



PREVENTION & REHABILITATION: Randomised Controlled Trial

Comparison of non-steroidal anti-inflammatory drugs and knee kinesio taping in early osteoarthritis pain: A randomized controlled trial

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ABSTRACT

NSAID in knee OA impose many related adverse effects. Kinesio taping was recently suggested as a novel conservative treatment for reducing pain in OA, without adverse effects. This study aimed to compare kinesio taping and NSAID therapy for kn.ee OA. There were 37 participants in the first group (mean age, 53.72 ± 8.91 years), 29 participants in the second group (mean age, 50.24 ± 8.63 years), and 18 participants in the third group (mean age, 53.33 ± 8.50 years). These groups were treated with NSAID therapy and kinesio taping, kinesio taping only, and sham taping with NSAID therapy, respectively. Taping was repeated three times a week at 1-day intervals. Participants reported pain each week, using visual analog scale scores. The main effect of group and the pain–group interaction were not statistically significant ($P = 0.88$ and 0.15 , respectively). Pain reduction in different weeks was statistically significant ($P < .001$). Cohen's effect size values for pain reduction in the first to third groups were 0.70 , 0.55 , and 0.48 , respectively. Pain reduction was observed in the three groups, but there was no significant difference among the various treatments. Kinesio taping as a pain relief method may reduce pharmacotherapy demands or at least delay NSAID prescriptions in patients with early OA.

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1. Introduction

Osteoarthritis (OA), a worldwide cause of pain and disability, affects 30–40% of people > 70 years of age (Hinman et al., 2003). The prevalence of OA varies from 22% to 39%, and the knee joint is known to be the most commonly affected joint (Anandkumar et al., 2014). Functional restrictions in activities of daily living, restricted range of motion, and weak social communications are other problems in patients with OA (Mutlu et al., 2017). No definite cure has been identified for OA, and joint replacement is considered only at the end stage of the disease.

Different treatments have been used to date, including non-steroidal anti-inflammatory drugs (NSAIDs), opioids, physical therapy, aquatic therapy, exercise therapy, massage therapy,

radiotherapy, intra-articular injection, and complete joint replacement (Cushnaghan et al., 1994; Bartels et al., 2007; Kongtharvonskul et al., 2015; Bennell et al., 2016; Bruyère et al., 2016; da Costa et al., 2016; Gay et al., 2016; Minten et al., 2016; Parker and Scholes, 2016; Smith et al., 2016). Obviously, of all available treatments, the one with the fewest adverse effects is deemed the best choice. The patellofemoral joint is one of the three compartments of the knee joint that is affected by OA, and it has been suggested to focus treatment on the main problematic compartment. Patellar malalignment is typically observed in a lateral direction and potentially involves the lateral patellofemoral joint compartment in OA (Leibbrandt and Louw, 2015).

Patellar taping was originally used by McConnell as a rigid taping method to correct patellar alignment (Mc, 1986). Taping is a rational inexpensive treatment that induces permanent and temporary biomechanical corrections (Cushnaghan et al., 1994; Hinman et al., 2004). Cushnaghan et al. reported that the use of medial patellar taping significantly reduced pain (Cushnaghan et al., 1994). A systematic review determined that a medially directed force on the patella decreased chronic knee pain on a 100-

Abbreviations: NSAID, Non-steroidal anti-inflammatory drugs; OA, osteoarthritis.

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mm scale by 16.1 mm compared with no tape and by 10.9 mm compared with sham tape (Warden et al., 2008).

Over the past few years, kinesio tape (KT) has been used by physical therapists as a relatively novel method of taping for pain reduction in joints. This is an elastic tape that mimics the thickness of the skin and appears to work by lifting the skin, which increases blood circulation and lymphatic drainage and leads to pain reduction (Lim and Tay, 2015). Previous studies reported controversial results in favor of KT as a suitable intervention in patients with OA (Mutlu et al., 2017; Wageck et al., 2016). However, further studies seem crucial in this new area to confirm KT as a valid treatment method for knee OA (Mutlu et al., 2017).

Although NSAID treatments are very popular, considering their different adverse effects (Flauaus and Schmidtke, 2017), it is reasonable to examine another safe treatment for managing pain in OA patients. We found no studies that compared KT with NSAID therapy in patients with OA. Such a comparison might lead to the replacement of NSAID therapy with KT or at least delay their prescription, which in turn reduces their adverse effects in the treatment process. Hence, our study aimed to evaluate the effect of application of KT, alone and along with the use of NSAIDs on pain control in knee OA.

2. Method

This study has registered in Iranian Registry of Clinical Trials (IRCT) and its allocated number is IRCT2014010513146N3.

