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REVIEW ARTICLE

Usefulness of Cognitive Behavioural Therapy for Sports Athletes in the Orthopedic Field: A Systematic Review

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Abstract

This study aimed to examine the usefulness of cognitive behavioural therapy as psychological support for sports athletes in the field of orthopedic surgery using a systematic review approach and to obtain suggestions for future support construction. This systematic review utilized the Minds Practice Guidelines Development Manual 2020 ver. 3. The Central Journal of Medicine Web, PubMed, CINAHL/MEDLINE, Cochrane Library, and PsycINFO were searched. Two articles met the eligibility criteria for primary and secondary screening and were reviewed by two investigators to assess the effectiveness of the intervention program. Although the content of the intervention programs and the duration and time of intervention differed between studies, the results suggest that cognitive-behavioural therapy is useful in the mental care of orthopedic sports athletes in preparation for returning to competition. However, the usefulness of cognitive behavioural therapy for sports athletes could not be sufficiently verified because of the paucity of previous studies and differences in the content of interventions in the literature. Additionally, the accumulation of studies using randomized controlled trials is an issue.

Keywords: Orthopedics, Sports, Athletes, Cognitive Behavioural Therapy, Systematic Review

1. Introduction

In the field of orthopedic surgery, from the standpoint of surgical treatment, consideration of surgical procedures and pre- and post-operative physical management for the early return sports athletes to competition have been emphasized; however, in recent years, not only intervention for physical disorders but also mental care for athletes has come into the spotlight in sports medicine[1-7]. Previous studies have reported that approximately 13% of the world's population experiences some form of mental illness[8], and more than one in three athletes experience psychiatric symptoms[9-10]. In Canada, 68% of Olympics hopefuls met the diagnostic criteria for depression[11]. A study of university student athletes in Japan found that 28–35% had moderate depressive symptoms[12]. Top athletes are often thought to not only be physically strong but also less vulnerable in terms of mental health; however, athletes competing at the top level are expected to compete under stressful conditions, and such environments can have a negative impact on mental health. Mental health problems faced by athletes include "overtraining syndrome"[13], a chronic state of fatigue caused by excessive sports and training, and other mental health problems. such as "burnout"[14-15]. Many athletes suffer from this problem, but in the field of orthopedics, which is a surgical field aimed at returning to competition, it cannot be said that a methodology for the mental care of athletes has been established, and building support is an urgent issue.

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Against this background, the International Olympic Committee (IOC) has clarified the reality of elite athletes' mental health and the surrounding environment and positioned their well-being as an individual top priority[16-17]. An example of how to deal with athletes' mental health is mental training called Psychological Skills Training (PST), which considers negative thoughts and emotions to be a hindrance to achieving an ideal performance. The goal of PST is to work on self-control of emotions and creating an optimal mental state[18]; positive thinking and relaxation are the main techniques used to create the optimal mental state for performance. However, few studies support the hypothesis that negative thoughts and emotions hinder achieving ideal performance[19]. Recently, the usefulness of an intervention using mindfulness, a type of cognitive behavioural therapy, was verified as an alternative to PST[20]. The IOC has also pointed out the importance of athletes' mental health[16-17] and the significance of building support using cognitive behavioural therapy, including mindfulness, as a methodology for the mental care of sports athletes in the field of orthopedics.

However, research in this field is just beginning to be considered. It cannot be said that the usefulness of cognitive behavioural therapy for athletes in the field of orthopedic surgery, where athletes are aiming to return to sports after surgical treatment, has been sufficiently verified. Therefore, in this study, we conducted a systematic review of intervention studies focusing on cognitive behavioural therapy for athletes in the field of orthopedics and obtained suggestions for building support that would lead athletes to return to competition.

2. Materials and Methods

This systematic review was conducted based on the Minds Clinical Practice Guideline Development Manual 2020 ver.3.0[19].

2.1 Formation of Clinical Questions and Literature Selection Criteria

The clinical question was, "Is cognitive behavioural therapy useful for athletes in the field of orthopedics?"

