Causal Relationships between the Psychological Acceptance Process of Athletic Injury and Athletic Rehabilitation Behavior

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Abstract. [Purpose] The purpose of this study was to examine the causal relationships between the psychological acceptance process of athletic injury and athletic-rehabilitation behavior. [Subjects] One hundred forty-four athletes who had injury experiences participated in this study, and 133 (mean age = 20.21 years, SD = 1.07; mean weeks without playing sports = 7.97 weeks, SD = 11.26) of them provided valid questionnaire responses which were subjected to analysis. [Methods] The subjects were asked to answer our originally designed questionnaire, the Psychosocial Recovery Factor Scale (PSRF-S), and two other pre-existing scales, the Athletic Injury Psychological Acceptance Scale and the Athletic-Rehabilitation Dedication Scale. [Results] The results of factor analysis indicate “emotional stability”, “social competence in the team”, “temporal perspective”, and “communication with the teammates” are factors of the PSRF-S. Lastly, the causal model in which psychosocial recovery factors are mediated by psychological acceptance of athletic injury, and influence on rehabilitation behaviors, was examined using structural equation modeling (SEM). The results of SEM indicate that the factors of emotional stability and temporal perspective are mediated by the psychological acceptance of the injury, which positively influences athletic-rehabilitation dedication. [Conclusion] The causal model was confirmed to be valid.

Key words: Psychosocial recovery factor, Athletic injury psychological acceptance, Athletic rehabilitation

INTRODUCTION

The fields of orthopedic and sports medicine have significantly contributed to the treatment and prevention of sports injuries. A marked advancement in rehabilitation sciences, such as biomechanics and physiotherapy has been seen in recent years, and it has played a central role in the early recovery of athletes and return from injury, as well as in the prolongation of athletic life span. However, although these fields dealing with the physical aspects of the injured athletes are constantly making progress, the progress of psychological aspects that directly deal with athletes’ psychological domain has remained slow1). Today, rehabilitation is performed during the acute phase. Therefore, the establishment of an intervention model facilitating a prompt shift to treatment, or rehabilitation is needed. In addition, the establishment of a theoretical model that deals with the medical contribution needed for holistic recovery, including shortening the time spent on the physiological and functional recovery of the body is required.

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feelings of sorrow and grief. The stage model formulates the self-defensive and natural coping processes toward such sorrow and grief. This model also deals with the grief of the injured athletes and includes grief therapy with the goal of “psychological acceptance of the injury.” However, although clinical psychologists and researchers engaging injured athletes may hypothetically advocate the effectiveness of the stage model, each stage and its order have not been confirmed by empirical research. With this as the background, doubt has been expressed about the stage model. For example, Brewer criticized the lack of predictive value of the stage model from a demonstrative perspective, and presented a cognitive appraisal model as a new theoretical model. The cognitive appraisal model is based on the “theory of cognitive appraisal for stress and coping” proposed by Lazarus and Folkman. In this theory, a sport injury is regarded as a stressor. This means that the way in which the injured athlete cognitively appraises his or her injury defines emotional reactions such as anger and depression, as well as the level of behavioral reactions such as treatment and rehabilitation. This model was developed around the same time as the implementation of acute rehabilitation, and it became widespread as a behavioral modification model aiming at the early recovery of athletes’ injuries. It is based on cognitive behavior therapy, and mainly aims to correct the cognitive distortions of the injured athletes, and decrease or control their negative emotional expressions, as well as providing an educational approach facilitating focus on rehabilitation behaviors. The goal of this approach is to enable injured athletes to learn adaptive behaviors, and some research has provided evidence of the effectiveness of this model. The cognitive appraisal model may have contributed to reducing the excessive expectations of the stage model, which indicates that, “all injured athletes go through a set of stages”, raising the risk of losing sight of the importance of injured athletes’ psychological processes. However, practical problems with the cognitive appraisal model have also been identified. They relate to how this model places importance on “grief” and “emotions” as these subjectively exist within the injured athletes. In other words, implicit in the position that the natural reaction of humans, grief (an emotion) subject to cognition and behavior, is an understimation of the meaning of emotions. This issue has been already been focused on in the field of rehabilitation. For example, Buckelew compared the difference in the state of mind of the patient before and after cognitive behavioral therapy was applied and spread in the US. His results indicate that higher rates of anxiety, hostility, fear, and psychiatric responses were observed after this therapy was introduced. Buckelew suggested that reducing stress levels and encouraging patients to undergo smooth and prompt rehabilitation made them feel higher rates of anxiety and fear. Consequently, Buckelew emphasized the importance of reconfirming the effectiveness of the stage model by describing the process of psychological acceptance. In addition, Petitpas and Danish, based on the examination of a clinical psychology case study, reported that lack of emotional reactions was a sign of a potential problem. The case description is that of a football player who forced himself to pretend to accept a medical condition by repressing his grief reactions. The stage model combined with grief therapy, that facilitates athletic injury psychological acceptance (AIPA) is expected to elicit grief (emotion) in injured athletes without delay, so that they can truly recover their mental state and sublimate as a human being. Thus, there is a need to return to the perspective of the stage model. However, the existing model, which claims that injured athletes have to go through a grief stage to reach acceptance has unclarities for response stages. Therefore, it is necessary to establish an alternative model. For that purpose, it is necessary to clearly define the condition of AIPA. In previous studies, AIPA has only been described using the recovery index of emotional variables, and this does not resolve the problem, because the meaning of acceptance remains ambiguous. Therefore, AIPA needs to be redefined by adding cognitive and behavioral aspects, and thoroughly examining factors involved in this acceptance.