2.1. Participants

The present study population comprised 111 patients with patellofemoral OA, all of whom had been referred from a diagnostic medical center supervised by Qazvin University of Medical Sciences (QUMS). The inclusion criteria were as follows: age ≥ 50 years, apparent osteophytes on radiography, reported knee pain in the previous months and pain and discomfort when standing up from a chair and climbing stairs. The exclusion criteria were as follows: performed physical therapy and surgery in the past 12 months, arthroplasty, intra-articular injection in the past 6 months, systematic arthritis, skin disorders, documented skin sensitivity to previous taping technique, and a body mass index (BMI) > 36 (Altman et al., 1986). All subjects signed an informed consent form approved by the ethics committee of Qazvin University of Medical Sciences.

2.2. Procedure

A total of 140 participants enrolled in the study, all of whom were referred from a diagnostic medical center supervised by Qazvin University of Medical Science; of them, 29 were excluded since they did not meet the necessary inclusion criteria according to the first evaluation. The remaining 111 participants were randomly assigned to three groups of 37 patients each. Each patient received a sealed envelope with a number and the patient's group was determined by a random generating number program (Mutlu et al., 2017).

Treatments in the three groups were as follows: medial directed patellar taping and NSAID therapy in the first group, medial directed patellar taping alone in the second group, and sham taping and NSAID therapy in the third group. The first and third groups were prescribed nimesulide, a cyclooxygenase-2 inhibitor, at dosage of 200 mg/day. Assessments were performed by a blinded individual and all participants were recommended to have no question related to their own group and treatment type.

A trained physical therapist (PT, PhD), applied KT to the knee

joint in a physical therapy center. Tape (Kinesio Tex Tape) with a width of 5 cm and thickness of 0.5 mm was used in all groups (Fig. 1). A Y-strip of tape was applied in the medial direction around the patella by a physical therapist. First, the participants were requested to flex their knees about 30° . The tape was applied to the lateral side of the knee aligned with the articular line of the knee found via palpation by the physical therapist. Tails of tape were applied on the superior and inferior borders of the patella in the medial direction. The physical therapist applied 25% tension to impose a medially directed force on the patella (Mutlu et al., 2017). During the tape application toward the medial side of the knee, the participants were asked to move their knee slowly from flexion to extension (Kase, 2016).

The tape was applied three times a week at 1-day intervals after the previous tape was removed in each session (Lim and Tay, 2015). After every tape removal, the therapist checked for skin sensitivity reactions. Overall, nine taping sessions were used in all three groups (Lim and Tay, 2015). Treatment was continued for 3 weeks. In the control group, sham taping was applied in a similar way without tension in the taping technique (Lim and Tay, 2015). Therefore, the participants were not able to feel a difference from the real taping. All participants reported their pain perception using a visual analog scale (VAS) score in four stages, at the beginning of treatment in the first session and every three sessions thereafter. The VAS scale used was horizontal and 10 cm long.

2.3. Data analysis

The difference in pain perception between groups at the different weeks was evaluated using analysis of variance (ANOVA). A paired *t*-test was used in each group to evaluate pre - post pain values of the participants. The significant level was defined as $P < 0.05$. Cohen's effect size was similarly used to evaluate the efficiency of our intervention for reducing pain. Effect size was interpreted according to Cohen's definition (Cohen, 1988). The ranges for the effect sizes were as follows: ≤ 0.2 (minimal to small), 0.2–0.5 (small to moderate), 0.5–0.8 (moderate to large), and ≥ 0.8 (large).



Fig. 1. Kinesio Taping application used in the study.

Table 1
Demographic characteristics of participants.

	GroupI	GroupII	Group III	P Value
Age(Y)	53.72 ± 8.91	50.24 ± 8.63	53.33 ± 8.50	0.09
Sex (M/F)	19/18	13/16	5/13	0.25
Height (cm)	159.02 ± 6.33	158.89 ± 6.26	156.27 ± 6.55	0.28
Weight (kg)	68.91 ± 10.85	74.37 ± 10.30	70.11 ± 11.72	0.21
BMI(Kg/m2)	27.74 ± 4.81	29.48 ± 3.95	28.67 ± 4.11	0.28

Values are (mean ± Standard deviation), BMI: Body Mass Index, M: male, F: Female. GroupI (NSAID therapy and kinesio taping), GroupII (kinesio taping only), Group III (sham taping with NSAID therapy).

3. Results

The demographic characteristics of all participants have shown in Table 1. During the treatment procedure, 8 participants from the second group (kinesio taping only), and 18 participants from the third group (sham taping with NSAID therapy) were excluded for not completing all treatment sessions (Fig. 2).

