

# Influence of the treatment of the Kinesio-taping® technique on pain and functionality in patients with Patellofemoral Pain Syndrome

## Influência do tratamento da técnica de Kinesio-taping® na dor e funcionalidade em pacientes com Síndrome de Disfunção Femoropatelar

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### Abstract

Patellofemoral Pain Syndrome (PFPS) is defined as anterior or retro patellar pain in the absence of another comorbidity of the knee. It is a pathology with high incidence, affecting 20% of the population in general. The Kinesio-Taping® (KT) technique, also known as elastic bandaging, is a method that has become popular in the last 10 years and since then has been used as a therapeutic approach both in prevention and directly acting on the symptoms of sports injuries and injuries that affect the knee. The aim of the study was to evaluate the influence of the Kinesio-Taping® technique on the symptomatology and functionality of individuals with Patellofemoral Pain Syndrome (PFPS). The subjects involved in this study contained 32 female subjects, clinically diagnosed with this syndrome, who were randomly divided into two groups. The first group received treatment with Kinesio-Taping® and conventional physiotherapy, and the other group received conventional physiotherapeutic treatment. Both groups were submitted to HOPTTEST, EVA scale, and the Lysholm questionnaire before and after the intervention, which was performed for 1 month. It was found that Kinesio-Taping® had a significant improvement in the VAS scale at the conclusion of the test ( $p = 0.012$ ), however, as for functionality and balance, in comparison between the control and experimental groups, no significant difference was observed. Given the above results, it is concluded that the Kinesio-Taping (KT) technique associated with conventional physiotherapeutic treatment provides greater pain relief to patients with PFPS.

**Keywords:** Physiotherapy. Patellofemoral Pain Syndrome. Stabilization. Evaluation.

### Resumo

A Síndrome da disfunção Femoropatelar (SDFP) é definida como uma dor anterior ou retro patelar na ausência de outra comorbidade do joelho. É uma patologia com alta incidência, afetando 20% da população em geral. A técnica de Kinesio-Taping® (KT), também conhecida como bandagem elástica é um método que se tornou popular nos últimos 10 anos e, desde então tem sido utilizado como proposta terapêutica tanto na prevenção, como atuando diretamente nos sintomas de lesões esportivas e naquelas que acometem o joelho. O estudo teve como objetivo avaliar a influência da técnica Kinesio-Taping® na sintomatologia e funcionalidade de indivíduos com síndrome de Disfunção Femoropatelar (SDFP). A população envolvida neste estudo foi de 32 indivíduos do sexo feminino, diagnosticados clinicamente com a referida síndrome, as quais foram divididas aleatoriamente em dois grupos, o primeiro grupo recebeu o tratamento com Kinesio-Taping® e fisioterapia convencional e o outro grupo recebeu tratamento fisioterapêutico convencional. Ambos os grupos foram submetidos ao HOPTTEST, escala de EVA e o questionário Lysholm antes e depois da intervenção, a qual foi realizada por 1 mês. Verificou-se que a Kinesio-Taping® teve uma melhora significativa na EVA ao concluir o ensaio ( $p=0,012$ ), no entanto, para a funcionalidade e o equilíbrio, na comparação entre os grupos controle e experimental, não foi verificada diferença significativos. Diante do exposto conclui-se que a técnica *Kinesio-Taping*(KT) associada ao tratamento fisioterapêutico convencional proporciona maior conforto algíco aos pacientes com SDFP.

**Palavras-chave:** Fisioterapia. Síndrome da Dor Patelofemoral. Estabilização. Avaliação.

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## INTRODUCTION

Patellofemoral Pain Syndrome (PFPS) is defined as anterior or retro patellar pain in the absence of another knee comorbidity. It is a pathology with a high incidence, affecting 20% of the general population of all ages, especially adolescents and young adults from 10 to 35 years, leading to several limitations in the functional activities in the individual. Activities such as going up and down stairs, running and / or walking, squatting and kneeling, or even sitting for an extended period of time, increases the compression forces in the Patellofemoral joint, which aggravates the dysfunction<sup>1</sup>.

