munroe-Chandler and Hall (2005) assessed the effect of MG-M imagery scripts on reported levels of collective efficacy across three groups within a youth soccer team (forwards, midfielders and defense/goal keeper). The results indicated that two out of the three groups showed increases in collective efficacy through both training and competitive settings; suggesting that MG-M imagery may be effective in increasing self-confidence/efficacy.

Strachan and Munroe-Chandler (2006) assessed potential developmental differences within young elite athletes in regards to the relationship between imagery use, anxiety, and self-confidence. MG-M imagery use was a significant predictor of self-confidence across athletes ages 12-19 years, while MS imagery predicted self-confidence in athletes ages 7-11 years. Furthermore MG-A imagery significantly predicted cognitive anxiety for the younger cohort, but not for the older cohort. As a result of this, the relationship between imagery-function and imagery-outcome differed between the age groups, such that varying levels of sport ability and competition may result in athletes using imagery for different reasons. Although it is important to note these developmental differences in imagery use within elite youth athletes, it is important to study the non-elite athletic population as Hall (2001) indicated that adult athletes’ imagery use varies across levels of competition (non-elite versus elite).

To add to that of Strachan and Munroe-Chandler (2006), Munroe-Chandler et al. (2008) investigated the relationship between MG-M imagery use, self-confidence, and self-efficacy in both elite and non-elite youth athletes (11-14 years). The study comprised 125 male and female
soccer athletes across both recreational and competitive levels. Overall, the researchers found that MG-M imagery was a significant predictor of self-confidence and self-efficacy throughout both recreational and competitive soccer players. This result solidified the findings of Munroe-Chandler and Hall (2005), suggesting that MG-M imagery can be a tool used to increase self-confidence or self-efficacy. Individually MG-M was found to account for between 40% to 57% of the variance for both self-confidence and self-efficacy, while MG-A and MS imagery only contributed a small amount of the variance. Additionally, MS imagery was shown to be a significant predictor of confidence in only the recreational athletes.

To build upon previous findings, Parker and Lovell (2009) found recreational level youth athletes reported using MG-M imagery most frequently and MG-A imagery least frequently. Furthermore, elite youth athletes were found to report using MS imagery (goal achievement) most frequently, therefore establishing the differences in motivational imagery use across competitive levels of youth athletes (Parker & Lovell, 2009).

In recent years, O et al. (2014) investigated the relationship between MG-M imagery and self-efficacy using individualized MG-M imagery interventions with five youth squash players (8-13 years). Overall, the MG-M imagery interventions increased the self-perceptions of self-efficacy within three of the five participants. As expected, the frequency of MG-M imagery use increased over the course of the invention, and those who increased their use of MG-M imagery the most, subsequently experienced the greatest increases in perceptions of self-efficacy. This lends evidence toward the notion of imagery function matching the outcome of the imagery as suggested in the applied model of imagery use by Martin et al. (1999).

Injury Rehabilitation
Despite recent advances in equipment, training techniques, and coaching, a high rate of sport injury still exists. In 2009, 35% of the injuries experienced by Canadians occurred during sport or exercise (Statistics Canada, 2010). Within the United States in 2012, 1.35 million youth (19 years or younger) visited a hospital emergency department for a sport-related injury (Ferguson, Green, & Hansen, 2013). One explanation for this high rate of sport injury may be a result of individuals aspiring to be elite athletes engaging in risky behaviors such as long hours of training, and pushing through pain, to succeed in their sport, potentially leading to injury (Wiese-Bjornstal, 2010). Considering the rate of sport injury as well as the impact it can have on an athlete’s life (both physically and psychologically), it is imperative to find ways to mentally and physically help these athletes return to their sport (Milne et al., 2005). When analyzing factors that may influence an athlete’s risk of injury, most of the research has focused on physiological damage, thereby ignoring the effect of psychological risk factors. As such, this literature review will focus not only on what psychological factors may put an athlete at risk of an injury, but also the subsequent relationship between the physiological and psychological responses of an injured athlete.

A significant body of research has focused on athletes’ cognitive, emotional, and behavioral responses to injury as these factors have become increasingly important in improving the rehabilitative process and enhancing recovery (Heil & Podlog, 2012). More specifically, these cognitive, behavioral, and emotional responses may in fact affect the physiological healing of an injury (Brewer, 2007). Furthermore, once an injury has occurred, athletes must contend with, the physical, mental, and emotional challenges associated with rehabilitation. Theories and models outlining not only psychological risk factors for injury, but the psychological responses of an injury during rehabilitation will be outlined below.
Theories of Psychological Factors and Injury Occurrence

**Stress-injury model.** One conceptual model that has focused on psychological factors related to injury occurrence is Williams and Andersen’s (1998) stress-injury model, which proposes that an athlete’s appraisal and response to a potentially stress inducing situation can affect the athlete’s susceptibility to injury. The key aspect within this model is the stress response by the athlete which is thought to be on a continuum such that an individual’s cognitive appraisal of a potentially stressful situation is at the base, while the attentional and physiological response to stress, are on the other end. That is, an athlete will be more likely to be injured if the injury creates an attentional or physiological response to the stressor (Williams & Andersen, 1998). If an athlete appraises a situation as stress inducing, the negative attentional factors which may arise include distraction and peripheral narrowing, while the physiological changes may encompass muscular tension, fatigue, and coordination (Williams & Andersen, 1998). As is evident, the appraisal of a potentially stressful situation is the key aspect of this model.