The first group consisted of 37 participants (mean age, 53.72 ± 8.91 years; mean weight, 68.91 ± 10.85 kg; mean height, 159 ± 6.33 cm), the second group included 29 participants (mean age, 50.24 ± 8.63 years; mean weight, 74.37 ± 10.30 kg; mean height, 158 ± 6.26 cm), and the third group included 18 participants (mean age, 53.33 ± 8.50 years; mean weight, 70.11 ± 11.72 kg; mean height, 156 ± 6.55 cm). No significant intergroup difference was noted in age, sex, or BMI ($p > 0.05$).

ANOVA showed that the main effect of group in pain perception and the pain–group interaction were not statistically significant ($P = 0.88$ and 0.15 , respectively). Table 2 shows the reported mean pain perception values of the three groups. The VAS score before treatment did not differ significantly among the three groups ($P > 0.05$). However, there was a significant difference in mean pain perception values among the different weeks (every three sessions) in all three treatment groups ($P < 0.05$). Effect size values for this pain reduction in the first, second, and third groups were 0.70, 0.55, and 0.48, respectively.

Table 2
Descriptive Data for VAS in Different Time Frame in three groups.

Time	Group1 Mean ± SD	Group2 Mean ± SD	Group3 Mean ± SD
W0 ($P = 0.22$)	5.83 ± 1.80	5.93 ± 2.20	5.00 ± 1.64
W1	4.56 ± 1.80	4.65 ± 2.20	4.33 ± 1.68
W2	3.62 ± 1.68	3.68 ± 2.59	3.61 ± 1.81
W3	2.62 ± 1.40	2.82 ± 2.50	3.11 ± 1.74

Values are: SD: Standard deviation, W0: Before treatment, w1: After first week, w2: After second week, w3: After third week.

4. Discussion

The results showed that use of the KT technique without reported side effect in our study, decreased pain in patients with OA within 3 weeks, but that the pain reduction trend did not differ significantly among the three groups (Fig. 3). Pain reduction in the sham taping group was also significant, although, the effect size in other groups was slightly higher than that of the sham taping group (Table 3).

This was probably related to the placebo effect based on releasing analgesic neurotransmitters in sham taping, which is according to patient expectations (Oken, 2008; Lim and Tay, 2015). The degree of the psychological effects of kinesio taping, however, remains uncertain (Vercelli et al., 2013). This part of the results can lead us to suggest sham taping as a method of reducing pain in patients with early-stage OA and sensitive skin to postpone pharmacotherapy because it is used without any tension and only glue on the skin.

The present study also showed pain reduction in medially directed kinesio taping with or without concomitant NSAID use. Medial taping has been confirmed as an inexpensive and simple treatment in OA that reduces pain in some studies (Warden et al., 2008; Anandkumar et al., 2014). Warden et al., in a systematic review, stated that taping with a medially directed force on the patella produced a clinically meaningful change in chronic knee pain. Nevertheless, they did not restrict their treatment approach to a

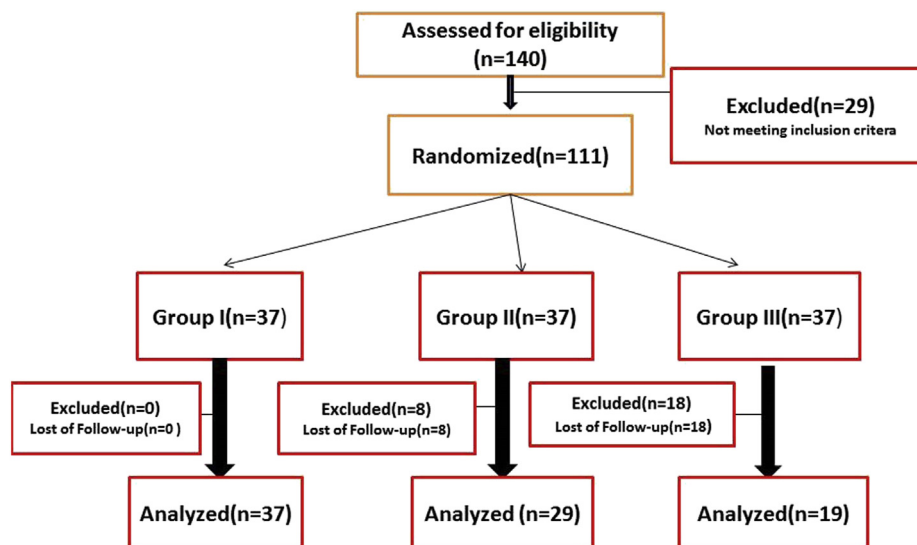


Fig. 2. Flow diagram of the study.

