Self-efficacy, imagery use, and adherence during injury rehabilitation

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Previous observational studies examining imagery, self-efficacy, and adherence during injury rehabilitation have been cross-sectional and thus have not provided a clear representation of what occurs over the course of the rehabilitation period. The objectives of this research were (1) to examine the temporal patterns of imagery, self-efficacy, and rehabilitation adherence during an 8-week rehabilitation program and (2) to identify the time–order relationships between imagery, self-efficacy, and adherence. The design of the study was prospective and observational. 90 injured people (n = 57 males; n = 33 females) aged 18–78 years attending an injury rehabilitation clinic participated. The main outcome measures were imagery (cognitive, motivational, and healing), self-efficacy (task and coping), and rehabilitation adherence (duration, quality, and frequency). Results indicated that task efficacy, imagery use, and adherence levels remained stable, while coping efficacy declined over time. During the course of rehabilitation, moderate to strong reciprocal relationships existed between self-efficacy and adherence to rehabilitation. Weak to moderate relationships were found between imagery use and rehabilitation adherence. The results of this study can be used to inform the development of interventions steeped in self-efficacy and imagery aimed at improving rehabilitation adherence and treatment outcome.

It is usual for people with injuries to be prescribed rehabilitation that includes physiotherapy (Spetch & Kolt, 2001). During their rehabilitation, patients are commonly expected to undertake a home exercise program (Sluijs et al., 1998), but approximately 63% do not adhere fully to these programs (Sluijs et al., 1993). However, adherence to a prescribed regimen of rehabilitation is associated with successful injury outcomes (Brewer et al., 2000; Bassett, 2006). These findings have led researchers to explore possible psychological variables related to injury rehabilitation adherence rates (Duda et al., 1989; Brewer et al., 1994; Evans et al., 2000).

Two social-cognitive variables that have been identified are self-efficacy and imagery. Self-efficacy reflects an individual’s belief in his or her ability to engage in specific behaviors that will yield a desired outcome (Bandura, 1986). It relates to one’s sense of competency and proficiency, and therefore affects one’s choice of behavior, activity, and exerted effort (Strauser, 1995). The exercise psychology literature has focused on three different types of self-efficacy: task, barrier, and scheduling (McCaul & Brawley, 1995; McAuley, 1992; DuCharme & Brawley, 1995; Rodgers et al., 2002). Task efficacy is described as the confidence in one’s ability to perform the fundamental aspects of a task in a specific situational context. Barrier efficacy is defined as confidence in one’s ability to perform a task under challenging conditions or to overcome social, personal and environmental constraints, and scheduling efficacy is the confidence in one’s ability to schedule or plan strategies for carrying out a specific action. Because both barrier and scheduling efficacy are self-regulatory in nature (Bandura, 1997), the two have been grouped together and considered as coping efficacy, which refers to an individual’s confidence in the ability to perform tasks under challenging conditions (Maddux, 1995). An example of task efficacy in an injury rehabilitation setting would be an individual’s belief in his or her ability to perform a specific rehabilitation exercise; an example of coping efficacy would be an individual’s belief in his or her ability to adhere to a prescribed regime of rehabilitation despite not having the time to exercise. Previous research found that higher levels of self-efficacy were associated with better adherence to a rehabilitation program (Flynn et al., 1995; Chen et al., 1999; Hall et al., 2002; Woodgate et al., 2005). Furthermore, Milne et al. (2005) found that both task and coping efficacy predicted rehabilitation adherence.

Imagery has been 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 smell, tastes, or sounds without
actually experiencing the real thing. Sometimes people find that it helps to close their eyes. It differs from dreams in that we are awake and conscious when we form an image” (White & Hardy, 1998, p. 389). Imagery has been found to serve three functions in injury rehabilitation (Rossman, 2002; Sordoni et al., 2000; Sordoni et al., 2002; Driediger et al., 2006). Cognitive imagery is used to rehearse rehabilitation exercises, whereas motivational imagery is used to set goals, control arousal levels, and increase self-confidence. Healing imagery entails imagining the physiological processes occurs during rehabilitation (e.g., tissue and/or bone healing). Increased imagery use during rehabilitation has been found to be related to increased rehabilitation adherence and faster recovery (Cupal & Brewer, 2001; Driediger et al., 2006). The randomized controlled trial conducted by Cupal & Brewer also found that a guided imagery intervention was effective in reducing pain and re-injury anxiety.

