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The Effectiveness of an Infrapatellar Strap on Reducing Pain Associated with Patellar Tendinopathy

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Purpose: To determine the effectiveness of an infrapatellar strap on pain reduction in participants with patellar tendinopathy. **Methods:** Articles were identified from PubMed, CINAHL, Medline, and SportDiscus using the string “(((patellar tendinitis OR patellar tendinopathy))) AND ((cho-pat strap OR infrapatellar strap OR compression device OR brace))) AND pain” from January 2009-January 2019, resulting in nine studies. After a review of the title and abstracts, six studies were reviewed in-depth. Of these articles, four studies met the inclusion criteria. Two independent reviewers assessed the level of evidence of included studies using the Oxford Center for Evidence-Based Medicine (2009). Changes in pain with the use of an infrapatellar strap during activity were recorded. **Results:** Four studies were included (LOE: 1 study=1b, 3 studies=3b). Three studies found a significant decrease in pain during jumping activities in participants wearing an infrapatellar strap, while the fourth study did not find a significant reduction in pain. **Conclusion:** Results indicate that an infrapatellar strap may be effective in reducing pain associated with patellar tendinopathy in participants performing jumping activities. **Keywords:** *Patellar tendinopathy, Infrapatellar strap, Pain*

CLINICAL SCENARIO

Patellar tendinopathy (also known as “jumper’s knee”) is a common activity-related injury that results in pain thereby decreasing sports performance.^{1 2} Patellar tendinopathy is thought to be the result of repetitive loading of the tendon, which is common in sports that involve jumping or repetitive loading of the extensor mechanism. In elite athletes, the prevalence of patellar tendinopathy has been reported to be as high as 14%, with the highest rates reported in volleyball (45%) and basketball (32%).³ In non-elite athletes, the overall prevalence has been reported to be 8.5%, with the highest prevalence among volleyball players (14.4%).⁴ Localized pain over the patellar tendon that is exacerbated with activity is the most common symptom reported. As a result of this pain many patients are forced to limit their physical or work-related activity. It is not uncommon for athletes to discontinue their sports career due to knee pain associated with patellar tendinopathy.¹

The exact mechanism of patellar tendinopathy is unknown but is thought to be multifactorial, implicating both intrinsic and extrinsic factors. Factors such as age, body mass index (BMI), nutrition, muscular imbalances, repetitive loading, poor technique, fatigue, and training errors have been shown to be possible risk factors, although the evidence is minimal.^{5 6 7} Histological examinations have demonstrated disorganization or separation of collagen fibers, indicating possible microtears of the tendon. It has also been postulated that pain may be a result of the biochemical stimulation of nociceptors, rather than inflammation.^{8 9} There is strong evidence to support the use of eccentric training for the treatment of patellar tendinopathy.¹⁰

Management of patellar tendinopathy is done conservatively and includes correction of intrinsic and extrinsic factors discussed above. Infrapatellar straps are a commonly prescribed treatment modality for patients with patellar tendinopathy. It is theorized that straps reduce the load on

the tendon at its insertion site on the tibial tuberosity. This reduced load is thought to occur as a result of altering the angle and direction of stress across the injured tendon. This change in angle allows the forces to be distributed over a larger area.¹¹ Infrapatellar straps are commonly prescribed for patients wishing to continue activity with decreased pain. However, it is unknown if this prophylactic treatment is effective in reducing pain during activity. Therefore, the purpose of this review is to determine the effectiveness of infrapatellar straps in reducing pain during activity in patients with patellar tendinopathy.

FOCUSED CLINICAL QUESTION

Are infrapatellar tendon straps effective in reducing pain during activity in patients with patellar tendinopathy?

SUMMARY

One randomized controlled trial and three case-control studies met the inclusion criteria.^{12 13 14 15} In patients with patellar tendinopathy randomized to wear an infrapatellar strap, a significant decrease in pain was noted with functional activity (single-leg squat) and during sporting activities, compared to controls (19.0 mm VAS score vs. 33.0 mm VAS score).¹³ In another study of basketball and volleyball players diagnosed with patellar tendinopathy, subjects reported a significant decrease in pain during a drop jump and single-leg jump when wearing an infrapatellar strap compared to performing the jumps without an infrapatellar strap (1.41 cm VAS score vs. 1.89 cm VAS score).¹² In a case-control study evaluating the effects of an infrapatellar strap on pain during jumping activities, patients had significantly less pain during single-limb landing when wearing the infrapatellar strap (28.0 mm

