Adherence to
Sport Injury Rehabilitation:
Implications for Athletic Training

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New England Orthopedic Surgeons
Wise, Jackson, and Rocchic (1979)

- administered the MMPI preoperatively to patients having knee surgery and evaluated outcome 1 to 3 years postoperatively
- elevations on the hysteria and hypochondriasis scales were associated with poorer postoperative outcomes
- what was responsible for this finding?
Simplified Theoretical Model

psychological factors

adherence to rehabilitation

rehabilitation outcome
Sport Injury Rehabilitation

Adherence Behaviors

• rest
• home exercises
• home cryotherapy
• medication prescriptions
• clinic-based exercises/therapy
Measures of Adherence to Clinic-Based Sport Injury Rehabilitation Activities

- healing rate
- attendance at rehabilitation sessions
- percentage of rehabilitation exercises completed
- self-ratings of adherence to clinic-based rehabilitation activities
- practitioner behavioral observations/judgments
Healing Rate

• assumes that better adherence leads to better outcome
• confounds adherence with treatment outcome
• should not be used as a measure of adherence
Attendance at Rehabilitation Sessions

- sessions attended/sessions scheduled
- simple and straightforward
- produces constricted, negatively skewed distributions
Percentage of Rehabilitation Exercises Completed

- quantifies clinic-based rehabilitation behavior
- no psychometric data supporting reliability and validity
- limited utility in closely-supervised rehabilitation environments, where compliance is typical and protocol adjustments are made when exercise completion is problematic
Self-Ratings of Adherence to Clinic-Based Rehabilitation Activities

- used infrequently
- taps patient self-knowledge of behavior
- subject to social desirability bias
- contingent on an accurate understanding of the rehabilitation protocol
- no psychometric data supporting reliability or validity
Practitioner Behavioral Observations/Judgments

- Rehabilitation practitioners record patient adherence behaviors or make judgments about patient adherence.
- Provide rich information, but are cumbersome to administer.
Practitioner Behavioral Observations/Judgments

Examples

- Sport Injury Rehabilitation Adherence Scale (SIRAS) - Brewer et al. (2000)
Sport Injury Rehabilitation Adherence Scale (SIRAS)

1. Circle the number that best indicates the intensity with which this patient completed the rehabilitation exercises during today’s appointment:
   - minimum effort  1  2  3  4  5  maximum effort

2. How frequently did this patient follow your instructions and advice?
   - never  1  2  3  4  5  always

3. How receptive was this patient to changes in the rehabilitation program?
   - very unreceptive  1  2  3  4  5  very receptive
Psychometric Properties of the SIRAS

- unidimensional
- Cronbach’s alpha = .82
- ICC = .79 over one-week period
- ICC = .57 for primary and secondary providers
- RAI = .94 for 2 raters over 4 sessions ($N = 12$)
- positively correlated with attendance at rehabilitation sessions
Construct Validity of the SIRAS (Brewer, Avondoglio et al., 2002)

- 43 athletic training and physical therapy students viewed videotaped interactions between an athletic therapist and a highly, moderately, and minimally adherent patient.
- Participants completed the SIRAS after viewing each vignette.
- Results supported the construct validity of the SIRAS and provided evidence of sensitivity to variations in adherence to clinic-based rehabilitation activities.
Means and Standard Deviations for SIRAS Scores Across Highly, Moderately, and Minimally Adherent Conditions

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\textit{Note.} RAI = .84 to .90

\textit{Source.} Brewer, Avondoglio et al. (2002).
Measures of Adherence to Home-Based Sport Injury Rehabilitation Activities

- knowledge of home rehabilitation protocol
- practitioner estimates of adherence to home-based rehabilitation activities
- home nonexercise treatment implementation
- home exercise completion
Knowledge of Home Rehabilitation Protocol

• assumes that greater knowledge corresponds with better adherence
• most appropriate for invariant, unprompted protocols
• no psychometric data supporting reliability or validity
Practitioner Estimates of Adherence to Home-Based Rehabilitation Activities