PFPS is one of the most frequent musculoskeletal disorders in the knee. Its symptoms consist of diffuse pain in the anterior part of the knee, usually along the medial part of the patella, retro patellar and lateral pain can also be diagnosed. These symptoms are due to structural or biomechanical changes of the joint, which is exacerbated by activities of small, medium and great efforts. Other signs are also present such as patellar cracking, edema, and articular block<sup>2</sup>.

Its etiology has not yet been clearly established, and may be related to biomechanical alterations, specifically, the static and dynamic imbalance. In static changes, some authors point out abnormalities such as poor patellar alignment, increased Q angle, high or low patella, excessive pronation, lateral rotation of the tibia, femoral anteversion, valgus or varus knees, and shortening of the lateral retinaculum, hamstring muscles and iliotibial tract<sup>3</sup>.

Precipitating static factors that are also highlighted are: trauma, overuse, osteochondral alteration, irritation of the synovial plica and ligament laxity. Patellar malalignment is the most frequently accepted hypothesis as the primary factor of pathology in the patellofemoral joint<sup>4</sup>.

Dynamic imbalance is related to changes in the forces between the stabilizing muscles of the patella located in the femoral quadriceps (vastus oblique and vastus lateralis). This imbalance is considered the main factor for the appearance of the symptoms, which changes the patellar kinematics and contributes to the increase of the patellofemoral reaction and

compression forces<sup>5</sup>.

The decreased strength of the quadriceps, the main dynamic stabilizer of the patella in the femoral trochlea, is directly related to the incidence of patellar-femoral pain and plays an important role in the onset of PFPS. Therefore, it is pointed out as a risk factor, which was also concluded in a recent systematic review<sup>6</sup>.

For patients diagnosed with PFPS, conservative treatment is always considered as the first and best option. This treatment aims to treat PFPS by means of voluntary exercises aimed at promoting balance between the muscular portions of the femoral quadriceps, especially the vastus medialis lateralis and vastus medialis oblique stabilizers<sup>7</sup>.

Among the various manners used in conservative treatment, functional bandaging is a form of treatment used in several pathologies with great effectiveness, correcting the patellar misalignment due to PFPS, through its biomechanical properties. It has a proprioceptive function stimulating the contraction of the muscle and it promotes joint stability<sup>8</sup>.

The Kinesio-Taping® (KT), also known as elastic bandage, technique was originally developed in 1973 by Kenzo Kase in Japan, a method that has become popular in the last 10 years and has since been used as a therapeutic application both in prevention and as directly acting on the symptoms of sports injuries and injuries that affect the knee<sup>9</sup>.

This elastic bandage is latex free, it has acrylic adhesive capacity which is activated by body heat, it is made of an elastic polymer fiber wrapped with cotton fibers (100%), it is thinner and more elastic than the conventional tape, it can be stretched up to 120-140% of its original length, it produces a smaller mechanical retention system and less mobility restrictions than conventional tape. Four beneficial effects were claimed by KT: normalization of muscle function, increase in lymphatic and vascular flow, reduction of pain, and contribution to correct occasional joint misalignments<sup>9,10</sup>.

It is believed that this new technique promotes improved circulation and reduction of local edema, as well as sensory stimulation offering stability and proprioception during the execution of movements. In addition, it also causes pain relief, since it stimulates the sensory

pathways of the central nervous system by increasing afferent feedback and reducing direct pressure in the subcutaneous nociceptors<sup>11</sup>.

In the evaluation of the prevention and treatment of sports injuries, KT did not have a significant effect on pain relief, but there was improvement in proprioception with the use of the bandage. KT also had some substantial effects on muscle activity, but it was not clear whether these changes were beneficial or detrimental<sup>11</sup>. In people with acute

musculoskeletal conditions, the effects of KT can significantly improve pain levels and range of motion. In individuals with chronic lumbar pain treated with KT and exercise, KT alone, or exercise alone, experienced a significant improvement in short-term pain, however, the long-term results are uncertain<sup>12</sup>.

Thus, the present study aimed to evaluate the influence of the KT technique on the symptomatology and functionality of individuals with PFPS.