To build upon this model, Williams and Andersen (1998) suggested three main categories of variables including personality traits, history of stressors, and coping resources, which all influence the magnitude of the stress response and subsequently the likelihood of injury. In regards to personality traits affecting the stress response, traits such as competitive anxiety, trait anxiety, and Type A behaviors are all related to increased likelihood of becoming injured (Brewer, 2007; Johnson & Ivarsson, 2011). Furthermore, athletes who report negative mood states (i.e., anger) or mood disturbances (i.e., depression) are more likely to become injured and have their injuries be more severe (Appaneal & Habif, 2013). When assessing the effect that a history of stressors has on the stress response, individuals who have been previously injured, who have experienced major life-event stress or who have to deal with chronic daily hassles, are
more susceptible to future injuries (Ivarsson, Johnson, & Podlog, 2013; Rogers & Landers, 2005). Finally, this model also suggests that those who utilize adaptive coping strategies (i.e., arousal control, thinking clearly under stress), will be less likely to incur an injury (Rogers & Landers, 2005). Research by Ivarsson and Johnson (2010) provided evidence for this relationship with coping strategies and injury through their findings that soccer players who use ineffective coping strategies (i.e., self-blame) are at a higher risk of injury than those who use effective coping strategies (i.e., goal setting). Overall, this theory highlights the importance of individual differences across personalities, history of stressors, and coping strategies.

**Models of Injury Rehabilitation**

The models used to outline the process of injury rehabilitation fall under one of two domains: grief-loss stage models or cognitive appraisal models. Grief-loss stage models suggest that when athletes are injured, they may experience a grief related to non-participation in an enjoyable activity, loss of fitness, or a loss of social contact among others. It is these losses and grievances that are proposed to affect the rehabilitative process for the athlete. Unlike the grief-loss stage models, cognitive appraisal models are designed to incorporate individual differences within the athletes, whereby each athlete will react differently to the stressors associated with athletic injury rehabilitation. In this review of the literature, the grief-loss stage models will be discussed first, followed by the cognitive appraisal models.

**Grief-loss models.** Many grief-loss stage models have been proposed for athletic injury rehabilitation, and most of those grief-loss models stem from the influential work of Elizabeth Kübler Ross’s (1969) *On Death and Dying*. Kübler-Ross interviewed terminally ill patients and found that the patients moved through a series of stages as they came to accept their death: disbelief, denial and isolation, anger, bargaining, depression and acceptance, and resignation.
Important within grief-loss stage models is that an injury represents a loss of some aspect of the self that follows a predictable pattern of responses (Heil & Podlog, 2012). Rotella (1982) was one of the first sport psychologists to adopt this model within sport injuries. Rotella suggested that athletes would undergo a similar emotional response to an injury to that of terminally ill patients. In support of this, athletes report a sense of loss over not being able to participate in their sport, which in turn may lead to feelings of isolation or alienation from the rest of the team (Tracey, 2003).

To utilize these grief-loss stage models in the athletic injury domain, Gordon and Lindgren (1990) proposed a four-stage process composed of denial, anger, depression, and acceptance. To provide more simplicity, Heil (1993) developed a grief-loss model that combined the anger and depression stages of Gordon and Lindgren’s (1990) model, resulting in only three stages: distress (e.g., anger, anxiety and depression), denial (e.g., refusing to accept the injury), and determined coping (e.g., using resources surrounding the individual to aid in the recovery process). By the same token, two-stage models have also been proposed, which suggested that athletes’ emotional responses to injury shift from negative to positive as the rehabilitative process evolves (McDonald & Hardy, 1990).

Overall, grief-loss stage models have been widely criticized for an inconsistency in the number of stages that athletes experience when injured, as well as for failing to account for the individualized nature of the injury response (Evans & Hardy, 1995). It is clear that every athlete may interpret the loss of participation in sport differently, and as such, may not go through all of the stages presented in the models (Brewer, 2007).

**Cognitive appraisal models.** Green, Green, and Walters (1979) developed the biofeedback theory for mind-body self-regulation as a means to provide a comprehensive model
that includes individualized responses to the injury. This theory was based heavily upon the notion that a relationship exists between a person’s psychological and physiological states. Green et al. postulated that for every physiological change that occurs in the body, a subsequent change in the mental-emotional state of the person occurs. When assessing this theory through the scope of an injury, it suggests that a physiological change such as an injury will cause a change in that person’s psychological well-being.