A comprehensive literature search was conducted using the Igaku Chuo Zasshi Web, PubMed, CINAHL/MEDLINE, Cochrane Library, and PsycINFO databases. The search terms included "sports," "orthopedics," and "cognitive behavioural therapy." The search conditions were limited to intervention studies with descriptions related to cognitive behavioural therapy for sports athletes in the field of orthopedics. To ensure a comprehensive search, no other search conditions were set (Last inspection date: March 4, 2024). Among the documents extracted using the search terms and conditions the following were excluded: (1) the subject was not related to orthopedics, (2) the subject was not related to sports, (3) there was no description related to cognitive behavioural therapy, (4) it was not an intervention study, and (5) review documents.

As a primary screening, two researchers independently conducted a primary screening of the documents selected in the exhaustive search to identify those that did not meet the clinical question of this study based on the title and abstract and those that had similar themes and researcher names. These were considered duplicate documents and were excluded from the target literature. In the secondary screening, two researchers independently read the full texts, selected articles that met the inclusion criteria, collated their results, and considered a third person's opinion if the two researchers had different opinions. We decided on the accepted papers. Only interventional studies that used cognitive were included.

2.2 Ethical Considerations

We strived to protect the copyrights of the documents targeted in this study, and two researchers extracted the results to ensure that the content of each document was not damaged. The authors declare no conflict of interest.

3. Results

3.1 Literature Search Results

Figure 1 shows the results of the literature search.

Seven searches were performed on the Japan Medical Abstracts Society Web, 72 on PubMed, 32 on CINAHL/MEDLINE, five on the Cochrane Library, and six on PsycINFO. Duplicate documents and documents that met the exclusion criteria set in this study were deleted, and two articles that were confirmed by the researchers to meet the eligibility criteria were targeted for analysis.

3.2 Cognitive Behavioural Therapy for Athletes in the Field of Orthopedics

3.2.1 Target selection/allocation/Dropout rate

Table 1 presents the subject selection method, allocation, and dropout rates for each study.

All the papers clearly described the method of recruiting subjects. One study (no. 1) was a

