Therapeutic Exercises Program for Improving Function and Pain in Meniscus Tear

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Abstract. Background: For meniscal lesions in adults, there are several approaches: surgical and conservative. However, there are still few studies comparing the therapeutic impacts of ACL (anterior cruciate ligament) injury. This paper aimed to determine the effectiveness of Therapeutic Exercises Program for Improving Functional and Pain in Meniscus Tear. Method: A systematic search was performed on five databases (NCBI, PubMed, ELSEVIER, ScienceDirect, Google Scholar). A systematic review and meta-analysis using randomized controlled trials (RCTs) comparing exercise with meniscectomy, no exercise, and other post-meniscectomy exercises. The PEDro scale is used to assess research quality. Result: Six studies were assigned to the review meta-analysis with an overall p-value = > 0 and focused on Knee Pain while using the Visual Analogue Scale (VAS) and Knee Function Using the Knee Injury and Osteoarthritis Outcome Score (KOOS) 05 in Pain Relief and Knee Improvement: Exercise Therapy Modalities, Meniscal Removal, and We have shown that nothing is more effective than different exercise regimens. Function in adults with meniscal lesions. Conclusion: Exercise therapy, meniscal removal, and various exercises can be used to reduce pain associated with meniscal lesions in adults. Considering various aspects such as age, meniscal condition, and previous exercise therapy, it is recommended to provide.

Keyword: Exercise therapy · Meniscus lesion · Degenerative meniscus

1 Introduction

Knee arthritis is strongly associated with soft tissue injuries to the knee. Adolescence and early adulthood are the years when clinically confirmed knee soft tissue injuries are most common. However, various knee injuries, including osteoarthritis, are present throughout adulthood. Physical therapists treat knee injuries often; in the Netherlands, there are roughly 5.3 to 17 traumatic and non-traumatic knee injuries per 1000 population per year. The estimated annual occurrence of meniscal tears in Swedish major and minor care is 79 (95% CI: 63.94) Peak age 15–19 years per 100,000 patients [1–3].

The causes of meniscal injury are either traumatic or degenerative. While the majority of elderly patients with meniscal lesions also have concurrent articular cartilage injury,

© The Author(s) 2023
B. Ichsan et al. (Eds.): ICHWB 2022, AHSR 61, pp. 277–288, 2023.
https://doi.org/10.2991/978-94-6463-184-5_26

the majority of young patients with meniscal lesions have both longitudinal and traumatic lesions. The meniscus, a tissue with a relatively low blood supply and a relatively avascular structure, is crucial to the biomechanical operation of the knee. The meniscus plays a role in increasing the fit of the articular surface of the knee joint. Moreover, the meniscus is crucial for load transmission and shock absorption while walking and performing other activities [3–5].

Numerous conditions, including localized joint pain, swelling, popping, pinching, locking, and instability of the knee, can be brought on by a torn meniscus. Men experience 80% of all tears, making them more likely to have this problem than women.

Many patients also report being unable to sleep because of this pain. This can occur when the pain in the inner knee can impinge on the opposite side when the patient rolls over during sleep [4, 6, 7].

The clinical manifestations of current patients with meniscal tears vary based on the mode of injury and the severity of any concurrent tibiofemoral injuries. A physical examination includes the presence of edema, range of motion, muscle strength, and certain tests. Recently, exercise therapy has become the first option for knee degenerations sufferers with the aim of reducing both acute and chronic joint pain and improving knee function. Non-surgical treatment of meniscal injury with exercise therapy and meniscal removal has been proven to enhance knee performance and reduce discomfort. Physiotherapists can perform balance exercises, walking, and other exercises in 1-12 weeks [12–15].

There are two treatment protocols for meniscal lesions; Exercise therapy and meniscus removal. In meniscus removal, the surgeon removes the damaged meniscus and removes pieces of cartilage. After meniscal removal process, patients underwent standard exercise therapy using the exercise therapy group's standard protocol. In the exercise therapy group, the protocol was used to manage knee function and pain [8–11].