As well as the individual effects of these two social-cognitive variables on rehabilitation adherence, research has also identified relationships between self-efficacy and imagery. Bandura (1997) argued that imagery is one of the primary sources of self-efficacy. Sordoni et al. (2002) were the first to investigate the relationship between imagery use and self-efficacy during injury rehabilitation and found that the use of healing imagery was significantly related to self-efficacy. However, self-efficacy was assessed as a single construct rather than considering task and coping efficacy separately. In a more recent study, Milne et al. (2005) examined the relationships among the three functions of imagery (i.e., cognitive, motivational, and healing), task and coping efficacy, and rehabilitation adherence. It was found that cognitive imagery significantly predicted task efficacy and both task and coping efficacy significantly predicted adherence.

The research conducted by Sordoni et al. (2002) and Milne et al. (2005) provides some important insights into the relationships between imagery use, self-efficacy, and rehabilitation adherence during injury rehabilitation. However, these two studies were cross-sectional in nature and did not provide a clear representation of what occurs over the course of injury rehabilitation. A prospective observational study examining how these variables may change and how the relationships among these variables may change over the course of rehabilitation is warranted, to assist with the development of future interventions. Time-order relationships may be identified, although this type of study design is not able to identify causality. The objectives of this preliminary investigative study were (1) to examine the temporal patterns of imagery, self-efficacy, and rehabilitation adherence during an 8-week rehabilitation program and (2) to identify the time-order relationships among imagery, self-efficacy, and adherence.

It was hypothesized that both self-efficacy and imagery would be related to adherence. However, because of the lack of prospective data examining these variables in a temporal fashion, no further hypotheses were specified. It is anticipated that this study may aid in hypothesis generation for future research.

Materials and method

Design

The design of this preliminary investigation was a prospective observational study.

Participants

Ninety injured individuals (n = 57 males; n = 33 females) receiving physiotherapy were recruited in both Canada and New Zealand. Eligibility criteria included being aged over 18 years and undergoing rehabilitation treatment for an injury that required a minimum of 8 weeks of physiotherapy. The majority of participants reported being in rehabilitation for shoulder (70%), knee (19%), or ankle (9%) injuries. Participants ranged in age from 18 to 78 years (M = 42.41; SD = 18.44) and reported participating in 28 different sports and activities, with golf (n = 13) and rugby (n = 13) cited most often. Fifty-five percent of participants participated at a recreational level, while 35% of participants participated at a competitive level. Approximately 39% of participants had three or more previous rehabilitation experiences, while 30% of participants had one or two previous rehabilitation experiences, and 31% of participants had never had any previous rehabilitation experiences.

Measures

Self-efficacy

Self-efficacy was evaluated using the Athletic Injury Self-Efficacy Questionnaire (AISEQ) (Milne et al., 2005). The AISEQ is comprised of seven items representing two types of self-efficacy, task and coping. An example of a task item is “I am confident that I can do my rehabilitation exercises when I am tired”. The participants rated their self-efficacy on a scale ranging from 0% (no confidence) to 100% (completely confident). The AISEQ has been shown to possess sound psychometric properties (Milne et al., 2005). In the present study, Cronbach’s alphas were found to be acceptable for all time points (task efficacy, α range = 0.76–0.95; coping efficacy, α range = 0.79–0.90).