## MATERIALS AND METHODS

This was a randomized, blinded clinical trial, whose randomization was performed by alternated inclusion in the groups. The research was carried out after the evaluation of the Research Ethics Committee respecting the ethical precepts of research involving human beings, being approved by proposal 003/14.

Thirty-two sedentary female patients with a diagnosis of PFPS performed by an orthopedist and confirmed by a physiotherapist, aged between 18 years and 50 years, participated in the study. Individuals with balance deficit, presence of fractures in the consolidation phase, lack of cognition, amputees, and patients with hip or knee arthroplasty were excluded from the study. In addition, those individuals who did not sign the Free and Informed Consent Form were also excluded.

Participants selected at the Clinical School of Physiotherapy were divided into two groups of equal sizes. The first group (experimental group) received KT treatment and conventional physiotherapeutic treatment, and the control group only received physiotherapeutic treatment. Prior to the start of the interventions the two groups underwent a blind evaluation, that is, performed by a capable and trained evaluator, who was not aware of which group the patients belonged to. The evaluation was performed before and after the protocol of one month of treatment and included the HOPTEST, EVA scale and the Lysholm questionnaire.

To assess the intensity of pain, a common language was necessary between the evaluator and the volunteers, demonstrating the

standardization and the correct way to fill the scales, ensuring the volunteers the adequate understanding and meaning of the instruments contained in the evaluation tool. The pain evaluation was then indicated by the volunteers through one-dimensional scales: Visual Analog Pain Scale (VAS)<sup>13</sup>. The VAS consists of a 10-centimeter-long horizontal line, marked at one of its stops the classification "NO PAIN" and, in the other, the classification "MAXIMUM PAIN". The volunteer makes a mark with a dash at the point that simulates the intensity of his / her pain.

In the HOPTEST (Single-Leg version) the subjects were instructed to jump as far as possible in unipodal support with the same leg. The test was performed three times for each member, alternating between right and left. The distance of each jump was measured in centimeters starting from the initial position of the test to the point of support. The best mark achieved in the three trials was considered as the value of the test. The modified version of the Single-Leg Hop Test was used in this study, which allowed the subjects to move their arms freely during the jump, aiming at greater functionality in their execution<sup>14</sup>.

The functional knee evaluation system adopted for this study was the Lysholm Knee Scoring Scale, a specific questionnaire for knee symptoms, which was translated and validated to the Portuguese language by Peccin, Ciconelli and Cohen (2006). The Lysholm questionnaire was used in its original language in many studies to evaluate knee ligament injuries. It is noticed

that care was given while forming the original version, because it clearly evaluates the criteria for selecting the questions. One can believe that this questionnaire has apparent validity and content. The specific evaluation measures available are clinically sensitive, demonstrating a greater capacity to detect specific aspects of the disease, restricted to the relevance domains to be evaluated<sup>15</sup>.

The Lysholm questionnaire helps evaluating by checking its relationship with the established diagnosis and other clinical parameters, all performed by the researcher, at the time of the first interview. The questionnaire consists of eight questions with alternatives of closed answers regarding pain, edema, difficulty climbing stairs, squatting, locking, instability, need for walking aid and claudication<sup>15</sup>.

The treatment period for both groups was 30 days, with a frequency of twice weekly and each treatment lasting 50 minutes. During the physiotherapeutic treatment in both groups, quadriceps and hip abductors were strengthened, stretching / relaxation of the rectus femoris, adductors, hamstrings, triceps of the leg and tensor of the fascia lata. In addition

to this, TENS was used for pain relief prior to the initiation of the kinesiotherapy treatment, only in cases where the patient reported pain at the beginning of the session greater than 7 on the VAS. Among the patients in both groups, this occurred only on one occasion for a patient in the control group. Electrical stimulation in the oblique medial vastus muscle was performed to correct patellar positioning, also in both groups. The elastic bandage (KT) was changed in all the visits, only in the experimental group. The treatment was conducted by the same professional in both groups. For the group using KT, the mechanical correction technique was used for patellar adjustment with taut tension and quadriceps technique.

