Original Article

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The Effectiveness of Exercise Therapy Based on Sahrmann Approach in Patients with Patella-Femoral Pain Syndrome

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ABSTRACT

BACKGROUND AND OBJECTIVE: The most common source of anterior knee pain is patellofemoral pain syndrome that occurs usually due to going up and down the stairs, squatting, prolonged sitting and kneeling or running. Therefore, this study was done to compare the effects of "conventional physiotherapy alone" and "combined conventional physiotherapy with exercise therapy based on Sahrmann approach" to improve patellofemoral syndrome.

METHODS: In this randomized controlled clinical trial, 30 patients with PFPS (aged 20-50) were participated. The participants were divided into two groups: "traditional physiotherapy group" and "Sahrmann treatment group". In both groups, interventions were applied for 6 weeks. Patients in traditional physiotherapy group only received TENS, hot packs, ultrasound, and knee exercise therapy. But in Sahrmann treatment group, in addition to traditional physiotherapy, posterior X taping, hip muscle strengthening and functional training was used. Before and immediately after the end of 6th week, quality of life variables (using questionnaires KOOS), pain (using the Visual Analogue Scale), and position sense of the knee were measured.

FINDINGS: In both groups, pain severity, KOOS scale and position sense of the knee at the end of sixth week significantly improved ($p<0.05$). In traditional physiotherapy group, mean pain score was decreased of 7.23±54.53 mm to 11.5±80.37 mm, mean score of KOOS questionnaire from 95.93± 6.12 to 73.26±6.23 and the average error of knee position of 57.1±98.4 to 2.28±1.15. In addition, in the Sahrmann treatment group, mean pain score was decreased from 59.93±7.75 mm to 40.2±5.36 mm, mean score of KOOS questionnaire from 95.73±10.94 to 71.4±7.87 and the average error of knee position of 6.18±9.1 to 2.99±1.11 degree at the end of the sixth week.

CONCLUSION: Essentially, using of Sahrmann approach including "posterior X taping on thigh, strengthening of hip abductor, extensor and lateral rotators muscles", compared to conventional physiotherapy, was not result in more effective improvement in patients with PFPS.

KEY WORDS: *Patellofemoral Pain Syndrome, Physiotherapy, Sahrmann Approach, Clinical Findings*.

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Introduction

Patellofemoral pain syndrome (PFPS) is most commonly reported source of anterior knee pain with a quarter of the total population prevalence (1) and this proportion is higher in young and active people (under 50 years), especially in women (2, 3). Anterior knee pain happens typically in the up and down stairs, squatting, and prolonged sitting, kneeling or running (2). Several different factors including lower limb misalignment, increased foot pronation, ante version of the femur, internal oblique vastus muscle weakness, tightness or shortness of Iliotibial band and lateralis Vastus muscle, have been proposed in the development and formation of patellofemoral pain syndrome (4-7). Therefore, a multifactorial etiology of patellofemoral pain syndrome is considered.

Although many studies on the influence of different methods and orthotic physiotherapy treatments have been performed in patients with patellofemoral pain syndrome (8-12) but most treatments used in this study, just have focused on the area that involved, including packing tape, physical therapy modalities, massage, stretching exercises, strengthening exercises and manual therapy techniques (13, 14).

While the etiology of patellofemoral pain syndrome is multifactorial and anterior knee pain syndrome is caused by the remote location of the pain and symptoms of musculoskeletal disorders (15). Recently, the Patho mechanism of musculoskeletal disorders of the knee, the issue of "muscular control" and "correct direction", not only directed to the knee but also focused on the proximal, is highly regarded. According to this view, which is called Sahrmann health perspective, "Facilitating and regain muscle control" and "maintain the right to detailed segment during functional activities" has an important role in the treatment of musculoskeletal disorders (16, 17). Power imbalance between internal and external rotator muscles of the hip joint proposed as one of the risk factors for developing patellofemoral pain syndrome. The researchers stated that gluteus muscle weakness can lead to increased internal rotation of the hip and increase the pressure on the patella (18, 19).