Based on this, firstly, Tatsumi took cognitive, emotional, and behavioral aspects into consideration of a case of injury. The AIPA condition was defined as “the psychological state in which an injured athlete is aware of the difficulties of injury but can control his emotions to actively figure out what needs to be done immediately, and what needs to be done with priority in order to overcome the injury”. Tatsumi explained that the AIPA consists of two factors, “self-motivation” and “focus on the present”. Self-motivation is defined as the mentality with a clear and consistent sense of purpose for rehabilitation effort for the injury event. The focus on the present is defined as the mentality enabling the feeling of compromise for the injury event. Tatsumi explained that these factors of the AIPA relate to the Athletic Rehabilitation Dedication (ARD). In addition, Tatsumi and Nakagomi examined a case of injury and identified; the three psychosocial perspectives, “emotional stability”, “temporal perspective” and “team attachment”, and the mind of “coping free of adhesion” as the predictive perspectives of the AIPA. Emotional stability refers to emotional recovery, temporal perspective refers to the recovery of prospect within a certain period, and team attachment refers to interpersonal communication within the club and recovery of the sense of presence. Coping free of adhesion refers to the mentality that enables the injured to escape from the persistent negative influences arising from the injury. Coping free of adhesion is a mentality that is similar to the AIPA, and was later included in the AIPA. Namely, three psychosocial perspectives were considered to predict AIPA; however, the relationship between these perspectives and the AIPA has not been empirically investigated. Therefore, in this study, first, the Psychosocial Recovery Factor Scale (PSRF-S), consisting of three factors including emotional stability, temporal perspective, and team attachment, was developed and evaluated. Second, the process by which the Psychosocial Recovery Factor (PSRF) influences the AIPA was defined as the psychological acceptance process, and the causal model (Fig. 1), in which this process influences athletic rehabilitation behaviors was examined. We hypothesized that these investigations would lead to an alternative model that could deal with the probability issue of the stage.
SUBJECTS AND METHODS

Subjects

The criteria for subject selection were set with consideration of the degree of injury, phase of the athletic rehabilitation process the injured was undergoing, and the dedication to competitive sports by the injured athlete because they were likely to influence their psychological state.

(a) Active athletes that had an injury experience and had stopped athletic activities for longer than a week after entering the university and those that had experienced athletic rehabilitation.

(b) Athletes who were not currently receiving rehabilitation for their injury and had returned to sports for over a week.

(c) Student athletes belonging to the Faculty of Sports and Exercise Science that were expected to aspire to participate in competitive sports and have strong competitive careers.

Former injured athletes who met all of the above criteria participated in this study. The criteria of the period that they had to stop playing sports due to injuries and the aspiration to competitive sports were similar to the criteria used in previous studies9, 23). Prior to this study, the overview of this research was explained to each adviser of the four leading athletic clubs of the Sport Science University, as well as to a medical scientist who worked as an instructor at the same university. Their consent to cooperate with this research was received (i.e., for the distribution and collection of the survey forms). When the study was implemented, potential subjects were required to confirm their willingness to participate in this research. One hundred forty-four athletes with injury experiences agreed to participate. This study was conducted after receiving ethical approval from the Research Ethics Committee of Kio University.

Methods

The scale development procedure for the PSRF-S (i.e., independent variables and precedent factors of the AIPA), the index of the ARD (i.e., dependent variables) and the index of the AIPA (i.e., mediators), the methods of conducting this study, and the data analysis procedures are described below.

On the basis of records from a previous interview study1), the PSRF-S items were created to address the following perspectives: "emotional stability", "temporal perspective", and "team attachment". Five former university students with injury experiences who had temporarily stopped competitive sports, and had undergone athletic rehabilitation participated in the interview study. Three semi-structured interviews were conducted with each participant for approximately 60 to 80 minutes. The questions asked in the interviews related to the athletes’ emotional states, their interpersonal relationships within the athletic club, situations of dealing with the injuries, and their approaches to rehabilitation. With the consent of the interviewees, their oral replies were recorded. A scale was developed based on the replies collected during the interview survey. The three perspectives described above were incorporated during the itemization procedure. Based on these procedures, a total of 24 items, consisting of seven items of "emotional stability", six items of "temporal perspective", and 11 items of "team attachment" were developed. The perspective of "team attachment" consisted of three subscales (i.e., self-competence in the club, cognition of the leader and the leader’s management, cognition of the teammates) from the Adjustment Scale for School Athletic Clubs (ASSAC)24) with identical contents that has previously been validated. Therefore, nine items from the three subscales of the ASSAC were used, and two items based on the interview survey were added to develop our scale. Furthermore, during the itemization process, an athletic trainer majoring in sports medicine and a clinical psychologist majoring in sports psychology examined the content validity of the scale.

Next, the Athletic Injury Psychological Acceptance Scale (AIPA-S), consisting of seven items, was employed to measure AIPA, which was the mediating variable23). The AIPA-S is an index used to measure the degree of psychological acceptance of athletic injury, and it consists of the following two subscales: "focus on the present (four items)" and "self-motivation (three items)." The reliability and validity of the AIPA-S have been confirmed. The reasons for using this scale were that Tatsumi and Nakagomi1) which extracted the predictive perspectives of the AIPA, and Tatsumi23) which developed the AIPA-S had indicated the relationship between perspective of this scale and the three psychosocial recovery factors.

Lastly, the Athletic Rehabilitation Dedication Scale (ARD-S) was used to measure athletic rehabilitation behaviors (i.e., the dependent variable). The ARD-S assesses the degree of dedication to rehabilitation. This scale consists of three items: participation in rehabilitation, “I always participate in the scheduled rehabilitation unless I have a reason to be absent”; rehabilitation completion, “I sufficiently complete the scheduled rehabilitation plan”; and rehabilitation effort, “during the course of rehabilitation, I try to make as much effort as I can to complete the tasks”. The validity of this scale has been examined in previous studies26–28). In the study by Tatsumi23), the ARD-S was used as the external criterion to examine the validity of the AIPA-S.