Similarly, the integrated model of response to sport injury focuses on individual differences in athletes’ response to injury (Wiese-Bjornstal, Smith, Shaffer, & Morrey, 1998). The interplay between pre-injury, post-injury, personal and situational factors, which affect how an athlete psychologically interprets their injury, is integral to this model (Wiese-Bjornstal et al., 1998). Pre-injury factors such as personality, a history of stressors, and coping mechanisms, as well as post-injury factors such as injury severity, and recovery status, all affect an athlete’s cognitive appraisal of an injury. Important within this model is the change in athlete’s cognitive appraisal of their injury, which in turn influences their emotions and outward behaviors regarding their injury. More specifically, these cognitive and affective factors are posited to change behavioral responses (e.g., rehabilitative adherence, coping, social support), which then influence physical and psychosocial rehabilitative outcomes (e.g., post injury performance and well being). Overall there has been significant empirical support for this model as research has found that aspects of cognition post-injury can be affected, such as reduced self-esteem, and time differences in sport self-confidence over the course of rehabilitation (Granquist & Brewer, 2013; Heil & Podlog, 2012; Quinn & Fallon, 1999).

The biopsychosocial model, put forth by Brewer Andersen, and Van Raalte (2002), describes the relationship between biological, psychological and social responses to injury
rehabilitation. Brewer et al. propose seven dimensions that influence the rehabilitative process: injury characteristics, socio-demographic factors, biological factors, psychological factors, social and contextual factors, intermediate biopsychological outcomes, and sport injury rehabilitation outcomes. The sport injury rehabilitative process begins with the occurrence of the injury including the location on the body, cause, severity, and history of previous injuries, which all affect the biological (i.e., tissue repair, metabolism, sleep), psychological (i.e., personality and affect) and social dimensions (i.e., social networks, situational characteristics, rehabilitation environment). Similarly, socio-demographic factors such as age, gender and socioeconomic status also have an effect on the biological, psychological and social dimensions. Moreover, Brewer et al. posits that these three variables (biological, psychological, and social) affect intermediate injury rehabilitation outcomes such as range of motion, strength and endurance. Finally, the intermediate outcomes subsequently influence the overall rehabilitation outcomes, such as functional performance, readiness to return to sport, and quality of life after the injury. Important to note within this model is the central role that psychological factors play, as the researchers suggested that psychological factors are reciprocally related to the biological and social factors, as well as the intermediate and final rehabilitative outcomes.

The neural training hypothesis stipulates that imagery creates adaptive changes in the same central processes that increase muscular activation during training (Enoka & Fuglevand, 1993; Sale, 1988). Sale (1988) proposes that strength performance is dependent upon not only the muscular activation itself, but the ability of the nervous system to activate the correct muscles to a certain degree (i.e., quality and quantity of muscular activation). Enoka and Fuglevand (1993) expanded upon this proposition by suggesting that imagery may play a role in facilitating these neural adaptations. The exact mechanism is not well known, but research has shown that
neural adaptations in motor unit recruitment and firing patterns can occur with imagery use (Enoka & Fuglevand, 1993; Ganis, & Schenda, 2008). This theory suggests that with a physiological injury, the use of mental imagery can stimulate neural adaptations that may facilitate recovery as well as keeping motor patterns intact.

Injuries in Youth Sport

Statistics Canada (2010) found that adolescents (12-19 years) had the highest incidence rate of injury among any age group, with 26.4% of adolescents experiencing an injury in 2009 alone. Additionally, Statistics Canada (2010) reported that approximately two thirds (66%) of injuries among young people (12-19 years) were related to sport, more than twice as high as working age adults (29%), and close to seven times higher than seniors (9%). As is evident from these statistics, adolescents are at risk for injury and at an even greater risk if they participate in sport.

Strategies Used During Rehabilitation

Considering the various stressors placed on youth athletes, and the effects of stress on the body, the sporting environment is primed for injury occurrence (Anshel & Delaney, 2001; Williams & Andersen, 1998). Injuries tend to be physiological in nature, but this physiological damage can be shortly followed by psychological damage (Milne et al., 2005). As a whole, the recovery process can be compromised by a failure to address psychological factors (Heil, 1993; Ievleva & Orlick, 1991). Within the integrated model of psychological response to sport injury (Wiese-Bjornstal et al., 1998), personal and situational factors are thought to influence athletes’ cognitive appraisal of their injury, subsequently impacting their emotional and behavioral responses. It is also believed that this process can happen in the opposite direction, such that the emotional and behavioral responses may affect cognitions. Within this model, mental skills are
posited to influence the sport injury rehabilitative process through three mechanisms: (1) acting as a mediator to injury occurrence, (2) acting as a personal factor influencing the cognitive appraisals, and (3) acting as a behavioral response that can potentially influence both the cognitive and emotional response to the injury (Wiese-Bjornstal et al., 1998). Psychological interventions for mental skills including imagery, goal setting, and stress inoculation, have been found to be effective in increasing the rate of recovery, adherence to the rehabilitative program, and overall outcomes of sport injury (Heil & Podlog, 2012). Furthermore, positive self-talk (Arvinen-Barrow et al., 2015) and relaxation combined with imagery (Cupal & Brewer, 2001), have also been found to be beneficial in the rehabilitative process. In a review of the literature regarding injury interventions, Durso-Cupal (1998) found that, regardless of the type of intervention, psychological interventions contributed to the rehabilitative outcomes in a positive manner (i.e., decreased pain or anxiety, increased strength or range of motion), clearly highlighting the importance of using psychological tools during rehabilitation.