According to the association observed between abnormal posture of the hip (adduction and too much internal rotation of the hip during weight-bearing activities) and proximal muscle weakness (abductor, extensor and external rotator of the hip) with patellofemoral pain syndrome (21 and 20), Sahrmann recommended the use of" posterior cruciate packing tape on the thigh", "reinforcement of abductor muscles, the extensor and external rotator of the hip" and "functional training" in the treatment of patients; but the effects of Sahrmann therapeutic approach in patients with patellofemoral pain syndrome has not been studied so far. Previous studies only have examined the effect of physical therapy and orthotic, which is directly related to the patellofemoral joint structures. So far the impact of rotating hip disorders (adduction and too much internal rotation of the hip during weight-bearing exercise) and gluteal hip muscle weakness, which is not directly related to the patellofemoral joint, has not been studied.

Thus, the aim of this study was to compare "traditional physiotherapy alone" and "traditional physiotherapy combined with exercise therapy approach Sahrmann" on pain, quality of life and position sense of the knee in patients with patellofemoral pain (22).

Methods

The controlled clinical trial study was performed, after receiving authorization from the ethics committee of Tehran University of Medical Sciences on 30 patients with knee and patellofemoral joint pain, which is based on the recognition orthopedic surgeon. Samples were divided into two equal groups, including "traditional therapy group" and " Sahrmann therapy group". Samples after completing the informed and voluntary consent of moral were studied. Sampling was conducted in the form of non-random and patient groups were selected randomly.

People with an average age of 20-50 years, the existence of pain in the anterior/posterior patella for at least two months and a maximum of twelve months, discomfort and pain in the medial and posterior external by touching the sides of the patella; worsening of symptoms during prolonged sitting, climbing stairs, squat, running, hopping, two kneeling and jumping, positive clinical testing of Clark & Apprehension and pain during resistance extension were recruited.

In addition, people with direct trauma to the patella and dislocation the existence of any rheumatologic conditions (osteoarthritis, rheumatoid arthritis), diabetes, any trauma and meniscus injuries, ligamentous instability existence of referred pain from the spine, hip and pelvic and sacroiliac; existence of a lot of inflammation and effusion in the knee, knee surgery and steroid injections and physical therapy history of

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knee, were excluded (8, 16, 18). In both groups, treatment for 6 weeks, 3 sessions was applied. In traditional therapy group, banding placebo on the inner side of the thigh, quadriceps progressive strengthening exercises, shortened soft tissues stretch exercises as illiotibial band, hamstrings, and gastrocnemius, electrical stimulation of the skin (TENS), ultrasound was used (24, 23).

Strengthening and stretching exercises in each session, depending on the findings of the examination was conducted according to standard protocols. The contract TENS (with profile duration: 80 microseconds, the frequency of 120 Hz) for 20 minutes with a hot pack on the knee was used. Continuous therapeutic ultrasound with the intensity of 1 W/cm^2, the frequency of 3 MHz, near the edge of the patella was used for 5 minutes. In Sahrmann therapy group, in addition to traditional physiotherapy, a comprehensive program for correction of gluteal muscles dysfunction and thighs contains "posterior cruciate knee packing tape, progressive abductor muscle reinforcement, extensor and external rotator of the hip, and functional training with the aim of avoiding wrong habits and repetition of rotation disorder of the femur during daily activities "were used.