The participants were asked to recall injury experiences, and based on their memory about the situation at the time, they were requested to respond to questions on the three scales described above using a 7-point Likert type response format ranging from 1 (not at all) to 7 (very much). They were also asked to respond to questions written on the face sheet regarding the athletic event, the competition results, the date of the injury, the name of the injury, the degree...
of the injury (i.e., the number of days sports were stopped based on a doctor’s diagnosis).

This study was conducted anonymously. The survey form distributed to formerly injured athletes was placed in an envelope with an attached letter requesting participation in the study. Those that consented to participate were asked to take out the survey form and respond to the questions. When collecting the survey form, regardless of the responses, the participants were asked to place the form in the original envelope and seal it. If the participants had multiple injury experiences in the past, they were asked to pick the one with the most memorable injury event and respond regarding that experience.

In the data analysis, the reliability and validity of the scales were first examined, followed by investigation of the correlations between the scales. Lastly, the causal model was examined with covariance structure analysis. More concretely, the descriptive statistics for all items of PSRF-S were first calculated, followed by confirmation of the score distribution and investigation of whether any items showed ceiling or floor effects. Second, item analyses were conducted using G-P analysis and I-T correlation analysis. Third, factor analyses were conducted on the PSRF-S data to examine if the hypothesized factor structure was observed. The factors were extracted and the final items were selected, and then factorial validity was examined. Fourth, factor analysis was conducted to examine the factor structure of the existing AIPA-S to confirm if it would replicate the one reported in a previous study. This is because the AIPA-S23 was originally designed to diagnose the psychological acceptance of athletes who are currently injured. In this study, the data was collected from the athletes after their recovery was complete; therefore, it was possible that the data did not demonstrate the same factor structure. Furthermore, the reliability of the internal consistency of these scales was examined using Cronbach’s alpha coefficient. Fifth, Pearson’s product moment correlation coefficient was calculated to examine the strength of the correlation between each scale. The scale scores of the PSRF-S and the AIPA-S were calculated by computing the total score of each scale and dividing it by the number of items. Furthermore, the raw data of the ARD-S consisting of “rehabilitation participation”, “rehabilitation completion”, and “rehabilitation effort”, were used as scale scores. Sixth, hierarchical multiple regression analysis and covariance structure analysis were used to examine the causal model in which the AIPA mediated the path from the PSRF to ARD (rehabilitation participation, rehabilitation completion, and rehabilitation effort). In the hierarchical multiple regression analysis, first, multiple regression analysis was conducted with the PSRF as the independent variable, and the AIPA as the dependent variable, followed by multiple regression analysis with the PSRF and the AIPA as independent variables and the three subscales of the ARD as dependent variables. The forced entry method was used in the analyses, and based on the standard partial regression coefficients as well as the significance of the regression equation, the causal model was hypothesized. Lastly, the causal model assumed based on the result of hierarchical multiple regression analysis was examined by using covariance structure analysis. The following measures of fit were used to evaluate the adequacy of the model: CMIN, goodness of fit index (GFI), adjusted goodness of fit index (AGFI), comparative fit index (CFI), root mean square error of approximation (RMSEA), and Akaike’s information criterion (AIC). The data were analyzed using IBM SPSS 20.0 Statistics and Amos 20.0.

RESULTS

The data for 133 participants (mean age was 20.21 years, SD = 1.07) who completely answered the PSRF-S, the AIPA-S, and the ARD-S were analyzed in this study. The mean length of time not playing sports based on the athlete’s doctor’s diagnosis was 7.97 weeks (SD=11.26). Athletic events taken part in by the participants consisted of team (n = 105) and individual sports (n = 28) covering eighteen events. All individual sports were also conducted as a team (or group) competition. The athletic level of the participants’ team was rather high (intercollege, or pre-intercollege level). All the colleges to which the teams belonged had a tradition of playing sports. Therefore, all the teams had excellent coaches and were highly organized. For a supplementary index, the subjects responded by indicating the degree of their devotion to competition at the time of the injury by choosing one of 4 levels: 1 (Not at all devoted) and 4 (Highly devoted). The results indicate that the mean level of devotion was high (M=3.52, SD=0.74). The above results suggest that participants’ devotion to competition was high and that they had sufficient experience of athletic competition.

First, the descriptive statistics of the item scores of the PSRF-S are presented in the left column of Table 1. The results showed that no item had a ceiling or floor effect. Second, the I-T correlation analysis and the G-P analysis were conducted. In the I-T correlation analysis, the total score of the 24 items was calculated, and correlation coefficients were computed between this total score and each item. The central column in Table 1 reports this result. Significant correlations were found for all 24 items, ranging from r = 0.17 to 0.74. In the G-P analysis, individual total scores were calculated. The top 25% of this score was defined as the G-group (n=35), and the bottom 25% was defined as the P-group (n=34). The t-test was conducted on the mean scores of each item. The results are reported in the right column of Table 1. As Table 1 shows, 23 items, all but item 7 or “I become tense”, showed statistical significance. Consequently, these 23 items were used for the PSRF-S, and item 7 was removed from subsequent analysis. Third, factor analysis using the principal factor method and the Promax rotation was conducted to elucidate the factor structure of the questionnaire consisting of 23 items. The criteria for the factor extraction were as follows: based on the Kaiser-Guttman criterion, an eigenvalue greater than 1.0; an absolute value of the factor loading greater than 0.40; high communality; and contents of the items being relevant to the name of the factors.