In one of the first studies of its kind, Ievleva and Orlick (1991) examined the relationship between psychological variables (positive attitude, outlook, stress and stress control, social support, goal setting, positive self-talk, and mental imagery) and the temporal component of physical recovery. Through an open-ended retrospective survey of 32 former sports medicine clinic patients with either knee or ankle injuries, the researchers found that recovery rates were higher among those athletes who used goal-setting, positive self-talk, and healing mental imagery. Additionally, it was found that athletes who were most satisfied with their rehabilitation and who recovered the quickest, had used mental skills spontaneously without instruction to do so. As such, it was suggested that psychological interventions perceived as credible and useful by the injured athlete themselves, will be beneficial.
In light of the findings of Ievleva and Orlick (1991), Brewer, Jeffers, Petitpas and Van Raalte (1994) conducted a series of studies to better understand whether athletes perceive imagery, goal setting, or counseling as an adjunct to physical therapy during injury rehabilitation. In the first experiment, 161 college students were randomly assigned to read a description of a fictitious injured athlete receiving either an imagery, goal setting, or counselling intervention. These participants were then asked to complete a questionnaire rating the fictitious injured athlete’s perception of satisfaction with the intervention. In the second experiment, 20 injured athletes (currently receiving physical therapy) were given brief introductory sessions on goal-setting, imagery, and counselling, and were asked to rate their perceptions of each of the interventions. Across both studies, positive perceptions were found for all three interventions with a slight preference for goal setting, therefore suggesting that athletes may in fact understand the utility and importance of mental skills use during rehabilitation.

More recently Arvinen-Barrow et al. (2015) sought to determine what, if any, mental skills college athletes were using during injury rehabilitation. In total, 1283 collegiate athletes were asked open and closed-ended questions regarding their use of mental skills during the rehabilitative process. The results indicated that only 27% of the athletes had used mental skills during injury rehabilitation. For those athletes who reported using mental skills during rehabilitation, goal setting was most commonly reported (162, or 46.8%), followed by positive self-talk (115, or 33.2%), imagery (110, or 31.8%), and relaxation (84, or 24.3%). Goal setting has been found to be effective in reducing athletes’ anxiety as well as improving their self-confidence, resulting in the athletes ultimately increasing their adherence to the rehabilitative program and perceiving the treatment as more effective (Evans & Hardy, 2002). Self-talk interventions are centered around helping athletes to recognize and change negative thoughts
associated with the injury, which is posited to enhance the athlete’s perception of the rehabilitative process (Podlog, Dimmock, & Miller, 2011). In the injury rehabilitation literature, imagery and relaxation have commonly been used in conjunction to enhance the rehabilitative process by reducing pain sensations and re-injury anxiety (Cupal & Brewer, 2001). Overall, Arvinen Barrow et al. found that out of the 346 athletes who used mental skills, 249 (72%) indicated that their use of mental skills helped them recover from their injury at a faster rate, henceforth supporting the findings of Brewer et al. (1994), such that athletes view the use of mental skills during rehabilitation as important and contributing to their recovery. In conclusion, it is clear that mental skills are being under utilized by injured athletes during rehabilitation (despite their positive perceptions of such techniques), but that those who do use these mental skills find them to be beneficial.

**Imagery in Injury Rehabilitation**

The variety of psychological responses an athlete may experience in relation to an injury highlights the importance of including both physical and psychological therapies in the rehabilitative program (Sordoni, Hall, & Forwell, 2000). One important psychological therapy that has found to enhance the rehabilitative process is imagery. Although imagery has been shown to be used for both cognitive and motivational purposes within a training or competitive environment, imagery use differs somewhat when in a rehabilitative setting.

Sordoni et al. (2000) assessed injured adult athletes’ use of imagery during rehabilitation, and subsequently developed a tool to measure imagery use during injury rehabilitation - the Athletic Imagery Questionnaire (AIIQ). Drawing on what was known in the sport imagery domain, the questionnaire assessed both cognitive and motivational types of imagery during rehabilitation. Through the use of self-report surveys and the AIIQ, injured athletes (receiving
rehabilitation) used imagery for both cognitive and motivational functions, but to a lesser degree than in training or competition. These authors also found that motivational imagery was the type of imagery that was used most frequently and that injured athletes rarely employed cognitive imagery for rehabilitation specific skills or strategies, and instead used cognitive imagery for sport specific skills and strategies. Overall, Sordoni et al. (2000) suggested that athletes fail to transfer their imagery use from training or competitive settings to rehabilitation, and therefore may need to be reminded to use imagery during injury rehabilitation.