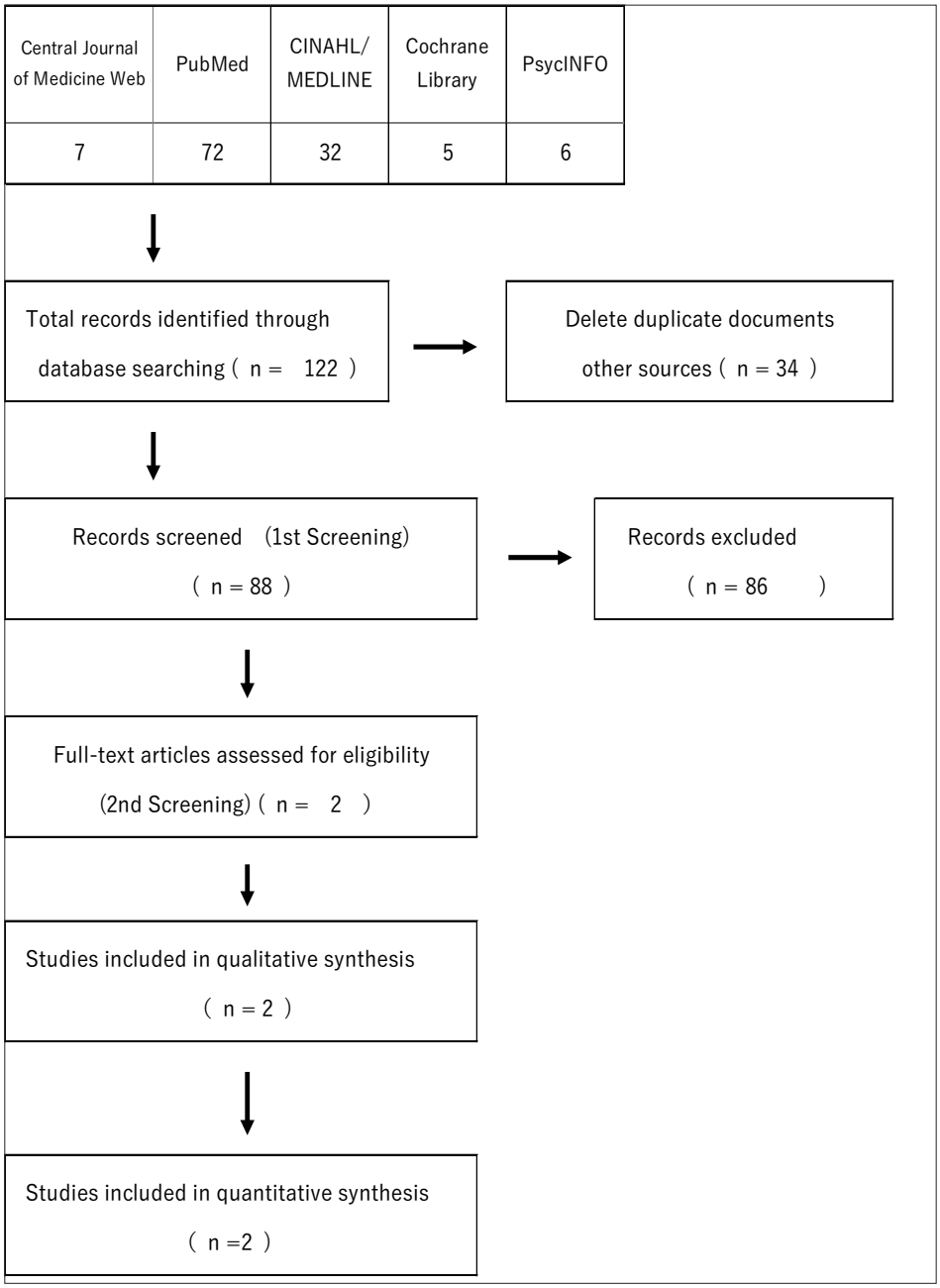

Figure 1. *Literature Search Flowchart*

randomized controlled trial that compared the effects of an intervention between an intervention and a control group, and one study (no. 2) was a pilot study that involved only the intervention group. Only one report (no. 1) described a randomization method for subject group assignment and blinding. Both two papers covered in this study, were intervention studies on subjects with knee injuries. Although the eligibility criteria for selecting subjects were clearly stated in all papers, the content was not unified. Only one case (no. 2) had exclusion criteria, which included those who were suffering from mental illness in a survey of the participant's mental status before the intervention.

One paper (no. 2) had a clear description of the dropout rate. The dropout rate will be relatively high if participants drop out after the eligibility criteria have been determined and are counted as dropouts. However, as in the previous study (no. 2), when we counted only those who dropped out after study registration and the start of the intervention as the dropout rate, there were no dropouts.

3.2.2 Intervention Programs and Usefulness of Cognitive Behavioural Therapy for Athletes

Table 2 shows the details and effects of the intervention program for athletes.

One case (no. 1) involved face-to-face intervention and one case (no. 2) involved telephone interventions. One therapist (no. 1) was a clinical psychologist with a doctoral degree, and one physical therapist (no. 2) had practical experience in cognitive behavioural therapy using the telephone, with the support of a clinical