- has been used for:
  - home exercise completion
  - application of treatment modalities
  - activity restriction

- no psychometric data supporting reliability and validity

- potentially confounded with rehabilitation progress and clinic behavior
Home (Nonexercise) Treatment Implementation

• has been used for:
  » medication use
  » cryotherapy
  » heat treatment
  » compression application

• sophisticated, well-validated objective measures available to assess medication use

• unvalidated, retrospective self-report has been used to measure home (nonexercise) treatment implementation in sport injury rehabilitation
Home Exercise Completion

- single retrospective report
- weekly journal
- retrospective reports at clinic sessions
- daily self-reports
- objective measures
Single Retrospective Report

- convenient
- susceptible to bias, distortion, and inaccuracy in recall
- no psychometric data supporting reliability or validity
Weekly Journal

- costlier and less convenient than single retrospective report
- less susceptible to bias, distortion, and inaccuracy in recall than single retrospective report
- no psychometric data supporting reliability or validity
Retrospective Reports at Clinic Sessions

• relatively convenient
• susceptible to bias, distortion, and inaccuracy in recall
• preliminary data suggest that recalled home exercise activity is strongly related to daily reports of such activity over a one-week period
Daily Self-Reports

- reduce or eliminate memory bias problems
- compliance challenge can be managed with appropriate incentives
- correlate positively with objective indices of home exercise completion
- conceivably can inflate adherence estimates by functioning as a self-monitoring intervention
Objective Measures

- examples
  - accelerometer
  - electronic counting device attached to splint
  - monitor mounted on ankle exerciser
  - motion sensor embedded in ankle exerciser
  - portable computer attached to EMG biofeedback unit
  - mechanical or electronic counting device for audiotaped or videotaped home exercise protocols
Objective Measures

- eliminates problems associated with recall biases
- less susceptible than self-report to response distortion
- can be corroborated with self-reports
- subject to technical difficulties and monetary expense
Videotape Counter Features

- Counting function not readily apparent
- Must be played at least 5 minutes to register a count of 1
- Will not count in fast forward and rewind modes
- Will not count for 12 minutes between plays
- Separate hand-held counter reader
- Power-down mode
Validity of Electronic Videotape Counter

- Daily self-reports of home exercise completion were collected and weekly readings of the electronic videotape counter were obtained from ACL reconstruction patients (Brewer et al., 2004)

- Correspondence: correlation between electronic and self-report data was significant, $r = .58$

- Concordance: self-reported home exercise completion was significantly higher than electronically-estimated home exercise completion

- Self-reported adherence slightly overestimates actual adherence
Predictors of Adherence to Sport Injury Rehabilitation

- personal factors
- situational factors
- cognitive factors
- emotional factors
- behavioral factors
Personal Factors

- internal health locus of control (+)
- pain tolerance (+)
- self-motivation (+)
- task involvement (+)
- toughmindedness (+)
- ego involvement (-)
Situational Factors

- belief in efficacy of treatment
- comfort of clinical environment
- convenience of scheduling
- hours of sport involvement
- importance/value of rehabilitation
- information about rehabilitation
- perceived exertion during rehabilitation activities
- perceived injury severity
- perceived susceptibility
- practitioner expectancy of adherence
- time to do rehabilitation
Cognitive Factors

- ability to cope with injury (+)
- attribution of recovery to stable and controllable variables (+)
- rehabilitation self-efficacy (+)
- psychological skills (goal setting, imagery, and positive self-talk) (+)
- self-esteem certainty (+)
Emotional Factors

- fear of reinjury (-)
- mood disturbance (-)
Behavioral Factors

- instrumental coping (e.g., asking for additional information regarding the injury or rehabilitation program)
Adherence-Outcome Relationship

- positive association is assumed
- not consistently supported empirically
- only 11 of 132 comparisons of adherent and nonadherent people were statistically significant in a study of multiple nonrehabilitation diagnoses and interventions (Hays et al., 1994)
Adherence-Outcome Associations