Imagery

Imagery use was evaluated using the Athletic Imagery Injury Questionnaire-2 (AIIQ-2) (Sordoni et al., 2002). The AIIQ-2 is comprised of 12 items concerned with the injured athlete’s current use of imagery. Items are representative of the three functions of imagery: motivational imagery (four items), cognitive imagery (four items), and healing imagery (four items). An example of a motivational imagery item is “I imagine myself achieving my treatment goals.” An example
of a cognitive imagery item is “Before performing a rehabilitation exercise, I imagine myself completing it perfectly.” An example of a healing imagery item is “I imagine my body repairing itself.” The participants rated their imagery use on a 9-point Likert scale from 1 (never) to 9 (always), indicating their use of that particular function of imagery. Previous research (Sordoni et al., 2002; Milne et al., 2005) has found the AIQ-2 to be both valid and reliable. In the present study, Cronbach’s alphas were found to be acceptable for all time points (motivational imagery, $\alpha$ range = 0.82 – 0.93; cognitive imagery, $\alpha$ range = 0.85 – 0.94, healing imagery, $\alpha$ range = 0.92 – 0.96).

**Rehabilitation adherence**

Rehabilitation adherence was evaluated in three ways: the frequency that rehabilitation exercises were undertaken, the duration of these exercises, and the quality with which they were completed (Milne et al., 2005). Frequency of exercise was measured with two questions: “How often does your physiotherapist want you to do your rehabilitation exercises (e.g., once per day)?”, which indicates the prescribed frequency, and “How often do you actually do your rehabilitation exercises?”, which indicates the actual frequency. Similarly, exercise duration also was measured with two questions: “How long (minutes) does your physiotherapist want you to spend on your exercises each time you do them?” (i.e., prescribed) and “How long (minutes) do you actually spend on your exercises each time you do them?” (i.e., actual). The percentage scores for frequency and duration of exercise were calculated by dividing the actual into the prescribed and multiplying by 100; a score greater than 100% indicated that participants performed their rehabilitation exercise more frequently or for a longer duration than prescribed. Quality of exercise was measured with one question: “What percentage (%) of the time do you believe that you perform your rehabilitation exercises correctly?” Milne et al. (2005) obtained face validity from four physiotherapists in the development phase of this adherence measure.

**Procedures**

All study procedures and related documents were approved by the respective Canadian university (The University of Western Ontario Research Ethics Approval Notice) and New Zealand Ministry of Health regional ethics committees. Contact was initiated by the referring orthopedic surgeon (New Zealand) or by the researcher (Canada) to discuss the study purposes and procedures. At their first visit (baseline) to the physiotherapy clinics, participants were provided with a participant information sheet outlining the study purpose and requirements, as well as a consent form. Once written informed consent was obtained, participants completed the questionnaires. Repeat questionnaire administration occurred at 2-week intervals for a minimum of 8 weeks. Questionnaires took approximately 15 min to complete.

**Data analyses**

To ensure adequate power (which is often reduced due to attrition that occurs because of poor compliance over time), missing data were replaced using full information maximum likelihood estimation (FIML) (Anderson, 1957) enabled by SPSS (Statistical Packages for the Social Sciences) (Norusis, 2002) version 14. Compared with other methods (e.g., means imputation), the FIML method has been found to produce the least bias estimates of missing values (Little & Rubin, 1990; Arbuckle & Wothke, 1999). Missing data were considered random in nature and a total of 23%, 32%, 38%, and 49% of the data were replaced at baseline, week 2, week 4, week 6, and week 8 assessments, respectively. This is important, particularly with a smaller data set and a high proportion of missing values (Tabachnick & Fidell, 2001). Thus, all analyses were performed with a sample size of 90. To establish whether the participants who had full sets of data differed significantly from those who had missing data comparisons were undertaken on their demographic and baseline adherence, self-efficacy and mental imagery data. These comparisons were made using analysis of variance for the continuous data and Chi-square tests for the categorical data.

To establish whether demographic characteristics measured at baseline could affect the variables of interest (adherence, mental imagery, and self-efficacy), the sample was categorized on the basis of age (under 50 years vs 50 years and older), injury type (upper vs lower limb), rehabilitation experience (previous experience vs no experience), and their level of sport involvement (competitive vs recreational). The groups were compared using analysis of variance.