Table 1. *Subject selection, allocation, and dropout rates*

No	author, year of publication, country	recruit	subjects	allocation method, allocated subjects, blinding	inclusion criteria, exclusion criteria	number of subjects, number of dropouts, dropout rate
1	Ross MJ.. et al... 1996. USA	snowball sampling (private sports medicine clinic)	knee-injured patients (60) ●Intervention group: 30 (physical rehabilitation and stress inoculation) ●Control group: 30 (physical rehabilitation only) 【AGE】 18 to 55 years (M = 28.9 years)	alternately assigned respondents to treatment and control conditions until each group consisted of 30 participants・NA・Physical therapist evaluation was masked	【inclusion criteria】 ①injury solely to the miniscus in one knee, with damage limited to a single tear rather than complete separation and no other significant damage to surrounding tissue, ②injury occurred during participation in an athletic activity, ③arthrospopic surgery prescribed for remediation of the injury, ④surgical procedures limited to arthroscopic intervention, ⑤postsurgi- cal rehabilitation likely to last at least 3 weeks, ⑥no previous history of either surgical treatment or physical therapy for an athletic injury 【exclusion criteria】 NA	60/NA/NA ※Total of intervention and control group (60)
2	Coronado RA.. et al… 2020. USA	snowball sampling (Sports Medicine division of Vanderbilt University Medical Center)	patients scheduled for a first time ACLR (8)	not random not blinding	【inclusion criteria】 ①between the ages of 14 and 35 years, ②English speaking, ③have no history of previous surgery to either knee, ④have injured their knee within 12 months of their scheduled surgery, ⑤were actively participating in a sport on a weekly basis prior to their injury 【exclusion criteria】 ①scheduled for a bilateral ACLR, ACLR revision, or concurrent surgical procedure including additional ligament repair (i.e. medial collateral ligament, lateral collateral ligament, or pos terior cruciate ligament), osteotomy, or meniscus transplantation, ②had surgery secondary to major trauma, tumor or infection, ③received workman's compensation for surgery, ④were active military duty, ⑤diagnosed with schizophrenia or other psychotic disorder, ⑥unable to provide a stable address and telephone number for follow-up ※ Patients were identified and screened at a preoperative clinic visit in collaboration with participating surgeons	12/8/33.3 【Reasons for dropping out】 ●didn't complete consent procedures (1) ●withdrew after consent and before surgery (1) ●never scheduled surgery (1) ●withdrew from the study during intervention (1) ※7 (88%) of the 8 patients completed all 7 phone sessions, and 1 (13%) patient completed 4 sessions

psychologist and a sports psychologist. Although the programs used differed between studies, all included relaxation exercises, such as breathing exercises and self-monitoring sessions.

In one case (no. 2), the session included an element of mindfulness, which focuses on the "here and now." Existing cognitive behavioural therapy consists of 16 sessions, each lasting 45 minutes[20]. However, the number of sessions in this study's target literature was two (no. 1) and seven sessions (no. 2), and the session times were 60 minutes (no. 1) and 30 minutes (no. 2). Compared with the existing cognitive behavioural therapy, the number of sessions and session time were shorter, and there were differences between the literature. Although the session structure differed between the target articles, taking a program using cognitive behavioural therapy lead to the reduction of anxiety (no. 1) and fear of re-injury (no. 2). It is said that taking a program using cognitive behavioural therapy can reduce anxiety (no. 1) and fear of re-injury (no. 2). This not only contributed to the mental care of athletes after surgical treatment, but also facilitated their return to competition.