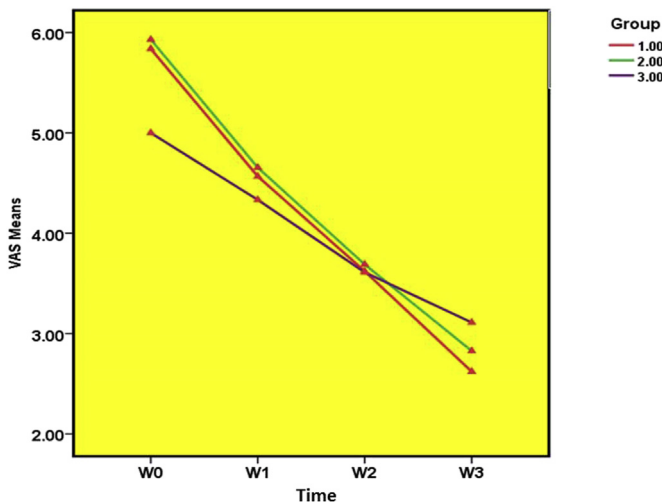


Fig. 3. Reported weekly pain in three groups. VAS: Visual Analog Scale, W0: Before treatment, w1: After first week, w2: After second week, w3: After third week.

Table 3

Intervention Assessment in Three groups (Before and After).

Group	VAS1	VAS2	P value	ES
1	5.83 ± 1.80	2.62 ± 1.40	P < 0.001	0.70
2	5.93 ± 2.20	2.82 ± 2.50	P < 0.001	0.55
3	5.00 ± 1.64	3.11 ± 1.74	P < 0.001	0.45

VAS1: Pain score in first session, VAS2: Pain score after last session, ES: Effect size.

special taping method. The use of KT in OA and studies related to anterior knee pain were included in that study as well (Warden et al., 2008).

They recorded VAS scores to evaluate pain perception without using pharmacotherapy in their method. Our results also confirmed the results of Manzer et al., who designed a more similar method but used McConnell taping instead of KT and exercise instead of NSAIDs for patellofemoral pain syndrome (Manzer et al., 2013). They reported a significant pain reduction in three groups but stated that taping and concomitant close kinematic exercise is a more efficient intervention for pain reduction in patellofemoral pain syndrome in 3 weeks (Manzer et al., 2013).

Bockrath et al. and Mostamand et al. stated sensory inputs from tape and decreased patellofemoral joint reaction force may be responsible for pain reduction in anterior knee pain, but taping method was not restricted to KT in that study (Bockrath et al., 1993; Mostamand et al., 2010). A review article in 2015 on KT stated some mechanisms for pain reduction (Lim and Tay, 2015). Lifting the skin by the applied tape reduces pressure, which improves blood circulation and lymph drainage and leads to pain reduction. Afferent stimuli provided by the applied KT may inhibit the transmission of nociceptive signals to the spinal cord and reduce pain in respect to gait control mechanisms (DeLeo, 2006; Lim and Tay, 2015).

Recent studies reported controversial results related to KT in OA (Mutlu et al., 2017; Wageck et al., 2016). Wageck et al. used different KT methods (e.g., drainage and pain relief techniques) to evaluate outcomes (e.g., isokinetic muscle strength, pain, and perimeter). They used the Western Ontario and McMaster OA Index and a pressure algometer to evaluate the pressure pain threshold instead of using VAS alone. They reported no positive effects on function in patients with OA (Wageck et al., 2016). Mutlu et al. reported on the short-term management of OA by KT. There were two groups in their method (taping and placebo), and they reported that taping had positive effects on walking task, pain (measured by VAS score),

and knee-flexion range of motion compared to placebo taping in patients with knee OA. Although the result of this study confirmed their results, pharmacotherapy was not considered an intervention in their study (Mutlu et al., 2017).

The results of the present study suggest that KT can be used to relieve pain and delay NSAID prescriptions. Since no significant intergroup difference was observed, safe taping techniques can compete with the analgesic mechanisms of NSAIDs. Our results should be verified in other studies of other doses of NSAIDs with KT following different long-term protocols.

This study had some limitations including short treatment duration. Longer treatment could likely result in a significant intergroup difference. Another limitation was related to dropout rate in third group (Sham taping and NSAID therapy). It seems with lower dropout rate, we might had higher effect size. Despite the lack of a significant intergroup age difference before treatment, the lower mean age of the second group is a limitation. Since all participants had a patellofemoral problem, the results cannot be generalized to all patients with OA. Nevertheless, the methodological strength of this study was that the testing environment and times of the day were standardized and the therapist was the same in all sessions.

In conclusion, KT is suggested as a treatment option for early OA that can be used for pain relief and reduce or at least delay NSAID prescriptions.

Conflicts of interest

None.

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