In mind of this, the goal of this research is to assess the impact of exercise therapy in meniscal lesions patients under three different conditions: (1) no exercise therapy for non-medical treatments, (2) meniscus removal, (3) any other sort of exercise therapy after meniscus removal are all prohibited.

2 Methods

2.1 Search Strategy

This database was searched through October 2022 from Ncbi, PubMed, ELSEVIER, ScienceDirect, and Google Scholar.

2.2 Study Selection

Studies that satisfied the inclusion and exclusion criteria were included. Inclusion criteria, namely: (1) randomized controlled trial (RCT), (2) patients aged 18 years or older. (3) studies examining degeneration and lateral or medial meniscal injury in men or women; (4) intervention should be exercise therapy; (5) exercise therapy should in contrast with different exercise regimens and meniscal removal treatments; be. Knee function and

pain were the main goals. Additionally, the following were excluded from this study: (1) controlled clinical trial (CCT), (2) patients amidst anterior cruciate ligament enthesis or medial or lateral collateral ligament lesions, (3) patients treated by open meniscal removal instead of arthroscopic treatment, (4) Neuromuscular or electromyographic stimulation consists of studies using biofeedback, and (5) measurements of muscle strength, physical performance, and physical fitness.

2.3 The Risk of Search Bias

For this effectiveness review the researcher used the PEDro scale leading to 11 items related to certain eligibility criteria, random allocation of participants or subjects, hidden allocation, similar groups at baseline regarding prognostic indicators, *blinding* or ignorance of participants or subjects, therapists and raters, outcome measures obtained more than 85% of participants or subjects, participants or subjects received treatment as allocated and statistical comparison results.

2.4 Data Extraction and Analysis

Researchers independently completed the data extraction from studies. I obtained the following data: participants' sex and age, meniscal lesion type, points of the type of exercise intervention and control group, the period of follow-up, and research findings. The Visual Analogue Scale (VAS) and the Knee Injury and Osteoarthritis Outcome Score (KOOS) were used to review outcomes. Data extraction was done using the VAS assessment results, as well as the KOOS total score of functions or the Hughston Clinical Questionnaire was used as follows: Exercise muscle strength at maximum repetitions of 60.0 and 180.0.5 in leg extension, or isometric strength during knee flexion and extension, and jump test for single- leg power. From the exercise and control group studies, the mean and standard deviation (SD) of change data from baseline to follow-up were obtained. A meta-analysis was performed on the studies and the mean distinction (MD) between exercise and control groups was deliberated with 95% CI. When studies evaluate the same outcome but calculate several outcome measures, mean distinction (SMD) is used. Analyzes were performed in subgroups that reported distinctions between exercise therapy and meniscus removal, exercise therapy and no exercise therapy, and exercise therapy and exercise therapy after meniscus removal.

3 Results

3.1 Study Characters Included

Table 1. displays the characteristics of the included researches. A total of 911 patients were present, with a mean age of 49.5 (range, 35-59 years) and 29.49% females. In six studies, there were two types of degenerative meniscus and four types of degenerative meniscus lesions.

3.2 Bias Risk

Assessment of the risk of bias from each study utilizing the PEDro scale. The results show an average score of 6.0 (see Table 2.). The most common limitations occur in *intention to treat* , *baseline comparability* , *blinding subject* and *elegibility criteria* . The characteristics of the patients used as samples varied so that they affected the results on the PEDro scale.

3.3 Effectiveness of Exercise Therapy Versus Meniscectomy

Research conducted by Osteras et al (2012) in two groups of patients said that there was no distinction statistically between the two groups regarding function and pain. [17].

Kise NJ et al (2016) in their study of degenerative meniscus sufferers conditions said that no clinical distinctions were found between the two exercise groupsand the meniscectomy group within two years. Of the total number of participants, 19% of them underwent exercise therapy and were then given surgical treatment for two years of follow-up and found no additional benefits after surgery [23].