To examine the temporal patterns of self-efficacy (task and coping), imagery use (motivational, cognitive, and healing), and rehabilitation adherence (frequency, duration, and quality) across time during injury rehabilitation (i.e., baseline, 2, 4, 6, and 8 weeks), separate repeated-measures ANOVAs were performed. This approach satisfied the first objective of the present study.

Path analyses using AMOS 4.0 (Arbuckle & Wothke, 1999) were used to investigate the relationships among the variables (i.e., self-efficacy, imagery, and adherence) across time during injury rehabilitation (i.e., baseline, 2, 4, 6, and 8 weeks). Path analysis is a straightforward extension of multiple regression. Its aim is to provide estimates of the magnitude and significance of hypothesized causal connections between sets of variables. Data imputation was executed as a function of the AMOS program. This approach satisfied the second objective of the present study.

**Results**

**Descriptive statistics**

Descriptive data for all variables are presented in Table 1. High levels of adherence were found for duration and frequency of exercises. Also, task efficacy scores were high throughout rehabilitation. Moderate (close to the midpoint of the scale) use of all three types of imagery was reported, which were consistent across time.

The only significant difference between the participants who had missing data and those who did not occurred for age ($P < 0.041$). Participants with missing data were significantly younger (38.36 ± 16.38) in comparison with those who did not have missing data (46.28 ± 19.62). When the data of those who completed the program were compared with the data using missing-data imputations, the results were almost identical. The baseline values for demographic and injury variables showed only one significant difference between the different demographic groups; recreational-level participants reported higher healing imagery scores at baseline than competitive-level participants ($P = 0.043$). No significant differences
were found for age, injury type, or rehabilitation experience. Bivariate correlations were conducted for all variables at each time point but no clear relationships emerged between self-efficacy, imagery, and adherence across time.

Temporal patterns of self-efficacy, imagery use, and rehabilitation adherence
Analyses examining the temporal patterns of self-efficacy, imagery use, and rehabilitation adherence across time during injury rehabilitation revealed that task efficacy, all three imagery variables (motivational, cognitive, and healing), and all three adherence variables (frequency, duration, and quality) remained stable over time ($P > 0.05$). However, coping efficacy declined over the course of the assessment period [$\text{Greenhouse–Geisser } F(2.76, 118.57) = 2.91, \ P < 0.05$, $\eta^2 = 0.06$, power = 0.65]. Tukey post hoc tests ($P < 0.05$) revealed that participants had higher levels of coping efficacy at baseline compared with the 2-and 8-week assessments. Furthermore, participants had higher coping efficacy at 4 weeks than at 8 weeks of injury rehabilitation.

Relationships between self-efficacy, imagery use and adherence measures
Path analyses were used to investigate the relationships among self-efficacy, imagery, and adherence across time (i.e., baseline, 2, 4, 6, and 8 weeks). Although a number of relationships emerged, only the models with adequate fit data (see Table 2) are presented and discussed for the purposes of the present study (i.e., Figs 1–3).

Self-efficacy and adherence
The model fit for these data is presented in Fig. 1. Adherence duration at baseline had a stronger and negative association to task efficacy at 2 weeks compared with baseline task efficacy to adherence duration at 2 weeks. Subsequent relationships

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Table 1. Descriptive statistics for variables of interest