The descriptive statistics of the data were initially performed through the Excel® program. After the data were tabulated, a statistical analysis was performed. The Shapiro-Wilks test was used to verify the normality of the data. This was done by Student's t test to compare the results before and after therapy and the t test for independent samples to compare the results between the groups. Values of  $p < 0.05$  were considered significant.

## RESULTS

The final sample consisted of 32 participants, with a mean age of  $27.71 \pm 7.74$  years, divided into two groups of equal size, denominated control and experimental groups.

The control group before starting the treatment had an average pain VAS of  $3.86 \pm 2.43$ , and at the end an average pain of  $2.43 \pm 0.98$ . The experimental group presented a pain scale at the beginning of treatment of  $6.86 \pm 1.16$  and at the end of the treatment  $4.29 \pm 0.83$  (figure 1).

When applying Student's t-test to analyze the effectiveness of the treatments in relation to VAS, it was observed that both groups showed significant improvement (control:  $p = 0.041$ , experimental:  $p = 0.000$ ) (figure 1).

In the comparison between the groups in relation to VAS before the intervention, there was a difference ( $p = 0.006$ ), that is, the experimental group presented higher pain

VAS and, in the same comparison after the intervention, there was no difference ( $p = 0.051$ ). This shows a significant improvement of the VAS in the experimental group. This finding was confirmed by means of the Student's t-test for independent variables, which showed a significant difference between the groups ( $p = 0.012$ ), that is, the decrease in pain in the experimental group was significantly higher when compared to the control group.

The mean score for the Lysholm scale at the start of treatment was  $75.29 \pm 9.72$  and at the end  $81.14 \pm 9.77$  for the control group. The experimental group had a Lysholm scale of  $67.86 \pm 7.47$  before starting treatment, and  $77 \pm 8.74$  at the end of the treatment (figure 2). The comparison of the Lysholm scales between the control group treatments verified that there was a statistical difference in both the control group ( $p = 0.001$ ) and the experimental

group ( $p = 0.000$ ). Therefore, it can be said that both treatments significantly improved the functionality of the knee (figure 2).

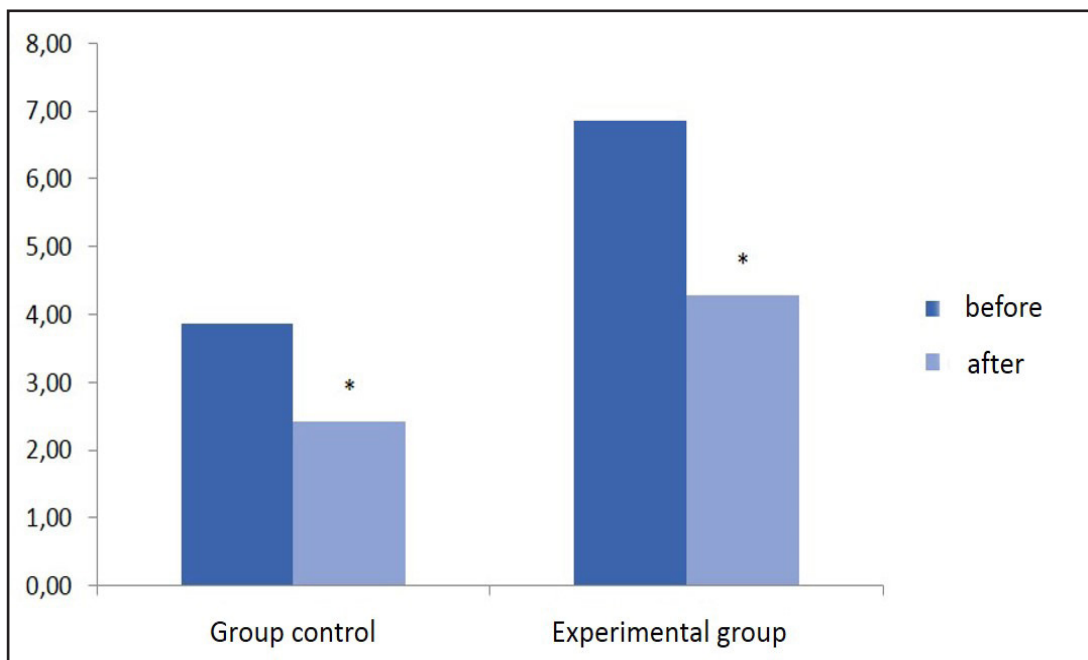
In the comparison between the groups before treatment there was no difference in the Lysholm ( $p = 0.067$ ), that is, the two groups had equal Lysholm scores. The same comparison made after treatment did not present statistical differences either ( $p = 0.122$ ). In the comparison between the groups through the t-test for independent variables, no differences were observed ( $p = 0.324$ ), that is, both groups had the same progress.