3.3.1 Knee Pain

Two studies in this investigation used the VAS to measure pain. The following scores were linked to an important distinction in post-meniscal removal pain, based on the scores: MD 4.69 [0.13, 9.26]; p-value = 0.04(chi2 = 0.08, df = 1 and p-value = 0.78; I2 = 0%) (see Figure 2).

3.3.2 Knee Function

Knee function assessment by KOOS was used in these two studies. The results showed an increase in kneefunction after meniscus removal, with no loss in quality in knee function between exercise therapy and meniscus removal, with the following values: MD - 0.41 [-8.24, 7.43]; p-value = 0.92 (chi2 = 1.44, df = 1, p-value = 0.23, I2 = 31%). These results indicate that the efficacy of both exercise therapy and meniscal removal can help improve knee function in patients with meniscal degeneration. (See Figure 2).

3.4 Effectiveness of Exercise Therapy Versus No Exercise Therapy After Meniscectomy

In their study, Osteras et al. (2014) found that exercise therapy was more credible than no exercise therapy after performing meniscectomy for patients with postoperativede-generative meniscus [16]. Within another study, Yim et al (2013) stated that there was no notable distinction in patients after meniscectomy who were given exercise therapy to relieve knee function and pain [22].

3.4.1 Knee Pain

In this study there were 2 studies using VAS pain assessment. The findings indicated that there was no clear differentiation in pain reduction without exercise therapy following

meniscectomy with values: MD 6.26 [-6.37, 18.89]; p *value* = 0.33 (Chi ^{2} = 21.48, df = 1, and p *value* = <0.00001, I^2 = 95%). These results mean that patients who are not given exercise therapy after meniscectomy can reduce the degree of pain in patients with degenerative meniscal lesions. (see picture 3)

3.4.2 Knee Function

In this study there were 2 studies using knee function assessment with KOOS. The results showed that there was no substantial distinction in knee function without exercise therapy after meniscectomy with values:MD 5.36 [-6.50 , 17.22]; p *value* = 0.38 (Chi ^{2} = 23.65, df = 1, and p *value* = <0.00001; I^2 = 96%). (see picture 3)

3.5 Effectiveness of Different Exercise Therapy After Meniscectomy

Research conducted by Gaufin et al (2014) said that there were massive distinctions in the various exercises offered to patients as part of their pain management following meniscectomy [20]. Herilin (2013) said that exercise therapy after meniscectomy is not superior to the same exercise therapy, However, various forms of exercise therapy may be suggested as an initial course of treatment [26].

3.5.1 Knee Pain

In this study there were 2 studies using VAS pain assessment. The findings showed that there were insignificant distinctions in pain in the same exercise therapy, but there were also results in patients who were given different exercise therapy with values: MD: 32.20 [-30.91, 95.31]; pvalue = 0.32; (Chi ^{2} = 10421.71, df = 1 (p < 0.00001) , and I^2 = 100%). This decrease in pain scores shows that the same exercise therapy and different exercise therapy can be used for patients with degenerative meniscus. (see picture 4).

3.5.2 Knee Function

In a study conducted by Gauffin et al (2014) and Herrilin et al (2013) in meniscus degenerative patients, the results of knee function assessment tests used KOOS.Following the same exercise therapy, the findings showed a large distinction in the refinement of knee-function with the following values: MD: -4.73 [-9.09,- 0.37]; *pvalue* = 0.03; (Chi ^{2} = 2.27, df = 1 ; p *value* = 0.13) and I^2 = 56%). These findings suggest that maintaining consistency with the same workout can enhance knee function. (See picture 4)

4 Discussion

Exercise therapy, no exercise therapy after meniscal surgery, and further exercise therapy after meniscal surgery are all equally helpful interventions for this problem, according to this systematic meta-analysis study. The main objective of this research was to assess whether there were exercise interventions without exercise and whether other exercises worked more effectively after meniscal removal. The results showed that exercise therapy, meniscus removal, no exercise therapy after meniscectomy, and different exercise regimens each had different effects in reducing knee function and pain. Great efficacy was not seen in this study as p-value = >0.05.