VAS score vs. 37.0 mm VAS score).¹⁵ The final case-control study evaluated the effects of an infrapatellar strap on decreasing pain during a two-legged drop and during a vertical jump. Results demonstrated that there were no significant differences in pain reduction in the tendinopathy group between the strapping condition and no strapping condition (21.5 mm VAS score vs. 27.6 mm VAS score).¹⁴ Although not statistically significant, subjects noted a 25% reduction in pain while wearing the infrapatellar strap during the functional activities. The sample size of this study was small (n=10), which may contribute to lack of significant findings.

CLINICAL BOTTOM LINE

There is moderate evidence to suggest that infrapatellar straps decrease pain in individuals with patellar tendinopathy.

Strength of Recommendation

Level B evidence¹⁶ exists that the use of infrapatellar straps during activity can decrease pain in individuals with patellar tendinopathy.

METHODS

Terms Used to Guide Search Strategy

- Patient/Client: patellar tendinitis OR patellar tendinopathy
- Intervention: cho-pat strap OR infrapatellar strap OR compression device OR brace
- Comparison: None
- Outcome: pain

Sources of Evidence Searched

- PubMed
- CINAHL
- Medline
- SPORTDiscus

- Additional resources obtained via forward search, hand search, and expert opinion

Inclusion and Exclusion Criteria

Inclusion

To be included in this review, articles were required to meet the following criteria:

- investigate the use of infrapatellar straps during functional activity in subjects with patellar tendinopathy
- at least one key outcome measures pain (e.g. VAS)
- level 3b or higher
- written in the English language
- published within the previous 10 years (January 2009-January 2019)

Exclusion

Articles with the following criteria were excluded from review:

- Review studies
- Subjects with concomitant pathologies such as patellofemoral pain syndrome or other types of tendinopathy
- Studies that did not use a commercially-made infrapatellar strap

RESULTS

Four relevant studies were identified. One study was a randomized controlled trial¹³ while the remaining three studies were case-control studies.^{12 15 14} Each study evaluated the effectiveness of an infrapatellar strap on decreasing pain during functional and sport-specific activity in subjects diagnosed with patellar tendinopathy. Table 1 provides a summary of the data extracted from each of the four studies. Level of evidence is based on the Centre for Evidence-Based Medicine¹⁷

DISCUSSION

The purpose of this review was to evaluate the effectiveness of infrapatellar straps in decreasing pain during activity in subjects with patellar tendinopathy. A search of the evidence located four studies that evaluated pain as a primary factor. Three of the four studies demonstrated a decrease in pain (as measured by the VAS score) during functional activity and/or sport activity while wearing an infrapatellar strap. The remaining study did find a 25% decrease in pain with the use of an infrapatellar strap but this decrease in pain was not statistically significant. Although this decrease in pain was not statistically significant, 30% of participants saw large decreases (>10mm) in pain with the use of an infrapatellar strap. Therefore, this reduction in pain may be clinically significant.

Patellar tendinopathy can significantly impact an individual's ability to participate in physical activity and/or organized sports. Evidence supports the use of rest, activity modification, and eccentric quadriceps exercise for decreasing symptoms and returning patients to full function.¹⁰ However, depending on the length and severity of symptoms, it may take significant time for patients to be able to return to physical activity symptom-free. The evidence suggests that the use of infrapatellar straps may allow individuals to remain active, while decreasing the pain associated with patellar tendinopathy. Given the minimal cost associated with infrapatellar straps, this may be a viable treatment option, used in conjunction with eccentric exercise, to return patients to full pain-free function.

Individuals participating in sports that require repetitive loading of the patellar