Data were collected through individual questionnaires, visual analogue scale (VAS), inventory and Knee Injury and Osteoarthritis Outcome (KOOS), and knee position sense (by measuring the angle reproduction absolute error 45 ° knee) before and after the study. Persian version of KOOS questionnaire with 42 questions, with Cronbach's alpha reliability coefficient greater than 7.0, including five items (9 question of pain item, 7 questions related to disease symptoms, 17 questions of activities of daily living items, sports items and explore with 5 questions, and items affecting the quality of life for knee problems with 4 items) was used. Each question consists of a 5-choice Likert scale; zero (no options) to 4 (for extremely severe options) had a score (17). The mean total scores in each item was considered as the score of that item. Visual analogue pain scale (VAS) was used to assess pain intensity; to do this a horizontal line with a length of 100 mm were shown to patient and was asked to rate their pain intensity from zero to 100 means no pain to severe pain. To measure the error rate in the reconstruction of knee angle the electrogoniometer was used. Then eye strip and earplugs were given to patient and asked him to rebuild the knee flexion angle of 45 degrees. The deviation of 45 degrees was recorded. For statistical analysis software SPSS version 18 and paired t-test to compare for each group and independent t-test to compare two groups was used and $p<0.05$ was considered significant.

Results

All the studied variables including weight, age, affection duration, pain intensity, KOOS questionnaire score, and the reconstruction knee position error (knee position sense) are normally distributed. Compare the data between the two groups before the intervention, showed that the two groups were not significantly different, which suggests similar in both groups at baseline (table 1).

Table1. Demographic and patient characteristics and data comparison between two groups before the intervention (N=30)

Group / Variable	Traditional physiotherapy Mean±SD	Sahrmann treatment Mean±SD	Possibility
Age (year)	28.40±6.04	28.86±6.30	0.659
Weight (kg)	75.66±4.87	75.2±5.82	0.452
Body mass	24.76±1.24	24.46±1.31	0.078
Affection duration (month)	10.6±2.2	9.8±2.5	0.086
Pain intensity (mm)	54.53±7.23	59.93±7.75	0.059
KOOS questionnaire score	95.93±6.12	95.73±10.94	0.095
Joint position sense (knee angle in degrees)	4.98±1.57	6.18±1.9	0.069

In traditional therapy and at the end of six weeks, the mean pain intensity (p=0.000), KOOS questionnaire score (p=0.000) and knee reconstruction error rate (p=0.000) all improved significantly; so that the mean pain intensity decreased from 54.53±7.233 mm to 37.80±5.11 mm, the mean KOOS questionnaire decreased from 95.93±6.12 to 73.26±6.23 and the average error reconstruction of knee position decreased

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from 4.98±1.57 degrees to 2.82±1.15 (table 2). In addition, in the Sahrmann treatment group and at the end of six weeks, the mean pain intensity (p=0.000), KOOS questionnaire score (p=0.000) and knee reconstruction error rate (p=0.000) have all significantly improved; so that the mean pain intensity decreased from 59.93±7.75 mm to 40.20±5.36 mm, the mean KOOS questionnaire decreased from 95.73±10.94 to 71.40±7.87 and the average knee reconstruction error decreased from 6.18±1.9 degrees to 2.99±1.11 (table 2). Although all the variables in the Sahrmann group compared to traditional physiotherapy showed higher relative improvement, but this difference was not significant (table 3)

Table 2. Comparison of the results in each of two groups of traditional physiotherapy and Sahrmann treatment group at the end of the sixth week

Group / KOOS score	Traditional physiotherapy Mean±SD			Sahrmann treatment Mean±SD		
	Mean before	Mean after	possibility	Mean before	Mean after	possibility
Pain intensity (mm)	54.53±7.23	37.80±5.11	0.000	59.93±7.75	40.20±5.36	0.000
Total KOOS score	95.93±6.12	73.26±6.23	0.000	95.73±10.94	71.40±7.78	0.000
Symptoms of disease	14.26±2.85	12.00±2.64	0.008	14.20±1.99	11.26±1.9	0.001
Pain	15.33±2.09	19.80±2.35	0.000	22.26±2.85	14.86±2.26	0.000
Life activities	35.00±3.66	28.80±3.46	0.000	33.66±7.12	26.13±7.6	0.003
Exercise activities	15.93±1.45	12.93±1.94	0.000	14.33±2.56	9.66±2.16	0.000
Life quality	10.93±2.65	9.35±2.12	0.008	11.26±1.85	9.41±1.89	0.001
Absolute error reconstruction of knee angle (degrees)	4.98±1.57	2.82±1.15	0.000	6.18±1.9	2.99±1.11	0.000