Table 1. Study characters included

AUTHOR	POPULATION	TRAINING GROUP (I)	CONTROL GROUP (C)	RESULTS OF FOLLOW-UP (MONTHS)	MEASUREMENT	AVERAGE (SD)	MD (95% CI)
Exercise therapy versus meniscectomy							
Osteras et al [17]	Women: 24% Age: 49.7 (-) Degenerative meniscus lesion	Exercise therapy (n = 9) 3 times a week for 60 minutes for 3 Months	Meniscectomy (n = 8)	3 months	Pain (VAS) Function (KOOS)	I : 15 (8) C : 11 (6) I : 11.8 (13.3) C : 7.5 (8.2)	4.00 [-2.68, 10.68] 4.30 [-6.08, 14.68]
Kise NJ et al [19]	Age: 49.5 (35.7-59.9) Meniscus Degenerative	Exercise therapy (n = 70)	Meniscectomy (n= 69)	24 months	Pain (VAS) Function (KOOS)	I : 17.3 (21.5) C : 12.0 (15.7) I : 44.0 (25.8) C : 47.8 (23.4)	1.4 [-3.9 – 6.7] -1.5 [-9.1- 6.1]
Exercise therapy versus no exercise therapy after meniscectomy							
Osteras et al [16]	Women: 33% Age: 46.3 (-) Degenerative meniscus lesion	Exercise therapy (n = 38) 3 times a week for 3 months	No exercise (n= 39)	3 months	Pain (VAS) Function (KOOS)	I : 19 (16) C : 6 (6) I : 18.0 (10.9) C : 6.5 (6.4)	13.00 [7.58, 18.42] 11.50 [7.49, 15.51]
Yim et al [22]	Male: 21 Female: 81 Age: 53.8 (43-62) Degenerative Meniscus Lesion	Exercise therapy (n= 52) 3 times a week for 24 months	No exercise (n= 50)	24 months	Pain (VAS) Function (KOOS)	I : 1.8 (1.8) C : 1.7 (1.1) I : 83.5 (7.8) C : 84.1 (6.5)	-0.10 [-0.57, 0.37] -0.08 [-0.47,0.31]
Exercise therapy versus exercise therapy is different after meniscectomy							
Gauffin [20]	Age : 54 ± 6 Meniscus Degenerative	Exercise therapy (n= 75) 2 times (30-40 min) a week for 12 weeks	Exercise therapy is Different (n = 75)	3 months	Pain (VAS) Function (KOOS)	I : 72 (1.9) C : 7.6 (2) I : 69 (21.2) C : 77 (16.6)	-64.40 [-65.10, -63.70] 8.00 [1.19, 14.81]
Herrlin [21]	Age: 56 ± 5 Meniscus Degenerative	Exercise therapy (n= 49) Twice a week for 40-60 min for 8 Weeks	Exercise therapy is Different (n= 47)	2-6 months	Pain (VAS) Function (KOOS)	I : 2.1 (2.4) C : 2.1 (2.2) I : 80.6 (14.8) C : 81.9 (16.3)	0.0 [-0.92, 0.92] 1.30 [-4.94, 7.54]