For the results obtained in the control group for HOPTTEST, the average on the right side was  $71.3 \pm 18$  cm (before) and  $73.2 \pm 16.77$  cm (after); and on the left side,  $71.3 \pm 13.03$  cm (before) and  $71.8 \pm 13.09$  cm (after). In the experimental group, the right side was  $58.3 \pm 23.52$  cm (before) and  $62.4 \pm 25.74$  cm (after); and the left side was  $57.8 \pm 23.56$  cm (before)

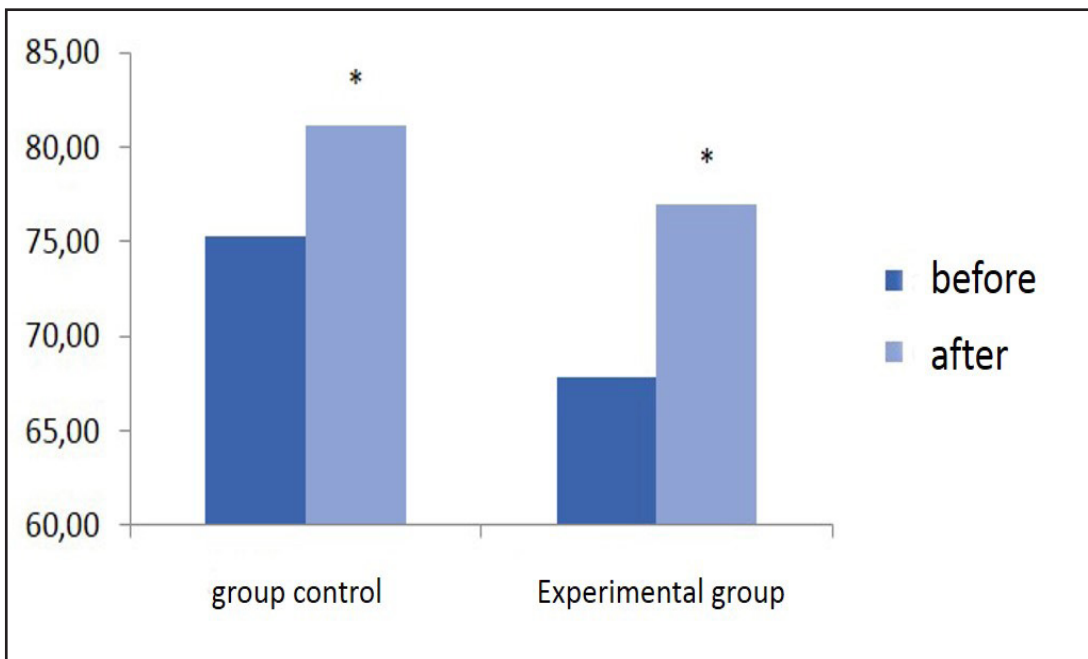
and  $61.3 \pm 25.26$  cm (after) (figure 3).

When comparing the HOPTTEST before and after the intervention, in the control group there was a statistical difference ( $p = 0.005$ ) in the lower limb on the right side, while for the left lower limb there was none ( $p = 0.325$ ), that is, there was an increase in the distance reached for the test on the right lower limb. Meanwhile, in the comparison for the experimental group, there was a statistical difference in the HOPTTEST for both the right lower limb ( $p = 0.018$ ) and the lower left limb ( $p = 0.027$ ), that is, the distance reached in the test for both limbs increased (figure 3).