Table 3. Comparison of the results between the two groups of traditional physiotherapy and Sahrmann treatment groups at the end of the sixth week

Group / KOOS score	The mean difference before and after intervention		Possibility
	Traditional physiotherapy	Sahrmann treatment	
Pain intensity (mm)	18.03	19.73	0.548
Total KOOS score	22.67	24.33	0.595
Symptoms of disease	2.26	2.94	0.391
Pain	4.47	7.4	0.562
Life activities	6.2	7.53	0.231
Exercise activities	3	4.67	0.134
Life quality	1.58	1.85	0.638
Absolute error reconstruction of knee angle (degrees	2.16	3.19	0.671

Discussion

The results of this study showed that 6 weeks using traditional physiotherapy alone or in combination with therapeutic approach Sahrmann significantly improves all the variables including pain intensity scores and overall KOOS questionnaire, its items and knee position sense. Positive and useful impact of traditional physiotherapy in patients with patellofemoral pain syndrome has been reported in other studies (25). Likely TENS physiotherapy modalities hot pack and ultrasound by reducing pain, have significant and positive effect on functional ability and quality of life (measured by KOOS questionnaire). Pain or discomfort in patients with patellofemoral pain syndrome is rooted in abnormal stress with various reasons affecting the patellofemoral joint and soft tissues (23, 26). It can be assumed that the quadriceps strengthening exercises (focusing on the internal oblique Vastus), and stretching exercises is helpful for the stiff and short muscles around the knee, to create a balance between the forces on the patella and thus to fix the abnormal stress on the patellofemoral joint and around soft tissues. It seems that the use of this topical treatment workout programs help to natural patellofemoral compression forces as well as local and foreign forces on the patella, had a significant positive impact on reducing pain, improving symptoms and

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discomfort of patients during daily activities and improve the functionality and quality of life (standard KOOS questionnaire), and also knee position sense. The results of this study showed that traditional physiotherapy had a significant positive impact on the position sense of the knee in patients with patellofemoral pain syndrome.

It should be noted that in this study specialized proprioception exercises such as "frequent knee reconstruction, balance board training and specialized training establishment neuromuscular control of the knee" was not used; Hence improving knee position sense can be possibly attributed to secondary effects of reducing the pain and discomfort of patients and perhaps more normal compressive forces and move the patella. It is clear that a part of the improvement observed in the Sahrmann treatment group can also be attributed to the reasons outlined in the traditional therapy group. But another part of the positive and beneficial effects observed in the Sahrmann treatment group should be attributed to effects resulting from the application of used specific programs in this group. According to the study, although use of the Sahrman exercise therapy approach in patients with patellofemoral pain syndrome, compared to traditional physical therapy alone, have a greater effect in improving pain and the overall KOOS scale score and its items, as well as reduce the knee reconstruction error; but this difference was not significant. No significant differences were observed between two treatment groups can be attributed to lack of screening and initial classification of patients with anterior knee pain on movement disorder syndromes, small sample size, lack of opportunities for full time to learn the correct knee movement patterns during weight bearing activities in Sahrmann group and lack of subsequent investigation to discover the lasting positive effects. According to obtained results, necessarily using of " of posterior cruciate packing tape technique on the thigh, hip muscle strength and functional training to correct the dysfunction of gluteal muscle and thigh" in general in all patients with patellofemoral pain and without screening and primary examination for classification of patients did not lead to more effective treatment.

Adding the Sahrmann medical training to traditional physiotherapy for correcting the dysfunction of gluteal muscles and thigh, by posterior cruciate packing tape on the thigh, hip muscle strength and functional training, in general and without screening and primary examination for classification of patients, could not lead to effective treatment in patients with patellofemoral pain.

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