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>2 weeks</th>
<th>4 weeks</th>
<th>6 weeks</th>
<th>8 weeks</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$M$ (SD)</td>
<td>$N$</td>
<td>$M$ (SD)</td>
<td>$N$</td>
<td>$M$ (SD)</td>
<td>$N$</td>
</tr>
<tr>
<td>Adherence</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adherence frequency</td>
<td>100.67 (50.88)</td>
<td>90</td>
<td>86.93 (26.49)</td>
<td>72</td>
<td>85.34 (25.04)</td>
<td>61</td>
</tr>
<tr>
<td>Adherence duration</td>
<td>109.43 (71.17)</td>
<td>86</td>
<td>93.23 (27.62)</td>
<td>66</td>
<td>99.67 (61.98)</td>
<td>54</td>
</tr>
<tr>
<td>Adherence quality</td>
<td>81.10 (18.69)</td>
<td>80</td>
<td>83.40 (17.72)</td>
<td>72</td>
<td>84.69 (17.11)</td>
<td>64</td>
</tr>
<tr>
<td>AISEQ</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Task efficacy</td>
<td>89.11 (11.90)</td>
<td>90</td>
<td>88.01 (12.79)</td>
<td>72</td>
<td>89.43 (11.72)</td>
<td>63</td>
</tr>
<tr>
<td>Coping efficacy</td>
<td>82.96 (14.83)</td>
<td>90</td>
<td>78.28 (16.09)</td>
<td>72</td>
<td>80.59 (14.64)</td>
<td>63</td>
</tr>
<tr>
<td>AIIQ-2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motivational imagery</td>
<td>5.73 (2.30)</td>
<td>90</td>
<td>5.94 (2.12)</td>
<td>72</td>
<td>5.72 (2.20)</td>
<td>63</td>
</tr>
<tr>
<td>Cognitive imagery</td>
<td>5.34 (2.46)</td>
<td>90</td>
<td>5.59 (2.23)</td>
<td>72</td>
<td>5.50 (2.26)</td>
<td>63</td>
</tr>
<tr>
<td>Healing imagery</td>
<td>5.24 (2.76)</td>
<td>90</td>
<td>5.17 (2.38)</td>
<td>72</td>
<td>5.12 (2.46)</td>
<td>63</td>
</tr>
</tbody>
</table>

AISEQ, Athletic Injury Self-Efficacy Questionnaire; AIIQ-2, Athletic Injury Imagery Questionnaire-2; The AISEQ measures self-efficacy on a 100% confidence scale, ranging from 0% (no confidence) to 100% (complete confidence); The AIIQ-2 measures imagery use on a 9-point Likert scale ranging from 1 (never) to 9 (always).

Table 2. Fit indices for the path analyses with adequate model fit

<table>
<thead>
<tr>
<th>Path Model</th>
<th>$\chi^2$</th>
<th>$\chi^2$/df</th>
<th>TLI</th>
<th>CFI</th>
<th>RMSEA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task efficacy-adherence duration</td>
<td>61.98*</td>
<td>2.21</td>
<td>.75</td>
<td>.88</td>
<td>.12</td>
</tr>
<tr>
<td>Motivational imagery-adherence frequency</td>
<td>49.01*</td>
<td>1.75</td>
<td>.89</td>
<td>.95</td>
<td>.09</td>
</tr>
<tr>
<td>Motivational imagery-adherence duration</td>
<td>51.00*</td>
<td>1.82</td>
<td>.88</td>
<td>.94</td>
<td>.10</td>
</tr>
</tbody>
</table>

* $P < 0.05$; $\chi^2$, Chi Square; $\chi^2$/df, Chi Square-Degrees of Freedom ratio; TLI, Tucker–Lewin Index; CFI, Comparative Fit Index; RMSEA, The Root Mean Square Error of Approximation.
were small in magnitude and reciprocal in terms of
direction.

**Imagery use and adherence**

The model fit for these data are presented in Figs 2
and 3.

As illustrated in Fig. 2, motivational imagery at
2 weeks had stronger relationships to adherence
frequency at 4 weeks than adherence frequency at 2
weeks to motivational imagery at 4 weeks. In addi-
tion, the strongest relationship was negative. For the
remaining duration, the relationships were reciprocal
in nature. Furthermore, as can be seen in Fig. 3, the
relationships between motivational imagery and
adherence duration were evident at the end of the
assessment period only, and were positive and reci-
procal in nature.

**Discussion**

The first objective of this study was to examine the
temporal pattern of imagery, self-efficacy, and reha-
bilition adherence during an 8-week rehabilitation
program. Overall, the participants’ scores for task
efficacy, imagery use, and rehabilitation adherence
remained stable over the course of the 8-week assessment period. Participants in the present study reported similar levels of self-efficacy, imagery use patterns, and adherence scores across time as those of participants in cross-sectional studies (Sordoni et al., 2002; Milne et al., 2005).