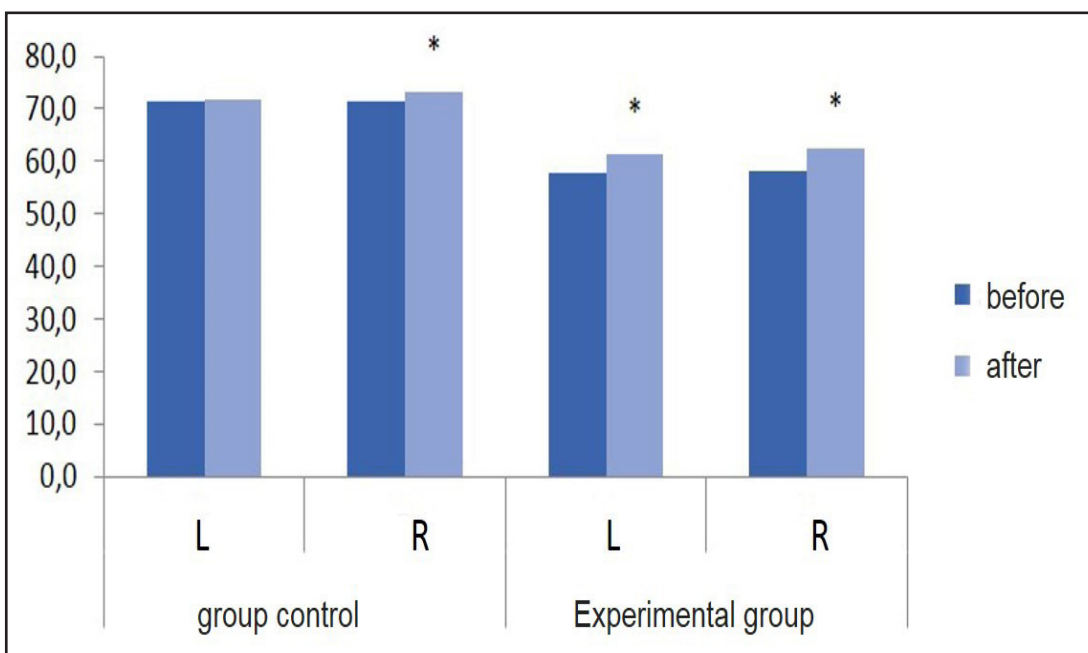
In the comparison between the groups in the HOPTTEST, there was no difference on the right side ( $p = 0.133$ ) or the left ( $p = 0.103$ ) before treatment. In the same comparison made after the intervention, no difference was observed ( $p = 0.185$ ), that is, the two groups obtained the same progress.



**Figure 1** – Comparison of the control group before and after, comparing the VAS. Rio Verde, 2017.



**Figure 2** – Comparison of the control group before and after, comparing the Lysholm. Rio Verde, 2017.



**Figure 3** – Comparison of the control group before and after, comparing the HOPTTEST. Caption: E-left; D-right . Rio Verde, 2017.

## DISCUSSION

The aim of this study was to compare two groups of patients with PFPS under treatment, one with the use of physiotherapy only (control) and another with the use of KT concomitant with physiotherapy (experimental).

It was observed in the results obtained that, through the Lysholm test, both the treatment with the KT technique associated with physiotherapy and physiotherapy alone obtained the same result in relation to functionality. When analyzed separately, a difference can be noted in each group.

In a study with 17 clinical trials, it was observed that the KT technique is superior in a minimal intervention of pain, yet in other treatment approaches, like functionality, addressed in this study with the Lysholm questionnaire, there seems to be no bandage superiority<sup>16</sup>.

Perhaps it was not possible to obtain significant results in relation to the function of the knee due to the 30-day period imposed in this study to collect the results. According to the in the systematic review of Parreira et al. (2013)<sup>17</sup>, a significant benefit of KT over pain was found in two clinical trials where the period of treatment was long enough to include some clinically valid effects, but these studies were of poor quality. Thus, there may be a need for increased time of physiotherapy time with KT to demonstrate a clinically significant effect on functionality.