As a result, four interpretable factors were extracted. As item 8, “I am trying to deal with things thoroughly by thinking about the future,” had a low factor loading, it was
removed from the analysis. Table 2 demonstrates the results of the factor analysis of the PSRF-S. The first factor includes eight items, which indicate the condition of emotional recovery and stability; therefore, it was named the “emotional stability” factor. Although item 2 and item 14 were included in the temporal perspective during the scale development phase, they were included in the first factor here. This may be because participants responded to the emotional components attached to these items, such as irritation and anxiety. The second factor includes five items, which indicate the relationship with the leader of the team, and the recovery of social competence related to the management aspect; therefore, it was named the “social competence in the team” factor. The third factor includes four items, which indicate the mentality of prospect for a certain period, from a psychologically unstable condition; therefore, it was named the “temporal perspective” factor. During the scale development phase, item 15 was included in the perspective of “team attachment”; however, this item was perceived to constitute the third factor. This may be because participants perceived this item reflected recovery of the temporal perspective, including awareness of the individual’s role in the team and reacquisition of a sense of purpose. The fourth factor includes five items, which indicate the recovery of the interpersonal relationship with teammates and the communication aspect; therefore, it was named the “communication with the teammates” factor. The results of this analysis show that the first and the third factors were equivalent to the ones that had been expected during the scale development; however, the second and fourth factors were divided in the perspective of “team attachment”. Thus, the perspective of “team attachment” contains two perspectives, “social competence in the team” and “communication with the teammates”. While the recovery of social competence in the team indicates an enhanced relationship with the team leader and management of the team, the recovery of communication with teammates indicates enhanced positive feelings toward teammates. Therefore, these indicate the effectiveness of using the two approaches for team attachment.

Based on the results described above, the factorial validity of the PSRF-S was confirmed. The internal consistency of the PSRF-S as assessed by Cronbach’s alpha coefficient was 0.89 for the total PSRF-S, and ranged from 0.82 to 0.85 for the subscales as indicated in Table 2. Consequently, the internal consistency reliability was found to be satisfactory.

Table 1. PSRF-S descriptive statistics and item analysis results

| No | Descriptive statistics | I-T correlation analysis | G-P analysis |
|----|------------------------|--------------------------|--------------|
|    |            | M ± SD      | r    | M ± SD      | M ± SD      | t  |
| 1  | 3.23 ± 1.95  | 0.29***     | 3.63 ± 1.97 | 2.32 ± 1.80 | 2.87 **     |
| 2  | 4.10 ± 1.93  | 0.68***     | 5.71 ± 1.55 | 2.41 ± 1.42 | 9.25 ***    |
| 3  | 3.86 ± 1.66  | 0.53***     | 4.91 ± 1.72 | 2.94 ± 1.58 | 4.96 ***    |
| 4  | 3.90 ± 1.51  | 0.35***     | 4.40 ± 1.82 | 3.29 ± 1.53 | 2.73 **     |
| 5  | 5.29 ± 1.61  | 0.61***     | 6.51 ± 0.74 | 3.82 ± 1.99 | 7.39 ***    |
| 6  | 3.82 ± 1.82  | 0.48***     | 4.71 ± 1.99 | 2.41 ± 1.64 | 5.24 ***    |
| 7  | 4.02 ± 1.65  | 0.17*       | 4.43 ± 1.77 | 3.82 ± 1.75 | 1.43 n.s.   |
| 8  | 4.45 ± 1.73  | 0.63***     | 5.91 ± 1.20 | 3.12 ± 1.25 | 9.49 ***    |
| 9  | 4.47 ± 1.70  | 0.69***     | 6.11 ± 1.18 | 3.35 ± 1.54 | 8.39 ***    |
| 10 | 3.92 ± 1.43  | 0.53***     | 4.74 ± 1.42 | 2.97 ± 1.34 | 5.33 ***    |
| 11 | 4.36 ± 1.64  | 0.63***     | 5.60 ± 1.61 | 3.03 ± 1.40 | 7.06 ***    |
| 12 | 4.49 ± 1.91  | 0.62***     | 6.00 ± 1.41 | 2.97 ± 1.71 | 8.02 ***    |
| 13 | 3.70 ± 1.48  | 0.46***     | 4.46 ± 1.72 | 2.68 ± 1.43 | 4.67 ***    |
| 14 | 4.58 ± 1.80  | 0.58***     | 6.11 ± 1.39 | 3.26 ± 1.66 | 7.75 ***    |
| 15 | 4.86 ± 1.54  | 0.56***     | 6.00 ± 0.84 | 3.82 ± 1.83 | 6.31 ***    |
| 16 | 3.77 ± 1.71  | 0.38***     | 4.63 ± 1.75 | 2.88 ± 1.75 | 4.14 ***    |
| 17 | 4.93 ± 1.42  | 0.52***     | 6.00 ± 1.03 | 4.06 ± 1.71 | 5.71 ***    |
| 18 | 4.24 ± 1.73  | 0.74***     | 5.86 ± 1.22 | 2.82 ± 1.60 | 8.83 ***    |
| 19 | 4.71 ± 1.64  | 0.55***     | 5.71 ± 1.41 | 3.47 ± 1.67 | 6.04 ***    |
| 20 | 4.93 ± 1.46  | 0.64***     | 6.17 ± 0.82 | 3.76 ± 1.67 | 7.56 ***    |
| 21 | 4.38 ± 1.48  | 0.50***     | 5.46 ± 1.34 | 3.71 ± 1.53 | 5.07 ***    |
| 22 | 3.86 ± 1.92  | 0.62***     | 5.49 ± 1.67 | 2.44 ± 1.31 | 8.42 ***    |
| 23 | 4.83 ± 1.67  | 0.51***     | 6.17 ± 1.07 | 3.94 ± 1.69 | 6.58 ***    |
| 24 | 5.08 ± 1.56  | 0.47***     | 6.09 ± 1.31 | 4.18 ± 1.47 | 5.70 ***    |