Over the duration of the 8-week rehabilitation program, the mean self-efficacy task and coping scores remained relatively stable and high, which has been associated with high levels of rehabilitation adherence (Brewer et al., 2003; Flynn et al., 1995; Taylor & May, 1996). The high scores for self-efficacy and adherence may also be a reflection of 69% of our participants having undergone rehabilitation previously. In other rehabilitation research, high adherence and self-efficacy scores have been attributed to the majority of participants having had previous physiotherapy experience (Bassett & Prapavessis, 2010). Bassett and Prapavessis (2010) suggested that participants’ prior experiences with physiotherapy gave them an insight into the requirements of the rehabilitation, which may have occurred with the participants in the current study.

Nonetheless, there was a slight decrease in the participants’ coping efficacy scores over the duration of the rehabilitation. This decrease may have been due to several aspects of the rehabilitation program. First, as acute symptoms associated with the injury subsided, the rehabilitation exercises become more complex, and more difficult to implement (Muszynski-Kwan et al., 1988; Bassett & Prapavessis, 2007). Second, patients frequently find it difficult to maintain exercise behaviors over a long period of time because of problems encountered in making these behaviors part of their daily routines, and the difficulty in overcoming perceived and actual barriers to their implementation (Sluijs & Knibbe, 1991).

Participants in the present study also started their rehabilitation program using all three functions of imagery to a moderate degree, which did not change over the 8-week period. Research in the sport and exercise domain showed that people’s use of imagery tends to remain stable over time unless an imagery intervention is applied to increase their imagery use (Cumming et al., 2004).

With respect to the frequency and quality of their rehabilitation adherence, participants reported 80% adherence rates, while adherence duration rates were at the recommended level (i.e., approximately 99% overall adherence). Adherence rates of 40–91% have been reported in earlier studies (Almekinders & Almekinders, 1994; Daly et al., 1995; Laubach et al., 1996; Taylor & May, 1996), which may be attributed to the different adherence measures used, such as participant self-reports, mechanical devices, and practitioner estimations of the patients’ adherence to their home physiotherapy.

The second objective of this study was to examine how self-efficacy, imagery, and adherence related to each other over time. Task efficacy had the most consistent association with the three adherence measures; however, the best model fit was found between task efficacy and adherence duration. The association between self-efficacy and adherence is consistent with research by Milne et al. (2005), which demonstrated that task efficacy was associated with the duration of which rehabilitation exercises were performed.

The negative relationship between baseline adherence duration and task self-efficacy at 2 weeks is contrary to previous research and has shown that higher levels of self-efficacy are significantly associated with better adherence (Taylor & May, 1996; Chen et al., 1999; Flynn et al., 1995; Hall et al., 2002; Brewer et al., 2003; Milne et al., 2005; Woodgate et al., 2005). The high initial mean adherence duration score could have been the cause of this result, with it being in excess of 100%. It could be that participants over-reported their actual levels of adherence, which is a known problem in treatment adherence research, (Myers & Midence, 1998). Mismatches have been found between participant self-reports and the recordings of electronic devices that have measured adherence (Hoelscher et al., 1984; Brewer et al., 2004). Hoelscher et al. (1984) found that in comparison with the video tape usage measured by electronic counter in the video, participants over-reported the time they spent practising their relaxation techniques by 124%. The high initial mean adherence frequency score, which was just over 100%, gives further support to the notion that there could have been over-reporting of adherence.