Table 2. *Cognitive behavioural therapy in Orthopedics*

No	Author, year of publication, country	therapists (number)	program, session duration, number of sessions, session duration (number of sessions), intervention method	session content	evaluation scale	results	control group
1	Ross MJ.. et al... 1996. USA	doctoral-level student in clinical psychology (1)	SIT(stress inoculation training), NA, 2, 1, Face-to-face intervention	①self-monitoring cognitive and emotional indicators of distress and pain ②physical-based relaxation strategies (i.e., deep breathing, progressive muscle relaxation) ③cognitive-based relaxation strategies (i.e., imagery) ④positive coping statements ⑤self-reinforcement statements ※ participants were instructed to rehearse these strategies several times a day and to use them in response to discomfort or pain	【physical】 ①Visual analogue scale (VAS) ※measure subjective experience of pain ②Cybex II isokinetic dynamometer ※measure knee strength for determining return to physical functioning 【psychological】 ①State-Trait Anxiety Inventory (STAI)	【significant group main effect】 ●state anxiety, F(1, 58) = 95.57, p < .001 ●pain, F(1, 58) = 132.33, p < .001 Test the two within-subjects factors (Time and Time X Group) 【state anxiety】 ●significant main effect for time：F(10, 49) = 89.00, p < .001 ●significant Time X Group interaction：F(10, 49) 45.51, p < .001 【pain】 ●Significant main effect for time：F(10, 49) 403.44, p < .001 ●significant Time X Group interaction：F(10, 49) = 40.09, p < .001 ※ both state anxiety and pain decreased over time but more rapidly for participants in the treatment condition than for those in the control condition 【Group Comparison】 Intervention group evidenced significantly less anxiety, compared with Control group (Time 2 through Time 9) Pre●Intervention：45.56±5.92 ●Control：45.53±5.50 t(1)= 0.02 Post Time2●Intervention：35.80±5.05 ●Control：44.10±4.67 t(1)= 6.61 Time3●Intervention：27.66±2.91 ●Control：40.53±4.49 t(1)= 13.17 Time4●Intervention：23.70±1.66 ●Control：36.63±3.61 t(1)= 17.80 Time5●Intervention：22.66±1.56 ●Control：32.53±3.26 t(1)= 14.93 Time6●Intervention：21.96±1.67 ●Control：27.40±4.41 t(1)= 6.30 Time7●Intervention：21.50±1.76 ●Control：25.20±4.29 t(1)= 4.37 Time8●Intervention：21.13±1.74 ●Control：24.03±3.89 t(1)= 3.72 Time9●Intervention：21.06±1.74 ●Control：22.96±3.60 t(1)= 2.60 Intervention group reported significantly less pain, compared with Control group (Time 2 through Time 10) Pre●Intervention：5.40±0.72 ●Control：5.4±0.65 t(1)= 0.00 Post Time2●Intervention：3.94±0.53 ●Control：5.38±0.57 t(1)= 10.18 Time3●Intervention：2.84±0.50 ●Control：4.78±0.56 t(1)= 14.14 Time4●Intervention：2.11±0.45 ●Control：4.13±0.60 t(1)= 14.90 Time5●Intervention：1.53±0.52 ●Control：3.32±0.57 t(1)= 12.68 Time6●Intervention：1.24±0.55 ●Control：2.72±0.57 t(1)= 10.19 Time7●Intervention：0.73±0.51 ●Control：1.98±0.70 t(1)= 8.02 Time8●Intervention：0.37±0.33 ●Control：1.35±0.67 t(1)= 7.22 Time9●Intervention：0.07±0.17 ●Control：0.74±0.60 t(1)= 5.93 Time10●Intervention：0.02±0.09 ●Control：0.34±0.45 t(1)= 3.86	physical rehabilitation only
2	Coronado RA.. et al··· 2020. USA	physical therapist (2) ※7 years of experience with telephone-based cognitive-behavioral strategies delivered the intervention ※cooperator ①clinical psychologist (1) ②sports psychologist (1)	CBPT-ACLR(cognitive behavioral-based physical therapy-Anterior cruciate ligament reconstruction), &, 7, 0.5, Telephone-based intervention ※Description of intervention strategies ①prior evidence- based cognitive-behavioral programs ②the original CBPT program designed for patients with chronic back pain ※seven sessions ①first session：preoperative time point ②six sessions：over the first eight weeks after surgery	①controlled breathing ②grounding ③setting activity goals ④monitoring self-talk ⑤setting daily intentions ⑥present-mindedness ⑦managing setbacks ⑧guided imagery ※delivered using motivational interviewing ※Patients received an intervention manual to review with the therapist during each phone session. The patient and therapist developed and reviewed an action plan and weekly homework tailored to the patient's goals. Patients were instructed to continue using the CBPT-ACLR strategies throughout their recovery. The CBPT-ACLR program was provided in addition to surgeon-directed standard care, which included referral to in-person physical ther- apy. No direct communication occurred between the study physical therapist and primary rehabilitation provider regarding the par- ticipant's progress with the CBPT-ACLR program	【Acceptability】 a post-intervention assessment form： ①Perceived helpfulness of the intervention for overall recovery was rated on an 11-point scale, where 0 indicated "not helpful," and 10 indicated "most helpful." ②Likeliness to recommend the program to a friend was also rated on a scale where 0 indicated "not likely," and 10 indicated "most likely." Mean scores greater than 8 were interpreted as exhibited high helpfulness or likelihood of recommendation 【physical (Knee function was assessed)】 ①Knee Injury and Osteoarthritis Outcome Score (KOOS) ※MCID：QOL 18.3, sports/recreation 12.1 ②International Knee Documentation Committee (IKDC) ※MCID：11.5 ③Subjective Patient Outcome for Return to Sports (SPORTS) 【psychological】 ①Tampa Scale of Kinesi- ophobia (TSK) ※MCID：4 ②Pain Catastrophizing Scale (PCS) ※MCID：45% change ③Knee SelfEf ficacy Scale (K-SES) ※MCID：no known	【Acceptability】 a post-intervention assessment form： ①Perceived helpfulness of the intervention for overall recovery：7.6±2.0 (moderate to high degree of helpfulness) ②Likeliness to recommend the program to a friend：8.6±1.4 (high likelihood of recommendation) 【physical (Knee function was assessed)】 ①Knee Injury and Osteoarthritis Outcome Score (KOOS) ※QOL：Exceeding MCID (3) ❶preoperative 12.5, 6 months after surgery 56.3 ❷preoperative 31.3, 6 months after surgery 50.0 ❸preoperative 37.5, 6 months after surgery 56.3 ※Sports/Recreation：Exceeding MCID (5) ❶preoperative 5, 6 months after surgery 60 ❷preoperative 80, 6 months after surgery 95 ❸preoperative 15, 6 months after surgery 65 ❹preoperative 45, 6 months after surgery 80 ❺preoperative 20, 6 months after surgery 65 ②International Knee Documentation Committee (IKDC) ※Exceeding MCID (4) ❶preoperative 32.2, 6 months after surgery 64.4 ❷preoperative 37.9, 6 months after surgery 56.3 ❸preoperative 40.2, 6 months after surgery 59.8 ❹preoperative 41.4, 6 months after surgery 64.4 ③Subjective Patient Outcome for Return to Sports (SPORTS) At 6 months：5 (63%) of 8patients had returned to their primary preinjury sport ※One patient：returned to the same level of effort and performance as before their injury and without pain ※2 patients：pain returning to their same level of preinjury level of effort and performance ※All patients：very satisfied (n 1 [13%]) or satisfied (n = 7 [88%]) with the overall results of their surgery 【psychological】 ①Tampa Scale of Kinesi- ophobia (TSK) ※Exceeding MCID (7) ❶preoperative 36, 6 months after surgery 29 ❷preoperative 36, 6 months after surgery 32 ❸preoperative 24, 6 months after surgery 18 ❹preoperative 34, 6 months after surgery 29 ❺preoperative 20, 6 months after surgery 16 ❻preoperative 21, 6 months after surgery 13 ❼preoperative 30, 6 months after surgery 22 ②Pain Catastrophizing Scale (PCS) ※Exceeding MCID (6) ❶preoperative 8, 6 months after surgery 0 ❷preoperative 18, 6 months after surgery 5 ❸preoperative 9, 6 months after surgery 1 ❹preoperative 1, 6 months after surgery 0 ❺preoperative 2, 6 months after surgery 0 ❻preoperative 20, 6 months after surgery 5 ③Knee SelfEf ficacy Scale (K-SES)：all patients reported increases at 6 months	-