For VAS, improvement in pain was observed in patients in the experimental group using KT, when compared to the control group under physiotherapy only. However, according to Callaghan (2012)<sup>18</sup>, patients often report an instant improvement in pain and in function after the tape is applied, but its long-term effects are uncertain.

Most studies consistently indicate that KT can stimulate cutaneous mechanoreceptors and improve knee proprioception. Sensory input can increase feedback to the central nervous system and thereby decrease pain. Thus, bandaging seems to involve the gate control theory as a cause of pain modulation<sup>19</sup>.

According to Gosling<sup>20</sup>, the most accepted idea to date is that of the gate control theory, in

which the mechanical stimulus provided by KT would act through fast-conducting fibers (AB) which, upon reaching the substantia gelatinosa (posterior horn of the spinal cord), performs synapses with inhibitory interneurons, causing a gate closure and therefore not allowing the passage of nociceptive stimuli (Fibers C and AB); which justifies the instantaneous improvement in pain. However, so far there are no studies that prove a long-term improvement with the use of bandaging, the maximum period tested was 4-6 weeks.

Considering that the period of evaluation of patients in this study was of one month, and taking into consideration Callaghan's data, a significant improvement in pain was to be expected after two weekly sessions of physical therapy and KT.

Nevertheless, Castro-Sanchez et al. (2012)<sup>21</sup> reported a similar result. According to them, the use of KT tape reduces disability and pain in people with chronic non-specific lower back pain, but these effects are small, and the improvements described are only short-term (24 hours to 1 week).

Given these data, it would be timely and necessary to assess these patients after a minimum of 7 days from the end date of the experiment of KT associated with physiotherapy. This could clarify the improvement of pain with the use of KT concomitant with physiotherapy.

Segundo Lim e Tay (2015)<sup>22</sup> o KT é eficaz no controle patelar, através do aumento da sensação de força muscular, e que poderia o mecanismo de alívio da dor em pacientes com SDPF.

According to Lim and Tay (2015)<sup>22</sup>, KT is effective in patellar control by increasing the sensation of muscular strength, which could control the pain relief mechanism in patients with PFPS.

The results of Akbas et al. (2011)<sup>23</sup> indicated significant pain relief in PFPS patients after the use of KT. They infer that KT can facilitate contraction of the quadriceps muscle, and that increased muscle strength can provide a dynamic patellar stability, thus reducing pain.

The HOPTEST assessment imposed on the

patients of this study also obtained clinically significant results after the use of KT. This test also addresses functionality, proprioception, and strength by assessing knee stability.

Corroborating with the results of this research, the studies performed by Pereira et al. (2012)<sup>24</sup> identified that the use of KT in injured athletes provided the reduction of pain, as well as improving proprioceptive capacity, supporting the muscles without affecting circulation and freedom of movement.

Pretti et al. (2007)<sup>25</sup> applied a physiotherapeutic treatment in an 18-year-old subject whose treatment proved to be effective and beneficial in controlling the pain, promoting an improvement of function and proprioception. The data are consonant with those found in this

study, in which KT coupled with physiotherapy assisted in pain reduction and stability of PFPS patients.

However, in disagreement with this research, results reported by Aytar et al. (2011)<sup>19</sup> indicated a non-significant change in the knee joint proprioception of PFPS patients when compared to a control group.

Therefore, the currently available evidence from studies reporting clinically relevant results is low and insufficient to draw conclusions about the effects of KT, whether used alone or as part of a treatment program. Further research is required, involving large populations, preferably multi-centered, of good quality and randomized controlled trials that can achieve clinically important long-term and short-term results.

## CONCLUSION

Based on the data presented, it can be concluded that the use of KT associated with conventional physiotherapeutic treatment leads to an improvement in the overall pain compared to the conventional physiotherapeutic

treatment alone. In addition, both treatments improve the index of functionality and stability/proprioception, without differences between the groups treated with and without KT techniques in PFPS patients.

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