- positive associations have been obtained in more than a dozen studies in the rehabilitation domain
- nonsignificant associations have been reported in more than 5 other rehabilitation studies and for other outcomes in studies where significant associations were reported
- negative associations have been reported in 2 rehabilitation studies
Adherence-Outcome Relationship

- investigated by our research group in two studies of patients undergoing rehabilitation following ACL reconstruction (Brewer et al., 2000, 2004)
- approximately 100 patients in each study
- clinic session attendance, SIRAS, and home exercise completion measures of adherence were obtained in both studies
- outcome evaluations were conducted at 6 months postsurgery in one study and at 6 months, 1 year, and 2 years postsurgery in the other study
Adherence-Outcome Relationship

- Brewer et al. (2000): attendance and SIRAS scores were positively related to functional performance (one-leg hop) but not knee laxity and subjective symptoms
- Brewer et al. (2004) study:
  - attendance and SIRAS scores were positively associated with subjective symptoms and negatively associated with knee laxity at 6 months postsurgery
  - no significant adherence-outcome associations at 1 year and 2 years postsurgery
Adherence-Outcome Relationship: Why So Elusive?

- adherence measures weakly related to each other
- outcome measures weakly related to each other
- factors other than adherence (e.g., physiological, medical) contribute to outcome
- adherence behavior (and the factors influencing it) can be situation-specific
- people healing quickly may adhere less
Adherence Enhancement

- intervention-related factors positively correlated with adherence in the general rehabilitation literature:
  - specialist (rather than GP) referral
  - telephone (rather than mail) appointment scheduling
  - reinforcement
  - self-help group membership
Adherence Enhancement

- Intervention-related factors positively correlated with adherence in the sport injury rehabilitation literature:
  - setting rehabilitation goals (Scherzer, Brewer, et al., 2001)
  - using positive self-talk (Scherzer, Brewer, et al., 2001)
  - using imagery (Milne et al., 2005; Scherzer, Brewer, et al., 2001)
Adherence Enhancement

- interventions for which experimental evidence of adherence enhancement has been obtained in the general rehabilitation literature:
  - goal setting
  - education
  - instructional media
  - professional supervision/instruction
  - multimodal intervention (e.g., goal setting, contingency contracting, reinforcement, modeling)
Adherence Enhancement

- intervention for which experimental evidence of adherence enhancement has been obtained in the sport injury rehabilitation literature:
  - goal setting (Evans & Hardy, 2002; Penpraze & Mutrie, 1999)
Adherence Enhancement

- findings from the general rehabilitation literature suggest that a variety of behavioral interventions can be used to enhance adherence
- findings from the sport injury rehabilitation literature suggest that psychological skills training (e.g., goal setting, imagery, relaxation, positive self-talk) may have a beneficial effect on adherence
Adherence Enhancement

- does enhancing adherence enhance outcome?
- enhanced adherence may at least partially explain effects of psychological interventions on sport injury rehabilitation outcomes
- example: Cupal and Brewer (2001) study
  - randomized controlled trial \( N = 30 \) ACL surgery patients
  - relaxation/guided imagery, placebo, and no treatment conditions
  - knee pain and reinjury anxiety assessed at 2 weeks and 24 weeks postsurgery (knee strength assessed at 24 weeks postsurgery only)
Effect of Relaxation and Guided Imagery Intervention on Knee Strength
Effect of Relaxation and Guided Imagery Intervention on Knee Pain

![Graph showing perceived pain over time for intervention, placebo, and control groups.](image-url)
Effect of Relaxation and Guided Imagery Intervention on Reinjury Anxiety
Conclusions

- multiple measures of sport injury rehabilitation adherence can be obtained and documented
- personal and situational factors are predictive of sport injury rehabilitation adherence
- sport injury rehabilitation adherence can be enhanced through psychological interventions
- adherence can contribute to sport injury rehabilitation outcomes