*p<0.05, **p<0.01, ***p<0.001. Item number (No) corresponds to the item shown in Table 2. Values are expressed as mean (M) ± standard deviation (SD).
Table 2. Factor analysis results for the PSRF-S

| Factors and Items (α=0.89) | F1 | F2 | F3 | F4 | h² |
|----------------------------|----|----|----|----|----|
| F1 Emotional Stability (8 items: α=0.85) | | | | | |
| 22 I don’t feel haste | 0.87 | 0.00 | −0.10 | −0.05 | 0.64 |
| 6 I don’t feel pressure | 0.72 | −0.04 | −0.08 | −0.09 | 0.42 |
| 2 I am not in a hurry, and try to begin at my pace | 0.71 | 0.04 | 0.10 | −0.08 | 0.55 |
| 18 I am calm | 0.63 | −0.01 | 0.18 | 0.10 | 0.64 |
| 11 I don’t have hesitation | 0.60 | 0.07 | 0.17 | −0.07 | 0.47 |
| 14* Prospects for the future are uncertain | 0.57 | 0.02 | −0.04 | 0.11 | 0.38 |
| 1 I do not feel shock | 0.57 | 0.00 | −0.18 | −0.12 | 0.21 |
| 12* It confuses me | 0.51 | −0.06 | 0.02 | 0.24 | 0.42 |
| F2 Social Competence in the Team (5 items: α=0.84) | | | | | |
| 4 The team leader understands me well | 0.02 | 0.79 | 0.04 | −0.25 | 0.55 |
| 13 My opinion is accepted for the team activity | 0.00 | 0.77 | −0.04 | 0.04 | 0.60 |
| 10 I think that I am suitable man as the member of the team | −0.02 | 0.73 | 0.01 | 0.14 | 0.63 |
| 16 I can talk without constraints with the team leader | 0.04 | 0.68 | −0.12 | 0.02 | 0.44 |
| 3 I think of myself to be a necessary part of the team | −0.02 | 0.62 | 0.13 | 0.08 | 0.50 |
| F3 Temporal Perspective (4 items: α=0.85) | | | | | |
| 17 The goal that can be achieved is set up little by little | −0.05 | −0.08 | 0.87 | −0.10 | 0.61 |
| 20 I try to work positively in my own way | 0.00 | −0.07 | 0.80 | 0.08 | 0.66 |
| 15 I will do what I can do for the team | −0.12 | 0.12 | 0.76 | −0.02 | 0.56 |
| 5 I try to begin to do in my own way | 0.03 | 0.01 | 0.75 | −0.01 | 0.58 |
| F4 Communication with Teammates (5 items: α=0.82) | | | | | |
| 23 I am satisfied with the interpersonal relationship with teammates | −0.10 | −0.15 | −0.03 | 0.96 | 0.74 |
| 19 I am satisfied with the colleague relation of the team | 0.06 | −0.04 | −0.06 | 0.78 | 0.59 |
| 24 There is somebody on my team with whom I can discuss problems | −0.13 | 0.10 | 0.05 | 0.63 | 0.43 |
| 21 My team values players’ individuality | −0.03 | 0.31 | −0.08 | 0.52 | 0.43 |
| 9 I can easily familiarize myself with relevant team issues | 0.27 | 0.04 | 0.14 | 0.44 | 0.51 |

Correlation coefficient

| F1 | F2 | F3 | F4 |
|----|----|----|----|
| 0.21 | 0.55 | 0.46 |
| 0.34 | 0.40 |
| 0.47 |

*Reversing score item

for the whole scale and the subscales. Correlations among the factors ranged from r=0.21 to 0.55.

Next, factor analysis using the principal factor method and Promax rotation was conducted on the seven items to confirm the factor structure of the AIPA-S. The result indicated the existence of two factors (Table 3). The first factor was interpreted as the mentality of consistent intention and purpose to cope and make efforts. The second factor was interpreted as the mentality of compromise in the event of injury. These are equivalent to the factors, “self-motivation” and “focus on the present”, described in a previous study by Tatsumi23; therefore, factor invariance was confirmed. However, although item 2, “I have come to terms with the past and am focused on the present”, was included in the second factor in Tatsumi’s previous study, it was confirmed to be in the first factor in the present study. This result may stem from the fact that the participants in the previous study were injured at the time of study, and they might have responded to the first half of the sentence of this item, whereas the athletes in the present study gave answers based on their memories of past injuries, and they might have responded to the latter half of the sentence of the item.

While the athletes’ responses in the previous study may have been based on their compromise for the already occurred injury event, their responses in this study may have been based on their introspections about their rehabilitation efforts in general. Item 4 was included in the first factor in the previous study23; however, the factor loading of this item was less than 0.40 in this study. Therefore, it was removed from the subsequent analysis. Based on these results, the factor structure of this scale was found to be almost the same as that in Tatsumi’s study. Although a slight difference exists for one item, it is within an acceptable range; therefore, it appeared to be reasonable to use the two factors (three items each) in the subsequent analyses.