In a later study by Sordoni, Hall and Forwell (2002), the AIIQ was revised to include a third subscale for healing imagery in addition to the cognitive and motivational imagery subscales, as a result of the findings by Ievleva and Orlick (1991) who suggested that injured athletes may image their injury healing. Healing imagery can be described as imagining the physiological processes taking place during rehabilitation (e.g., tissue mending) and has been suggested to enhance the rate of physiological recovery (Ievleva & Orlick, 1991; Milne et al., 2005). Using the Injury Self-Efficacy Questionnaire (ISEQ) and the revised AIIQ-2, Sordoni et al. (2002), assessed both self-efficacy and imagery use in injury rehabilitation of adult athletes. Participants indicated similar frequencies with all three types of imagery (cognitive, motivation, and healing), directly contradicting the results of Sordoni et al. (2000), which suggested injured athletes use motivational imagery most often. Furthermore, competitive athletes used more cognitive imagery than recreational athletes, and healing imagery was the only type of imagery that was significantly related to self-efficacy of the injured athlete. This finding regarding healing imagery was extremely important in that it provided evidence toward the impact of healing imagery on enhancing the rehabilitative process. Healing imagery may not only enhance the rate of physiological recovery, but may also increase feelings of control and serve to
empower the athlete, therefore enhancing the rehabilitative process (Sordoni et al., 2002).

Furthermore, athletes reported that during injury rehabilitation, cognitive imagery was rarely used to rehearse rehabilitation exercises or strategies, but rather sport specific skills and strategies. Similar to the purpose of motivational imagery in the competitive domain, the authors suggested that the use of motivational imagery in injury rehabilitation is for arousal control and increased self-confidence.

This work by Sordoni et al. (2000, 2002) was reexamined by Milne et al. (2005) who assessed the factorial validity of the Athletic Injury Self-Efficacy Questionnaire and the relationships between self-efficacy, imagery use, and rehabilitation adherence. In regards to imagery use, which was examined using the AIIQ-2, Milne et al. found that injured athletes used more motivational and cognitive imagery than healing imagery. This is in contrast to the results of Sordoni et al. (2002), which found injured athletes use motivational, cognitive, and healing imagery to about the same extent. This lack of consistency within the literature warranted further exploration of imagery use with injured athletes during rehabilitation.

In addition to the inconsistent results in the use of the various types of imagery, another limitation of the research done by Sordoni et al. (2000, 2002) and Milne et al. (2005) is that it lacked any injury specific conceptual underpinning (Evans, Hare, & Mullen, 2006). Sordoni et al. (2000, 2002) developed the AIIQ based upon the SIQ, which had no relation to injury rehabilitation and was developed in light of findings from imagery use in training and competition. To assess the effectiveness of the AIIQ and AIIQ-2 as tools to assess imagery use in rehabilitation, qualitative exploration of imagery use during rehabilitation was necessary. As such, Driediger, Hall and Callow (2006) used a “four W’s of imagery use” interview structure to examine 10 injured adult athletes’ use of imagery during rehabilitation, training and competition.
Overall, the results suggested that injured athletes used imagery for cognitive, motivational, healing, and pain management purposes, but that athletes use imagery less frequently in injury rehabilitation than in training and competition, which coincides previous findings (Sordoni et al., 2000, 2002). Contrary to previous research (Sordoni et al., 2000, 2002), however, Driediger et al. (2006) found that injured athletes use CS imagery to rehearse rehabilitative skills to enhance the learning of these exercises (instead of using CS for sport skill rehearsal).

Similar to previous research, Driediger et al. (2006) found that injured athletes use CG imagery to imagine strategies associated with their sport (instead of imaging strategies related to rehabilitation). Further, motivational imagery is used most frequently in conjunction with rehabilitation, and is used to set goals, enhance mental toughness, and foster a positive attitude. More specifically, MS imagery is used to set process goals for rehabilitation and the outcome goal of fully recovering from the injury. MG-A imagery is used by athletes when attempting to control anxiety, relax, or motivate themselves to execute their rehabilitation program. MG-M imagery is also used to help the athletes focus and to get through difficult situations. As for their use of healing imagery, the injured athletes describe images of both internal (i.e., imaging a torn ligament healing) and external (i.e., imaging strength returning to injured area) physiological processes. In relation to managing pain, it was found that athletes use imagery to; practice dealing with pain, distract from pain sensations, image the pain dispersing, and to block the pain. This finding of injured athletes using imagery to manage pain further built upon previous research by Sordoni et al. (2000, 2002) and subsequently established pain management imagery as an important type of imagery in rehabilitation.

With respect to when athletes use imagery, Driediger et al. (2006) found they use it before and during the execution of rehabilitation exercises to control their technique for future
injury prevention. Finally, the researchers noted that the injured athletes’ imagery sessions vary in length, but that overall the imagery sessions are longer in rehabilitation than in training and competition. As is clear from this study, along with that of Sordoni et al. (2000, 2002), injured athletes do use imagery during rehabilitation, and this imagery use may benefit the injured athletes through an enhanced adherence to the rehabilitative program, or through expedited physiological recovery (Ievleva & Orlick, 1991).