**VAS (Visual Analogue Scale), **KOOS (Knee injury and Osteoarthritis Outcome Score)*

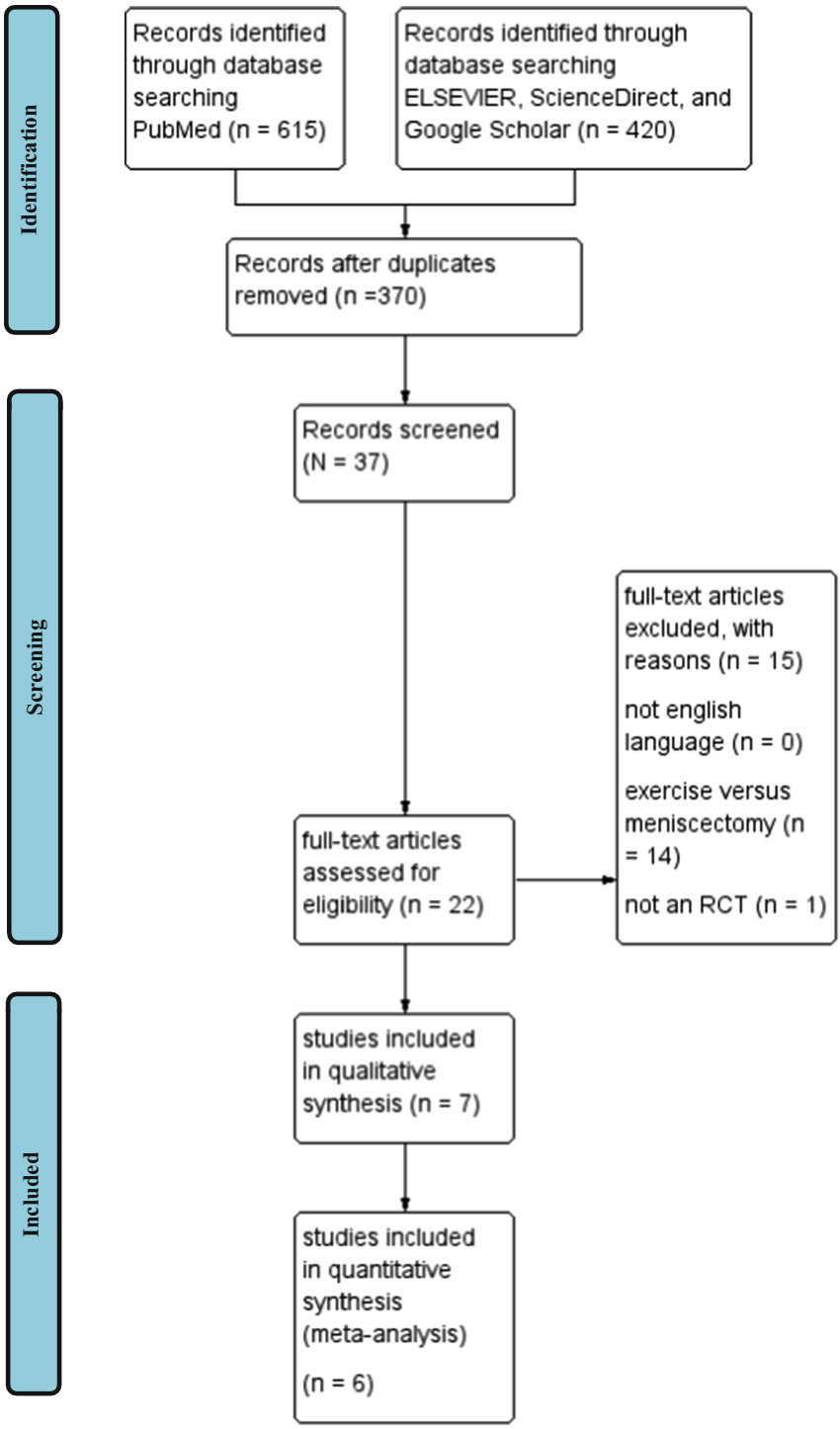

Fig. 1. Flow of studies through the review with PRISMA

Table 2. PEDro scale Risk of bias

Author	Items											Total
	1	2	3	4	5	6	7	8	9	10	11	
Osteras et al.(2012)	Y	Y	Y	Y	Y	Y	Y	N	N	Y	Y	8
Herilin et al. (2013)	Y	Y	Y	N	N	Y	N	Y	N	Y	Y	6
Yim et al. (2013)	Y	Y	Y	N	Y	Y	Y	Y	Y	N	Y	8
Osteras et al.(2014)	Y	Y	N	Y	Y	Y	Y	Y	N	Y	Y	9
Gaufin et al.(2014)	N	Y	Y	N	Y	Y	N	Y	N	Y	Y	6
Kise NJ et al. (2016)	N	Y	Y	N	N	Y	Y	Y	N	Y	Y	6