Table 4 presents the correlation coefficients of the subscales of the PSRF-S, the AIPA-S, and the components of the ARD-S (i.e., the rehabilitation participation, the rehabilitation completion, and the rehabilitation effort). The correlations among the four subscales of the PSRF were significant, and the correlation coefficients ranged from 0.19 to 0.45. The correlation between the four subscales of
the PSRF and the two subscales of the AIPA were also significant (correlation coefficients ranged from 0.28 to 0.71). Regarding the correlations between the PSRF and the ARD, the temporal perspective subscale significantly correlated with the three subscales of the ARD (correlation coefficients ranged from 0.18 to 0.48). However, no significant correlation was found among the other subscales. Although previous studies have pointed out that “emotional stability” and “rehabilitation” positively correlate28), in the present study, we found no such correlation between the two factors. Regarding the correlations between the AIPA and the ARD, the self-motivation subscale of the AIPA was significantly correlated with the three subscales of the ARD (correlation coefficients ranged from 0.25 to 0.44). The focus on the present subscale of the AIPA significantly correlated with rehabilitation effort as well, r=0.25.

Lastly, using hierarchical multiple regression analysis, the paths for the causal model were estimated, in which the path from the PSRF to the ARD is mediated by the AIPA. Then, the final model was examined with a covariance structure analysis. The results of the multiple regression analysis using the four variables of the PSRF-S as independent variables and the two variables of the AIPA-S as dependent variables are reported in Table 5A. “Emotional stability” and “temporal perspective” showed statistically significant positive standard partial regression coefficients for “self-motivation” and “focus on the present”. In addition, “communication with teammates” showed a statistically significant positive standard partial regression coefficient for “focus on the present”. Furthermore, “social competence in the team” tended to positively influence “self-motivation”. The results of the multiple regression analysis, using the four variables of the PSRF-S and the two variables of the AIPA-S as independent variables and the three variables of the ARD-S as dependent variables, are presented in Table 5B. Although “self-motivation” showed statistically significant positive standard partial regression coefficients for the three variables of the ARD, “emotional stability” of the PSRF showed statistically significant negative standard partial regression coefficients for the same

Table 3. Factor analysis results for the AIPA-S

| Factors and items (α=0.86) | F1 | F2 | h² |
|----------------------------|----|----|----|
| F1 Self-Motivation (3 items: α=0.89) | 7 I understand what I need to do to move forward | 1.01 | -0.13 | 0.87 |
|                             | 6 It is clear to me what I have to do now | 0.93 | -0.03 | 0.82 |
|                             | 2 I have come to terms with the past and am focused on the present | 0.63 | 0.18 | 0.57 |
| F2 Focus on the Present (3 items: α=0.67) | 1* I want to run away from my current situation | -0.08 | 0.71 | 0.43 |
|                             | 3* I am still worrying about the past and cannot move forward | -0.03 | 0.61 | 0.35 |
|                             | 5 I don’t have any worries and am positively accepting my current situation | 0.31 | 0.49 | 0.54 |

(Reminder Item)

| 4 I am clarifying what I can do now and what I cannot do and planning ahead | 0.35 | 0.39 | 0.47 |

Correlation coefficient F1

- | 0.67

*Reversing score item

Table 4. Correlation, mean and standard deviation of each scale

| Psychometric properties | M   | SD  | 1   | 2   | 3   | 4   | 5   | 6   |
|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|
| Psychosocial Recovery Factor Scale |     |     | 1   | 2   | 3   | 4   | 5   | 6   |
| 1 Emotional stability  | 4.08| 1.29| -   |     |     |     |     |     |
| 2 Social competence in the team | 3.83| 1.21| 0.19* | -   |     |     |     |     |
| 3 Temporal perspective | 5.00| 1.25| 0.45*** | 0.28** | -   |     |     |     |
| 4 Communication with teammates | 4.70| 1.23| 0.42*** | 0.39*** | 0.40*** | -   |     |     |

Correlation coefficient

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
|   |   |   |   |   |   |

| Athletic Injury Psychological Acceptance Scale |     |     |     |     |     |     |     |
| 5 Self-motivation | 4.74| 1.39| 0.64*** | 0.33*** | 0.70*** | 0.42*** | -   |     |
| 6 Focus on the present | 4.56| 1.41| 0.71*** | 0.28**  | 0.48**  | 0.50*** | 0.58*** | -   |

| Athletic-Rehabilitation Dedication Scale |     |     |     |     |     |     |     |
| 7 Rehabilitation participation | 5.19| 1.68| -0.03| 0.09| 0.18* | -0.03| 0.25**| 0.04| -   |
| 8 Rehabilitation completion | 4.86| 1.46| 0.09| 0.14| 0.40***| 0.04| 0.44***| 0.16†| 0.68***| -   |
| 9 Rehabilitation effort | 5.16| 1.44| 0.10| 0.10| 0.48***| 0.15†| 0.44***| 0.25**| 0.70***| 0.78*** |

†p<0.10, *p<0.05, **p<0.01, ***p<0.001
three variables. Furthermore, “temporal perspective” was confirmed to have a positive influence on “rehabilitation effort” and have tendency of negative influence on “rehabilitation completion.” Furthermore, “focus on the present” of the AIPA have tendency of positive influence on “rehabilitation effort.”

Next, based on the results of these hierarchical multiple regression analyses, a hypothetical causal model was created, and it was examined using covariance structure analysis. Firstly, covariance among the four variables of the PSRF (i.e., exogenous variables) and covariance among the error of three variables of the ARD (i.e., endogenous variables) were hypothesized. In addition, considering the strong correlation among the subscale scores of the AIPA (i.e., endogenous variables), the error terms were allowed to covary. Then, based on the result of multiple regression analysis, the initial path was taken up from less than 10% of the significance level of a standard partial regression coefficient. And then, the paths which are not significant were sequentially deleted, and the analysis was repeated until the fit indices showed the highest fit to the observed data. The fit indices for the final model indicated a good fit to the observed data: $\chi^2(14)=19.32$ (p=0.15), GFI=0.97, AGFI=0.90, CFI=0.99, RMSEA=0.05, AIC=81.32. This result is presented in Fig. 2. All the path coefficients are significant. The values indicating single or double directions in Fig. 2 show path coefficients (standardized values).