To provide clinically controlled evidence for the efficacy of imagery during rehabilitation, Cupal and Brewer (2001) compared the effects of a relaxation and guided imagery intervention in addition to physiotherapy (treatment group), with adult athletes who were only receiving physiotherapy (control group). Moreover, a placebo group was used in which 10 athletes engaged in sessions receiving attention, encouragement and support from a sports medicine clinician in addition to the normal physical therapy. Beginning at two weeks post-surgery, 10 athletes received imagery sessions every two weeks over the course of a six-month rehabilitation from anterior cruciate ligament reconstruction. Initially, the imagery sessions were focused around facilitating athletes in coping and reducing physical pain. Athletes were also taught to take deep diaphragmatic breaths as a method of relaxation to help reduce anxiety and decrease affective distress. As the athletes progressed through their rehabilitation, the imagery sessions changed accordingly to focus on images of improving strength and flexibility, and lastly to sport specific imagery. Overall, when comparing those who received the intervention to those who only attended their physiotherapy, at 24 weeks post-surgery the intervention group experienced less re-injury anxiety and pain, as well as significantly greater knee strength than the placebo and control groups (Cupal & Brewer, 2001).
Taken together, it is clear that injured athletes report using four types of imagery: cognitive, motivational, healing, and pain management imagery. And although these types of imagery may not be exhaustive, there is evidence supporting their beneficial function of enhancing the rehabilitative experience for injured athletes.

**Imagery in Youth Rehabilitation**

Although no study to date has examined young athletes’ use of imagery in an athletic rehabilitative setting, there is research supporting adolescents’ use of imagery within hospital rehabilitative settings (Huth, Broome, & Good, 2004; Lambert, 1996). More specifically, a moderate body of research exists which demonstrates that adolescents’ postoperative pain can be significantly reduced using imagery (Huth et al., 2004; Lambert, 1996; Pölkki et al., 2008).

To assess the clinical applicability of using imagery to reduce postoperative pain in youth, Lambert (1996) examined the effects of guided imagery on the postoperative course of pediatric surgical patients. In total, 52 children (matched for age, sex and diagnosis; 7-19 years) were randomly assigned to an experimental or control group. The experimental group was informed about the nature of guided imagery and were taught how to engage in this guided imagery (i.e., were taught ways to relax and use their imaginations before and after surgery). In the hospital rehabilitative setting, guided imagery is defined as a technique used to distract individuals, in which attention is focused away from something undesirable (McCloskey & Bulecheck, 1996). Overall, those participants who were taught the guided imagery prior to the operation experienced significantly lower postoperative pain and shorter hospital stays than those who were assigned to the control group. As is evident from these results, guided imagery may have positive effects on the rehabilitative process for pediatric surgical patients, however one important consideration that Lambert did not control for was analgesic administration.
Building upon that of Lambert (1996), Huth et al. (2004) assessed the efficacy of an imagery intervention in reducing postoperative pain within adolescents, while controlling for analgesic intake. Seventy-three children (6-12 years) undergoing either a tonsillectomy or adenoidectomy (both surgeries have a same day discharge expectation) were assigned to either a control or treatment group. Around one week prior to surgery (Time 1) the treatment group watched a professional video on the use of imagery and then listened to a 30-minute audio tape of imagery. Participants in the treatment group were asked to listen to the audio tape at between one to four hours post-surgery (Time 2), and 22-27 hours after discharge (Time 3), while the control group received standard care. Those who used imagery reported significantly less pain and anxiety at Time 2, but not at Time 3. This differentiation found in the effectiveness of imagery in reducing pain at different times was attributed by the researchers to lowered pain and anxiety scores while at home. The researchers suggested that imagery may be more effective when children experience moderate anxiety and pain, such as immediately post-surgery.

As shown by Huth et al. (2004), imagery itself may reduce postoperative pain in children. To build upon this and develop a practical tool for reducing postoperative pain in children, Pölkki, Pietila, Vehvilainen-Julkunen, Laukkala and Kiviluoma (2008) examined the effects of a guided imagery and audio relaxation in reducing postoperative pain in children. Sixty children (8-12 years) who had undergone appendectomy or upper/lower limb surgery were assigned to either a treatment or control group. Participants in the treatment group listened to an audio imagery trip (around 20 minutes in length) that included both imagery and relaxation. At the beginning of the audio recording, the child was encouraged to mentally choose a favorite place and during the imagery the child proceeded toward this place along a comfortable path. At the end of the trip the child returned along this path. Repeated music and sounds of nature were used
on this imagery audio recording to facilitate the children reaching a deep state of relaxation. The study used a pretest-posttest design in which the intensity of children’s pain was measured prior to (Time 1), immediately after (Time 2), and one hour after (Time 3), receiving the intervention. Pölkki et al. found that the children in the treatment group reported having significantly less pain scores at Time 1 and 2, but no difference in the pain scores at Time 3. This result nearly mimics that of Huth et al. (2004) as they found significantly lower levels of pain and anxiety in the treatment group at Time 2, but not Time 3. A few explanations for this finding provided by the researchers were that both studies involved collecting data on the first postoperative day, when the experience of pain during the postoperative period is most common, or that the effect of the imagery and relaxation audio recording was reduced due to the relatively short duration of the recording. In summation, it is clear that imagery, either by itself or in conjunction with other psychological techniques (i.e., relaxation) has a positive effect in reducing post-operative pain within children.