	Dar ¹²	de Vries ¹³	Rosen ¹⁵	Rosen ¹⁴
Steady Design	Case-Control	Randomized Controlled Trial	Case-Control	Case-Control
Participants	16 male basketball and volleyball players diagnosed with patellar tendinopathy (mean age 15.8 years)	97 participants diagnosed with patellar tendinopathy (59 male, 38 female; mean age 27.0) participated in the functional testing and 69 of these participants completed the sports performance portion of the study	30 participants with patellar tendinopathy (15 male, 15 female; mean age 21.5 years) and 30 control participants (15 male, 15 female; mean age 21.3 years)	10 males (mean age 21.3 years) with patellar tendinopathy and 10 matched control males (mean age 22.0 years)
Intervention	Participants performed four jumping tests: squat jump, drop test, single-leg jump, and jumps 30s test while wearing an infrapatellar strap and without an infrapatellar strap	Participants performed three functional tests (single-leg decline squat, vertical jump test, and triple-hop test) and participated in one week of sports participation under one of four randomized conditions: infrapatellar strap, sports tape, placebo, and control.	Participants performed 5 50% maximum vertical jumps on their affected limb with an infrapatellar strap and without an infrapatellar strap	Participants performed a two-legged drop landing from a 40 cm box, followed by a 50% max-vertical jump. Participants completed 5 trials of this functional assessment with an infrapatellar strap and 5 trials without a strap.
Outcome Measure(s)	Pain severity (VAS, 0-10 cm) and jumping performance parameters (jump height and power)	Pain severity (VAS, 0-100 mm) after completion of functional tests and during sport, 2 hours after sport, and the following morning	Pain severity (VAS, 0-100mm)	Pain severity (VAS, 0-100 mm)
Main Findings related to clinical question	Participants had significantly less pain while wearing the infrapatellar strap when performing the drop jump (1.41 cm ± 1.40 cm) than without the strap (1.89 cm ± 1.29 cm). Participants had significantly less pain while wearing the infrapatellar strap when performing the single-leg jump (2.25 cm ± 1.94 cm) than without the strap (3.14 cm ± 1.86 cm)	Participants with the infrapatellar strap reported significantly less pain when performing a single-leg squat (19.0 mm ± 33.0) compared to controls (33.0 mm ± 36.5 mm). Participants with the infrapatellar strap and sports tape had significantly less pain during sporting activities compared to controls.	Participants had significantly less pain while wearing an infrapatellar strap (28.0 mm ± 18.5 mm) than without the strap (37.1 mm ± 22.1 mm).	There was no significant reduction in pain in the tendinopathy group between the strapping condition (21.5 mm ± 18.8 mm) and the no strap condition (27.6 mm ± 23.8 mm). There was no significant difference in pain between the tendinopathy group while wearing an infrapatellar strap (21.5 mm ± 18.8 mm) and the control group (0.0 mm ± 0.0 mm).
Level of Evidence	3b	3b	3b	3b
Conclusion	The use of an infrapatellar strap decreased pain severity in two jumping tests	The use of an infrapatellar strap and sports tape reduced pain during sport and functional activities compared with a control group.	The infrapatellar strap effectively reduced pain during single-limb landing in participants with patellar tendinopathy	Although there was a 25% reduction in pain in the tendinopathy group with the use of an infrapatellar tendon strap, this was not statistically significant compared to no strap or to the control group.

Table 1. Summary of Data Extraction

tendon are at increased risk of developing patellar tendinopathy. Sports such as volleyball and basketball have the highest incidence rates of patellar tendinopathy. All four included studies assessed changes in pain with the use of an infrapatellar strap during activities that provide excessive loading of the extensor mechanism. These activities included squat jumps, drop jumps, single leg jumps, single-leg squats, and a triple-hop tests. In three of the four studies, patients had a significant decrease in pain during these activities while wearing an infrapatellar strap. In addition, de Vries et al also evaluated the use of an infrapatellar strap during sporting activity. Although there was no significant decrease in pain during sporting activity with the use of an infrapatellar strap, patients did note a significant decrease in pain two hours following the activity. This suggests that the use of an infrapatellar strap may be beneficial for use in some sporting activities.

Although results demonstrated a decrease in pain during jumping activities in participants with patellar tendinopathy, it should be noted that the participants in these studies completed no more than five repetitions of the jumping activity while pain was evaluated. It is unknown if similar results would be found in participants that performed repetitive jumping over a longer period of time. This would more likely simulate the conditions that occur during practices or competitions. Future studies should evaluate the use of infrapatellar straps in reducing pain associated with physical activity over longer periods of time.

CONCLUSION

This review demonstrated that the use of an infrapatellar strap may be an effective

treatment adjunct for patients diagnosed with patellar tendinopathy that desire to continue physical activity. Infrapatellar straps are a common treatment modality and the evidence supports their use during activities that require repetitive loading of the patellar tendon. However, it is currently unknown if infrapatellar straps are effective in reducing pain associated with patellar tendinopathy during repetitive physical activity.

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