### Table 5A. Multiple regression analysis result with the criterion variable of AIPA-S 2 variables

| Psychometric properties | 5. Self-motivation | 6. Focus on the present |
|-------------------------|--------------------|------------------------|
| 1. Emotional stability  | 0.392 ***          | 0.560 ***              |
| 2. Social competence in the team | 0.104 †      | 0.067                  |
| 3. Temporal perspective | 0.493 ***         | 0.134 *                |
| 4. Communication with the teammates | 0.016          | 0.182 **               |
| R²                      | 0.639              | 0.570                  |
| F                       | 56.597 ***         | 42.424 ***             |

†p<0.10, *p<0.05, **p<0.01, ***p<0.001

### Table 5B. Multiple regression analysis result with the criterion variable of ARD 3 variables

| Psychometric properties | 7. Rehabilitation participation | 8. Rehabilitation completion | 9. Rehabilitation effort |
|-------------------------|---------------------------------|-----------------------------|--------------------------|
| 1. Emotional stability  | −0.314 †                       | −0.320 **                   | −0.410 ***               |
| 2. Social competence in the team | 0.036                   | 0.017                       | −0.090                   |
| 3. Temporal perspective | 0.033 †                       | 0.192 †                     | 0.323 **                 |
| 4. Communication with the teammates | −0.133                  | −0.159 †                    | −0.035                   |
| 5. Self-motivation      | 0.436 **                      | 0.537 ***                   | 0.408 **                 |
| 6. Focus on the present | 0.053                          | 0.057                       | 0.195 †                  |
| R²                      | 0.133                          | 0.290                       | 0.329                    |
| F                       | 3.212 **                       | 8.579 ***                   | 10.300 ***               |

†p<0.10, *p<0.05, **p<0.01, ***p<0.001

Fig. 2. Covariance structure analysis result for the model of causal relationships between the psychological acceptance process of athletic injury and athletic-rehabilitation behavior.
DISCUSSION

The purpose of this study was to examine an alternative model to complement the intervention model that has been used in the field of athletic rehabilitation. This study aimed to establish a model incorporating the value of the mean- used in the field of athletic rehabilitation. This study aimed to establish a model incorporating the value of the mean-

In summary, first, regarding the PSRF, the levels of recovery of "emotional stability" and "temporal perspective" were mediated by "self-motivation" of the AIPA; therefore, there were paths indicating indirect positive influences on the three variables of the ARD (which is subsequently referred to as the indirect effect). Second, the levels of recovery of "emotional stability" and "communication with teammates" positively influenced "rehabilitation effort" with mediation by "focus on the present" of the AIPA; therefore, the indirect effects can be pointed out in the paths. Third, it should be noted that "emotional stability" was not mediated by the AIPA, and directly and negatively influenced the three variables of the ARD (i.e., direct effect). Lastly, the direct effects suggest that the level of recovery of "temporal perspective" of the PSRF positively influenced "rehabilitation effort" and "rehabilitation completion".

In the data analysis procedure, descriptive statistics were calculated for each item to identify ceiling and floor effects. The results indicated that the items were adequate. Next, items were examined using I-T correlation analysis and G-P analysis to improve their reliability. In this process, 23 items were selected after the removal of one item. Then, factor analysis was conducted using these 23 items. The results indicated that PSRF-S consisted of four factors: emotional stability, social competence in the team, temporal perspective, and communication with teammates. These factors fully reflected the three psychosocial perspectives assumed in the development process of the scale. Furthermore, the originally hypothesized perspective of "team attachment" was reflected by the following two factors; "social competence in the team" and "communication with teammates". Ryan and Deci29 proposed the basic needs theory in which three innate basic human needs (i.e., competence, autonomy and relatedness) have to be satisfied to enhance intrinsic human motivation and behavior. They also pointed out that when these needs are satisfied, people become motivated and reach for integration of their personality including social and cognitive development29. Athletes entrust their teams and sports fulfill these needs and lead to their senses of self. Injuries mean to athletes that they must be out of action and that they totally lose this psychological environment. The factors extracted in this study, "social competence in the team" and "communication with teammates", suggest that the conditions for needs of competence and relatedness are met. Regarding the "temporal perspective" factor, it corresponded to the condition meeting the need for autonomy, which makes it possible for injured athletes to engage with situations in a future-oriented manner. In addition, the "emotional stability" factor suggests an emotional condition fulfilling these three needs was satisfied. Consequently, psychological acceptance of athletic injury is conceptually related to motivational needs. We considered the PSRF-S was conceptually valid, because the extracted factors of psychological acceptance of injury could be understood from the perspective of motivational needs. As the reliabilities of the whole scale and subscales were sufficient, we concluded that the PSRF-S is an effective scale.