As a result of the aforementioned research indicating that imagery may be effective in reducing post-operative pain, researchers were interested in qualitatively exploring what pain management techniques youth in post-operative care in fact use. Pölkki, Pietila, Vehvilainen-Julkunen (2003) interviewed 52 children (8-12 years old) who were inpatients on a pediatric surgical ward, to explore their use of post-surgical pain relieving methods. All of the children reported using at least one self-initiated pain relieving method, while 31% of the children reported using imagery to manage their post-operative pain. Additionally, most children reported their worst pain to be severe or moderate. This finding outlines the importance of finding more effective ways to reduce post-operative pain, or better educating those about the techniques that have been found to be effective, such as imagery.
References


Brain Research, 3, 87–93.


APPENDICES

APPENDIX A

Letter of Information

Title of Study: **Injured Youth Athletes’ Imagery Use During Rehabilitation.**

You are asked to participate in a research study conducted by Mr. Matthew Miller, a Master’s student from the Faculty of Human Kinetics at the University of Windsor. Imagery use during rehabilitation from an injury will be investigated. The results of this research will contribute to Mr. Miller’s Master’s Thesis. If you have any questions or concerns about the research, please feel to contact Mr. Matthew Miller at (519) 253-3000 (x4058), mille127@uwindsor.ca or his advisor Dr. Krista Chandler at (519) 253-3000 (x2446), chandler@uwindsor.ca

**PURPOSE OF THE STUDY**

The purpose of the present study is to qualitatively examine injured athletes’ use of mental imagery during injury rehabilitation as an adolescent (13-17 years).

**PROCEDURES**

If you volunteer to participate in this study, you will be asked to:

**a) Participate in an interview**

Participants will take part in an interview (about 60 min) at the University of Windsor Human Kinetics Building.

a) An interviewer will lead the interview and audio record the session. Audio recording is necessary in order to capture all discussion with respect to imagery use.

b) We will begin by asking questions regarding your use of mental imagery, where you use it, when you use it, why you use it, and the content of your images all during injury rehabilitation. The interview session will be structured around four main questions: what was the content of your imagery, why did you use this imagery, when did you use imagery, and where did you use this imagery, all of which in relation to injury rehabilitation.

**b) Be Audio Tape Recorded**

Audio recording is a voluntary procedure and you are free to withdraw at any time by requesting that the recording be stopped. If you do not wish to be recorded, you will not
be part of the study. Your name will not be revealed to anyone, as recording and listening to the files will be kept confidential. Audio files are numbered only and stored in a locked cabinet in the lead researcher’s office. The audio files are for research use only. The audio files will be appropriately disposed of after the study is completed.

**POTENTIAL RISKS AND DISCOMFORTS**
There is a possibility of you recalling negative images associated with your injury, but these negative images tend to result in positive behaviour directed at recovery.

**POTENTIAL BENEFITS TO PARTICIPANTS AND/OR TO SOCIETY**
Each participant will receive a take home sheet of the best practices on imagery use after the interviews have been conducted. Participants may gain a better understanding of the imagery functions used during rehabilitation. There is currently no established research examining youth athletes’ imagery use during rehabilitation and therefore results from the proposed study may further contribute to the scientific literature.

**COMPENSATION FOR PARTICIPATION**
If you so choose (see below), you will be entered into a draw to win one of two $50 gift certificates to Sport Chek. You will be required to pay for your own transportation to the University of Windsor if transportation is required.

**CONFIDENTIALITY**
During the data collection phase, all participant data will be kept in a locked cabinet, to which only the listed investigators have access. After five years, all hard copies of the data will be destroyed and audio files erased. Each participant has the right to review the audio files and may request to have their section of the files edited by the researcher. Once the data collection phase is complete, each participant will be assigned a participant number and participant’s data, identified only by participant number, will be entered into a qualitative analysis program. The resulting data set will be password-protected to ensure that only the listed investigators are able to access the data. In release of the findings, the results will be referred to only by a participant number, and thus, it will not be possible to identify or link any results to any one specific participant. Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission.

**PARTICIPATION AND WITHDRAWAL**
Participants will be informed that if they volunteer to participate in this study they can withdraw at any time without penalty. Participants may refuse to answer any questions that they choose and will still remain a participant in the study. Participants can withdraw from the study at any time. It should also be noted that participants must complete the interview in order to be entered into the draw. If a participant withdraws before completion of the interview, he/she will not be entered into the draw. The investigator may withdraw you from this research if circumstances arise which warrant doing so.