A second reason for the high mean initial adherence duration score could be that in early stages of a rehabilitation program when the patients’ symptoms are acute, the exercises are usually gentle, active-assisted or free active movements, and at a low dose (small number of repetitions or of a short duration). As the patients recover the exercises become more demanding and time consuming (see rehabilitation program outlined by Bassett & Prapavessis, 2007). Hence in the early stages of rehabilitation, the participants may have over-adhered because of the apparent simplistic nature of the exercises, which in turn may have aggravated their symptoms leading to a reduction in the time they spent exercising. Undertaking too many rehabilitation activities can have a detrimental effect on recovery, especially with older patients (Pizzari et al., 2005), which could be contrary to tissue healing in these people (Wilmore & Costill, 1999).

While there is considerable research investigating the influence of imagery on athletic performance (for a review, see Hall (2001), we are not aware of any research examining the direct relationship between
imagery use and rehabilitation adherence over the course of the rehabilitation period. The findings of the present study demonstrate consistent significant associations between imagery use and rehabilitation adherence, specifically between motivational imagery and adherence frequency and duration. Although these associations were relatively weak, they were apparent in the middle and latter stages of the study with adherence frequency demonstrating the strongest associations with motivational imagery use. In general, the findings of the present study suggest that after being involved in the rehabilitation program for a few weeks, imagery is associated with forthcoming rehabilitation adherence, whereas after being involved in rehabilitation for a few weeks longer the relationship becomes reciprocal in nature. An interesting finding is that in the middle stages of the rehabilitation, the relationship between motivational imagery and adherence frequency was negative, whereas in the latter stages of the study the relationships between motivational imagery and adherence duration were positive. This suggests that if an injured athlete imagines achieving specific treatment goals, this would influence how often and for how long they actually perform the assigned rehabilitation exercises. Interestingly, the pattern of the adherence frequency measure increased over time, which suggests that rehabilitation exercises became more habitual, which may also have accounted for these differences.

The present study offers insights into the associations among self-efficacy, imagery use, and program adherence in injury rehabilitation; however, there are limitations to acknowledge and consider. Although the adherence measure used in the present study was a more comprehensive assessment than what has been used in the past (e.g., attendance to physiotherapy sessions) (Duda et al., 1989; Daly et al., 1995; Fisher et al., 1998), and therefore can be seen as a strength of the present study, there are some aspects of adherence measurement that can be improved upon. For example, even though the results demonstrated that participants were highly adherent, it is possible that these adherence rates were due to response bias, which is a recognized problem in adherence research especially when self-reports are used (Sluijs et al., 1998). As well, the adherence measure was not specific to the treatment program, which may account for the weak associations between adherence frequency and duration and the other variables of interest. An assessment of adherence that corresponds with the specific demands of the patient’s rehabilitation program and the necessary behaviors required to implement the program (Brewer, 1999) may provide further insight into how self-efficacy, imagery, and adherence are related. For example, involving the physiotherapist in evaluating the participant’s clinic behavior and attendance could be another method of measuring adherence (Brewer, 1998). Another limitation was that there were no measures of functional or treatment outcome, which should be included in future research. Finally, the findings should be viewed with some caution because of the missing data common in these types of adherence studies (Little & Rubin, 1990).

This study may help to inform the development of interventions steeped in self-efficacy and imagery aimed at improving rehabilitation adherence and treatment outcome. Interventions aimed at increasing self-efficacy and imagery use have been developed and effectively used in other physical activity domains such as sport and exercise (Cumming et al., 2004), which suggests they may also prove worthwhile in a rehabilitation setting. Future research should explore the use of adherence-enhancing interventions designed to bolster self-efficacy and the use of imagery.

**Perspectives**

Self-efficacy and imagery are two social-cognitive variables that may positively influence adherence in an injury rehabilitation setting, which may subsequently improve treatment outcome. However, there is a lack of information regarding how these variables may shift over the course of rehabilitation. This study provides prospective data indicating that these constructs remain fairly stable over the rehabilitation period, with the exception of coping efficacy, which declined over time. Furthermore, reciprocal relationships between adherence and both imagery and self-efficacy were identified. This information may help to inform interventions aimed at improving adherence in a rehabilitation setting.

**Key words:** self-efficacy, imagery, adherence, injury, rehabilitation.

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Self efficacy & imagery use in rehabilitation