The results of factor analysis of the AIPA-S23 supported the two factor (i.e., self-motivation, and focus on the present) solution of a previous study23. There were slight differences in items that constituted each factor. However, they were regarded as being within the interpretable range in the context of collecting retrospective information. Correlation analyses were conducted for the PSRF-S, AIPA-S, and ARD-S. The results indicated significant correlations between the four subscales of the PSRF and the two subscales of the AIPA, as well as between the two subscales of the AIPA and the three subscales of the ARD. These correlations generally supported the validity of the tested model. In a previous study23, using the recovery of emotions as an index for AIPA, the Profile of Mood States indicated a significant positive correlation between recovery of emotions and devotion to rehabilitation. However, no significant correlation between any index used for rehabilitation and recovery of emotions (r=−0.03 to 0.10)
was found in the present study. Consequently, as a complementary examination, cluster analysis was conducted with the scale scores of the 133 participants with emotional stability. The levels of emotional stability were divided into high and low groups, and correlation coefficients were calculated between the total score of the ARD and the subscale score of emotional stability, separately for each group. The results of the t-test between the low level (n=49, M=2.77, SD=0.73) and high level groups (n=84, M=4.85, SD=0.86) were, t=14.22, df=131, p=0.00. The correlations for the low and high levels of emotional stability groups were r=-0.25 (p=0.09) and r=0.32 (p=0.00), respectively. Thus, the level of emotional stability did not always correlate positively with the level of the ARD, suggesting the possibility of a negative correlation between them. Furthermore, the results also suggested the possible existence of threshold values regulating positive and negative values. The reason why no correlation was found between emotional stability and ARD may be explained by the possibility that these positive and negative influences cancelled each other. In addition, regarding the negative correlation between emotional stability and the ARD, it is helpful to consider the findings of Uemukai who reported an “impatient” factor as the unique emotional state specific to injured athletes. As Tatsumi pointed out, overwork of injured athletes can be an issue in the treatment structure, especially during the initial phase, at the sites of treatment for athletic injury and athletic rehabilitation. Superficially, injured athletes of this type appear to devote themselves to rehabilitation. However, there is the possibility that feelings of impatience mediated in the background. In other words, although emotions did not recover, it can be considered that the feeling of impatience drives the athletes to devote themselves to rehabilitation. Similarly, it is more natural to think that the foundation of the consulting behaviors and participation in rehabilitation is driven by the anxiety of the injured athletes. Positive participation in the treatment and rehabilitation behaviours may not occur when injured athletes perceive rest caused by the injury as a release from the stressful competitive environment, even though athletes may achieve emotional stability. The temporal perspective was also found to facilitate the prospect of recovering the temporal perspective expected to be effective strategies. The findings for recovery of emotional stability of injured athletes on rehabilitation behaviors were not unequivocal. As a significant influence of the recovery of the emotional stability on rehabilitation behavior exists, the condition of the emotions are specifically noted, and future studies need to investigate support for the recovery of the emotional stability that can lead to the AIPA. Therefore, future research needs to clarify the emotions that are elicited in the specific stages of rehabilitation and the specific cognitive conditions for their elicitation. Future studies also need to examine how such emotions influence the AIPA and ARD.

Lastly, an initial causal model was developed based on the results of hierarchical multiple regression analysis and covariance structure analyses were repeated using certain criteria. The fit indices for the final model indicated the best fit to the observed data. From the directions and levels of the path coefficients, emotional stability and temporal perspective of the PSRF were found to be mediated by self-motivation of the AIPA, which indirectly and positively influenced the three subscale scores of the ARD. Likewise, emotional stability and communication with teammates of the PSRF were found to be mediated by focus on the present, which indirectly and positively influenced rehabilitation efforts. Consequently, the causal relationship between factors in the model tested by this study (Fig. 1) was confirmed to be adequate.

In the present study, a direct effect of the PSRF on the ARD was confirmed. Examination of the path from the PSRF to the ARD indicated that emotional stability negatively influenced the three perspectives of the ARD, if not mediated by the AIPA. Thus, this study clarified both positive and negative aspects of emotional stability. The positive aspect of emotional stability is that it functions as a facilitating factor of the AIPA, and contributed to the ARD with a mediated by the AIPA. The negative aspect is a solely negative influence on ARD without the mediation effect of the AIPA. This suggests the effectiveness of psychological interventions using emotional stability with an indirect effect of AIPA. The temporal perspective was also found to positively impact rehabilitation efforts and the completion of rehabilitation. However, the magnitude of the path coefficients suggested the effectiveness of psychological interventions using recovery of the temporal perspective with an indirect effect of the AIPA.

Based on our present results, it can be concluded that psychological support leading to the recovery of psychosocial variables facilitating AIPA is required. Based on the path from the PSRF to the AIPA and the magnitude of the path coefficient, psychological interventions that center on emotional support for recovery of emotional stability and support for facilitating the prospect of recovering the temporal perspective were expected to be effective strategies. However, the findings for recovery of emotional stability of injured athletes on rehabilitation behaviors were not unequivocal. As a significant influence of the recovery of the emotional stability on rehabilitation behavior exists, the condition of the emotions are specifically noted, and future studies need to investigate support for the recovery of the emotional stability that can lead to the AIPA. Therefore, future research needs to clarify the emotions that are elicited in the specific stages of rehabilitation and the specific cognitive conditions for their elicitation. Future studies also need to examine how such emotions influence the AIPA and ARD.

The results of this study clarified the psychological acceptance process in which the PSRF influences the AIPA. The results suggest that having the perspective of the PSRF in addition to the index of the AIPA-S facilitates diagnostic assessment of the AIPA with higher precision. Future studies need to include the temporal axis when investigating the psychological process of AIPA, and accumulate retrospective data on various phases of rehabilitation. Moreover, the number of participants in this study was influenced by athletic events. The Characteristics of events might affect athletes’ feelings of social competence and communication in the team. In future studies, randomization of the participants should be considered from the perspective of athletic events. Moreover, the effect of a team’s coaching staff was not considered in this study. Preceding research on social support by Suzuki and Nakagomi has indicated that the
effects of coaches, physical therapists, and former teachers on the psychological process of AIPA are high. This suggests that future intervention studies should investigate the effect of interactions between injured athletes and people around them on the psychological process of AIPA.

ACKNOWLEDGEMENT

This study was supported by a Grant-in-Aid for Scientific Research from the Japan Society for the Promotion of Science, KAKENHI-No. 25560332 to the presenter.

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