4. Discussion

4.1 Utility of Intervention Programs for Athletes in the Field of Orthopedics

4.1.1 Dropout Rate of Subjects

Among the target literature, one study (no. 1) did not provide a clear description of the dropout rate; however, the dropout rate was low for both documents. Although the intervention methods were different, face-to-face (no. 1) and telephone (no. 2), considering the low dropout rate in the previous studies targeted in this study, the intervention program using cognitive behavioural therapy may be easy for athletes who have undergone surgical treatment in the orthopedic field to continue. Looking at the sessions as a whole, in one case (no. 1), the participants were required to practice several times a day in accordance with the program content. In one case (no. 2), the program made effective use of time outside of sessions, with participants and therapists making action plans and doing homework for each session. This is similar to existing cognitive behavioural therapy programs[21], in which homework is assigned for each session, and these assignments result in patients working on their own tasks even when they are not in a session with a therapist. This could lead to the development of self-management skills. Although the reason for the low dropout rate cannot be generalized, it is that the participants are provided with a system that allows them to continue learning. This type of environment has been described in previous research studies, although the study participants differed. Therefore, it is possible that cognitive behavioural therapy influences the active participation and continuation of the program for athletes who aspired to return to competition as soon as possible[22], leading to a low dropout rate. Cognitive behavioural therapy does not involve unilaterally instructing the target person on how to improve the target's problems, as perceived by the therapist, but it is important that the target person considers the problem as their own and continues to learn. It is thought that athletes continue with the program because they realized the effectiveness of the cognitive behavioural therapy program through continued learning.

However, the reasons for this are unclear. Therefore, it is necessary to verify the low dropout rate of the target participants in the program, as revealed by this study's review, by accumulating randomized controlled trials.