Y: yes; N: no

*1. Eligibility criteria; 2. Random allocation; 3. Concealed allocation; 4. Baseline comparability; 5. Blind subject; 6. Blinding therapist; 7. Blinding of assessors; 8. Outcomes are made on all subjects who are randomized to groups 85%; Intention to treat; 10. Comparison of group results; 11. Point measures; ** Total 10 point PEDro scale score (items 2 through 11); 0-3 "poor", 4-5 "fair", 6-8 "good", 9-10 "excellent"

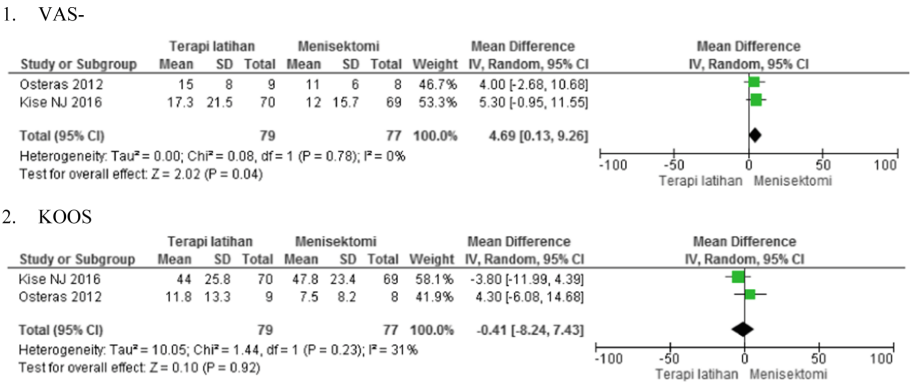

Fig. 2. Forest Plot of Exercise Therapy versus Meniscectomy

Exercise therapy with meniscus removal, if performed correctly with frequency, duration, and exercise therapy program, can increase the length of motion of the knee, thus reducing pain post-surgery for degenerative meniscal disease and reducing knee pain. Effective in improving functionality [18]. Jianxiong et al. (2020) research shows that exercise therapy combined with meniscus removal can control knee function and pain for up to 6 months, but must be performed carefully and under control [23]. In another study by Fernandez et al. (2022) stated that an exercise therapy program was the right choice after meniscectomy over the past 5 years. [24].

Knee function and pain were not significantly different in two comparative studies of degenerative patients undergoing exercise therapy and meniscectomy. There is moderate evidence for the benefits of debridement in meniscal removal, according to the results

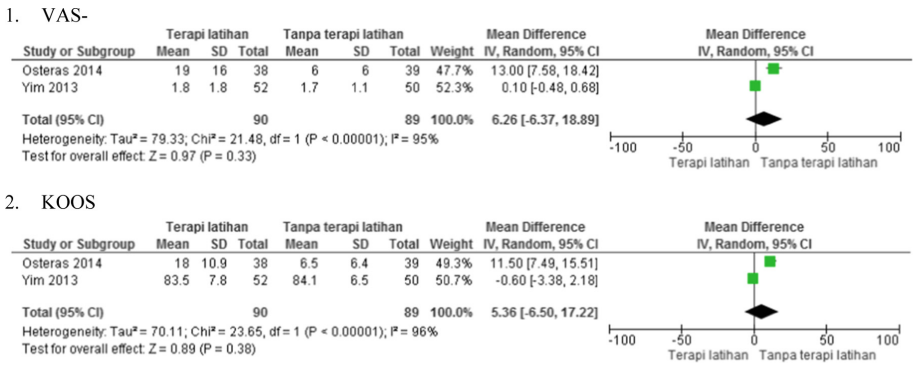

Fig. 3. Forest Plot Exercise therapy versus no exercise therapy after meniscectomy