**FEEDBACK OF THE RESULTS OF THIS STUDY TO THE PARTICIPANTS**
The investigator will provide a written summary of the study’s findings to you upon request. If you have any additional concerns or questions you can email or call the investigator(s) at the address or number provided above. Please keep this Letter of Information.

**SUBSEQUENT USE OF DATA**
These data will not be used in subsequent publications and in presentations.

**RIGHTS OF RESEARCH PARTICIPANTS**
If you have questions regarding your rights as a research participant, contact: Research Ethics Coordinator, University of Windsor, Windsor, Ontario, N9B 3P4; Telephone: 519-253-3000, ext. 3948; e-mail: ethics@uwindsor.ca

**SIGNATURE OF INVESTIGATOR**
These are the terms under which I will conduct research.

____________________________________  __________________
Signature of Investigator                Date

Would you like your name to be entered into a draw to win one of two $50 Sport Chek gift cards?

Yes [ ]  No [ ]
APPENDIX B

Consent for Audio Recording

CONSENT FOR AUDIO RECORDING

Research Subject Name:

Title of the Project: **Injured Youth Athletes’ Imagery Use During Rehabilitation.**

I consent to the audio-recording of interviews, procedures, or treatment of myself.

I understand these are voluntary procedures and that I am free to withdraw at any time by requesting that the recording be stopped. I also understand that my name will not be revealed to anyone and that taping will be kept confidential. Audio files are numbered only and stored in a locked cabinet.

The destruction of the audio recording will be completed after the files have been transcribed, and stored for 5 years.

I understand that confidentiality will be respected and that the audio files will be for professional use only.

________________________________________________________________________.

(Research Subject)                                                      (Date)
APPENDIX C

Injured Youth Athletes’ Imagery Use During Rehabilitation

Interview Guide

1. Welcome
   a. Thank you for taking the time to participate in this interview on imagery use during rehabilitation. My name is __________. Assisting me is __________.

2. Guidelines
   a. Before we begin, let me suggest some tips to ensure the discussion will go smoothly. You will be audio-recorded because we don’t want to miss any of your comments. Be sure to speak loudly enough because all your comments are important to us. We will use your first name here today, but in a report that we write after we collect our data, your name will not be used so that no one will know who made the comment.

3. Getting to Know You: (approx. 5 min).
   a. Please tell me your name, age, your sport, and your favorite thing(s) to do other than any sport you play.
   b. Please tell me how you were injured in your sport.

4. Overview of the topic:
   a. We want to hear how you use imagery when you are or were injured and receiving rehabilitation.
   b. Definition: Imagery is a mental skill that is used to create or re-create pictures and feelings in your mind.
c. You were selected because you have experienced an injury requiring physical therapy that took you out of sport (defined as missing time in your sport, or medical, physiotherapy, or chiropractic attention).

d. Today we will be discussing what you were picturing in your mind while you were injured. I’ll be asking questions such as when you used imagery, why you used imagery and what you imaged, all while you were injured.

5. **Key Questions:**

a. **Overall Imagery Use:** Please discuss, what images you created in your mind relating to the injury?

   -Can you describe how frequently you created these images?
   -How did the frequency of the images change from when you were not injured?
   -How long would you usually image for?

b. **Content of Imagery:** When you created these images in your mind, what images were you thinking of?

   -With anyone else?
   -Who, and what were they doing?
   -Before, during, and after rehabilitation treatment.
   -Coping with your injury, what did you image?
   -Recovering from your imagery.
   -Tough aspects of injury, what did you image?
   -Managing the pain of the injury.
   -Did the imagery change if at all, over the course of the injury?

c. **Why imagery is used:** Please discuss the reasons for you creating these images?
-Positives or negatives (if any) creating these images had; these can be mental or physical.

-Purpose of imagery always the same, or did it change throughout the imagery? If it did change, in what ways did it change?

d. **When Imagery is used:** While you were injured, please discuss when you used imagery?

   -Tell me about when you think the best time for you to use imagery was?

   -Why was this the best time?

e. **Where Imagery is used:** Please discuss what settings you used imagery in while you were injured? (Home, rehabilitation, school, sport etc.)

   -Most effective setting for imagery while injured.

   -Why was this the best setting?

f. **Final Thoughts:** Is there anything that we have discussed today that you would like to expand on or talk more about?

g. **Summary:**

   a. Summarize the most important findings (refer to assistant).

      Probe: Is there anything that we should have talked about and didn’t? Did we miss anything?
VITA AUCTORIS

NAME: Matthew Miller

PLACE OF BIRTH: Halifax, Nova Scotia, Canada

YEAR OF BIRTH: 1993

EDUCATION:

Citadel High School, Halifax, NS, 2011

Mount Allison University, B.Sc (Hons) Psychology, Sackville, NB, 2015

University of Windsor, M.H.K., Windsor, ON, 2017