4.1.2 Effects of Cognitive Behavioural Therapy Programs on Sports Athletes

Based on the results of the target literature, there were differences in the intervention method, number of interventions, intervention time, and content of each session between the studies. However, intervention programs using cognitive behavioural therapy may be useful for improving the mental health of athletes in orthopedics.

The reasons why a program using cognitive behavioural therapy was useful for athletes in orthopedic surgery can be attributed to the characteristics of the participants and the fact that a physical rehabilitation program was being conducted concurrently, in addition to the following. We believe that the content of the intervention program influenced the results. Both the articles reviewed in this study target athletes who aim to return to competition after undergoing surgical treatment, and physical rehabilitation involving a doctor, physical therapist, etc. is inevitably required. Physical rehabilitation for early recovery, rather than psychological support, is the top priority for athletes who have undergone surgical treatment.

However, the importance of psychological reactions in recovery has been reported[23-25]. When a participant is undergoing physical rehabilitation, their anxiety about returning to competition and fear of re-injury are thought to be higher based on the severity of the injury and longer rehabilitation period. In such an environment, psychological support was required, and it functioned effectively, which may have alleviated the participants' anxiety and fear. In addition, the intervention program included simple, low-load sessions such as breathing exercises and sessions on self-monitoring, including mindfulness and objective self-viewing. In the target literature, in one case (no. 2), the specific diagnosis of knee joint injury was unknown (no.1); however, it was related to patients with anterior cruciate ligament injury, which accounts for more than 60% of knee joint injuries due to sports injuries[26] (no. 2). It has been reported that the risk of re-injury after surgery is a serious problem[27-28]. Mindfulness is defined as "intentionally paying attention to the experience of the present moment, and simply observing it in a non-judgmental state"[29], and through the program, athletes can be possible that he objectively viewed changes in his physical condition as he continued physical rehabilitation, as well as his emotions and cognitions, such as anxiety about returning to competition and fear of re-injury. Although various factors may lead the participant to

return to competition, it is believed that mindfulness allows one to view oneself objectively and allows one to consider reality as it is. It is possible that by viewing reality objectively, the athlete themself would not perform physical rehabilitation that would result in overwork, preventing re-injury during rehabilitation and leading to a smooth return to competition.

One document included in this study (no. 2) was an intervention study that used telephone calls. Although the target audience is different, the effectiveness of cognitive behavioural therapy using the telephone has been reported[30]. Unlike face-to-face psychological support provided when visiting a hospital or clinic for physical rehabilitation, telephone-based interventions are easier for the target person to consult, as there are no time constraints, such as traveling to the treatment location. The environment is expected to be comfortable. Furthermore, considering the possibility of providing support to athletes after returning to sports, it is important to expand support for athletes, including post-intervention follow-ups, by using communication media, such as telephones and face-to-face contact. Additionally, it is necessary to connect this to the construction of support that is utilized.

4.2 Limitations of Research and Prospects

Although this study targeted only intervention studies using cognitive behavioural therapy, there were differences among the target literature in terms of eligibility criteria, exclusion criteria, intervention methods, etc., in selecting participants, apart from small number of target and intervention studies. Considering the differences in the quality of skills of the participants, the question remains as to whether the program implemented in the literature covered by this study was maximally effective for athletes in the field of orthopedics. To develop a methodology that will help athletes maintain and improve their mental health in anticipation of their return to competition, it is necessary to conduct randomized controlled trials while ensuring the quality of therapists' intervention skills. Additionally, in previous studies targeted here, the number of interventions and intervention times were shorter than those of existing cognitive behavioural therapy[21]. Recently, the usefulness of simple cognitive behavioural therapy has been verified[31], and it is necessary to develop a simple cognitive behavioural therapy program that supports return to competition, taking into consideration the rehabilitation period after surgical treatment.

5. Conclusion

The effects of cognitive behavioural therapy on athletes in the field of orthopedics have been clarified through intervention studies using systematic review methods, and its usefulness has been suggested. However, owing to the paucity of prior research, it cannot be said that it has been established as a methodology that can help maintain and improve the mental health of athletes, and the accumulation of randomized controlled trials remain an issue.

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