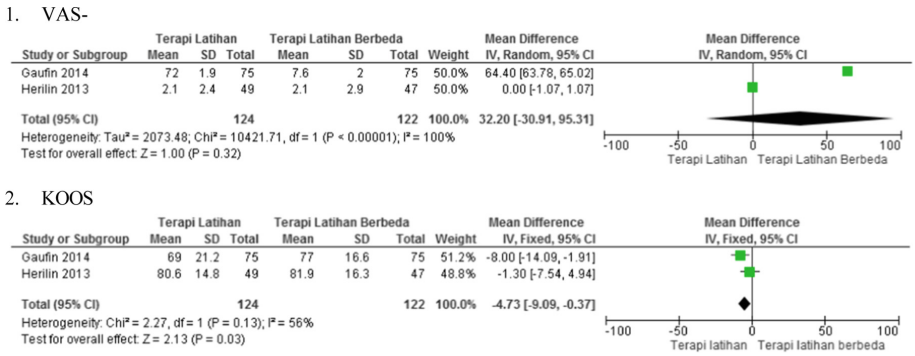

Fig. 4. Forest Plot Exercise therapy versus exercise therapy differs after meniscectomy

of this study, which are comparable to those of a more recent review [25]. However, international guidelines recommend that patients undergo conservative treatment rather than meniscectomy to treat meniscal lesions. [26, 27].

Exercise therapy was preferable to no exercise therapy in considerations of the function of the knee and short-term muscle extension strength post meniscectomy. There is mixed information from research on effectiveness with and without exercise therapy. Although there was no obvious distinction between the groups in considerations of knee discomfort, continuing exercise therapy was preferable than none at all in terms of improving knee function [28]. Another study found no significant distinctions, even in the short term, among numerous forms of training therapy for knee function and pain. For patients who underwent meniscectomy, comparable outcomes for the benefits of exercise therapy were attained [29].

This study has limitations in the exercise therapy given in conditions of meniscal lesions, so that the assessment of these exercises is still subjective. Given the many types of exercise therapy for meniscus lesions, it is necessary to reconsider selecting other types of exercise therapy for the same condition so as to get better results.

Counseling activities to overcome the problems experienced by residents in the form of joint gymnastics and education as well as simulations of strengthening exercises for the limbs. Activities are also interspersed with health checks and vital signs [30]. The advantages of this study with Augmented Feedback (External Clue) are cost effectiveness in which the value of the success of the intervention is greater than the costs incurred, although it needs further research related to cost effectiveness [31].

5 Conclusion

Based on the results of studies that have been observed and then carried out *a meta-analysis* shows that in the selection of methods in the treatment of degenerative meniscal lesions, nothing is superior to meniscectomy than exercise therapy within a period of 3 months. Exercise therapy can still be utilized for knee function and pain recovery in the next 24 months, even though the results were similar in the selection of exercise therapy methods and without exercise therapy following meniscectomy within the first 3 months. Providing different exercise therapy can be used as an alternative treatment after meniscectomy because it can reduce pain in the initial 3 month stage, but more aspects must be considered before treatment is carried out such as age, meniscus condition and previous exercise therapy. Future research is expected to show more effective evidence in treating degenerative meniscus lesions in collaboration with other medical personnel or with other practitioners who deal with degenerative meniscal lesions.

Acknowledgments. Thank you to the Muhammadiyah University of Surakarta Physiotherapy Study Program for helping to complete this study. Guidance and encouragement to complete this study will be very beneficial for the writer.

Authors' Contributions. AG understands and understands the ideas presented, takes them into account and develops them. SSP as the verifier and ANA participated in providing overall ideas for this research study so that contributions were made to the final study text.

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