A Step in the Right Direction: Orthotics in the Military

AN IN DEPTH REVIEW OF ORTHOSES FOR SPECIFIC LOWER EXTREMITY INJURIES

Capstone Project

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Introduction

Basic military training involves recruits performing many physical activities throughout the day including marching.

Orthotics are frequently used as a conservative treatment method for a variety of lower extremity conditions. The support for orthotic treatment usually stems from biomechanical reasoning/ analysis or clinical case studies rather than well designed scientific investigations. Randomized double blind clinical controlled trials are considered the gold standard in research because they control for bias. Currently there is limited evidence for orthoses and treatment of specific conditions that utilize this research method.

One possible reason for this discrepancy in research is that it is difficult to perform a randomized double blind clinical controlled trial with orthoses. Blinding, not revealing the intervention, of the examiner and the participant is hard to conceal when the treatment has to be distributed and worn. Another issue is that many investigations do not include a true control group which does not receive any intervention. Most studies completed on orthotics compare their use to other types of orthoses or treatments. Therefore the true impact of orthoses on a particular condition cannot be determined. Some studies will provide a sham insole as a control but this still might have cushioning or placebo effect.

The following reviews two conditions that can be seen during basic military training due to overuse injury: patellofemoral pain syndrome and plantar fasciitis. Currently these are the only two overuse injuries with multiple high quality studies examining the effects of orthotic intervention.

Both patellofemoral pain syndrome and plantar fasciitis are seen in highly active populations, such as runners, and in part can be associated with poor foot mechanics during gait. Therefore the use of custom orthoses may provide symptom relief.

Common Overuse Injuries[1]:

- Patellofemoral Pain Syndrome
- Iliotibial Band Syndrome
- Tibial Stress Syndrome
- Low Back Pain
- Chronic Exertional Compartment Syndrome
- Plantar Fasciitis
- Tendinopathies

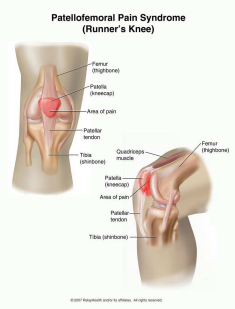
Literature Review:

Patellofemoral Pain Syndrome		**Plantar Fasciitis**	
Author (Year)	*Design*	*Author (Year)*	*Design*
Collins et al (2008)[3]	Randomized Control	Winemiller et al (2003)[8]	Randomized Control
Wiener-Ogilvie et al (2004)[4]	Randomized Control	Gross et al (2002)[9]	Prospective Cohort
		Seligman and Dawson (2003)[10]	Prospective Cohort
		Roos et al (2006)[7]	Randomized Control
		Landorf et al (2006)[5]	Randomized Control
		Rome et al (2004)[11]	Randomized Control

Table 1. List of included studies within review. Author, year, and type of research design are presented.

Conservative Treatment Options for Patellofemoral Pain Syndrome[2]

- Orthoses
- Patellar Taping
- Knee Supports
- Physical Therapy
- Analgesics
- Non-Sterodial Anti-Infammatory Drugs



PPS presents as anterior knee pain and is highly associated with running.

Physical Therapy Interventions for Patellofemoral Pain Syndrome[2]

- Patellar Mobilizations and Taping
- Quadricep and Hamstring Strengthening and Stretching
- Hip Stretches
- Hip External Rotator Retraining

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Patellofemoral Pain Syndrome Background

Patellofemoral pain syndrome (PPS) is associated with pain over the anterior (front) of the knee which is aggravated with squatting, stairs, and/or running and tends to be chronic in nature.[2,3] PPS is a common musculoskeletal condition that affects about 26% of young adults that are seen in sports injury clinics and is connected to about 19% of all running related injuries. PPS can negatively affect recreational and occupational activities especially if the activities listed previously are involved.[2,3]

The cause of PPS is not fully understood but malalignment of the patella and joint overuse are thought to be contributing factors.[2] Overuse injuries of the knee can be perpetuated by structural or biomechanical abnormalities (such as excessive foot pronation) causing excessive loading of the joint.[2] Custom orthoses may benefit PPS patients by controlling ankle/foot motion during gait which could improve lower extremity biomechanics.[2]

Patellofemoral Pain Syndrome Literature

Currently there are only two well designed intervention studies, randomized and quasi-randomized controlled trials, examining the effects of custom orthoses on patellofemoral pain.[2] Collins et al divided 179 adults with PPS into one of four groups: foot orthoses, physical therapy, foot orthoses plus physical therapy, and a sham insole group.[3] Wiener-Ogilvie et al allocated 31 patients with PPS and excessive foot pronation to either: foot orthoses, physical therapy, or foot orthoses plus physical therapy.[4]

Both investigations used a prefabricated orthoses (made from ethylenevinyl acetate) that could be customized to an individual's foot via heat molding and addition of wedges or heel posts.[3,4] Outcome measurements were collected at 6, 12, and 52 weeks and 4 and 8 weeks for Collins et al and Wiener-Ogilvie et al, respectively.[3,4]

Collins et al demonstrated that foot orthoses provided better results for reducing knee pain (Global Improvement Scale [GIS] and worst pain Visual Analog Scale [VAS]) than insoles at 6 weeks.[3] However, the differences between groups were not significant at long term follow-up.[3] Orthoses also improved knee function over insoles at 6 weeks on the Anterior Knee Pain Scale [AKPS].[3] Knee function on the Functional Index Questionnaire [FIQ] at each follow up and the AKPS at long term follow up were not statistically different.[3]

When examining foot orthoses compared to orthoses plus physical therapy, neither investigation provided evidence supporting differences in outcome measures at short or long term follow ups.[3,4] Knee pain (GIS, worst pain VAS, SF-36 pain scale), knee function (FIQ, AKPS), or physical function (SF-36 physical function scale) were not statistically significant.[3,4]

Orthoses compared to physical therapy yielded no significant differences in knee pain at any follow up point for either investigation (GIS, SF-36 pain scale).[3,4] Collins et al did find a statistically significant difference in knee function favoring the physical therapy group at both short and long term measurements with the FIQ; no such differences were seen with the AKPS for the same group.[3] Wiener-Ogilvie et al did not find any other differences in secondary outcomes (SF-36 physical function scale).[4]

Patellofemoral Pain Syndrome Conclusion

There are limited high quality investigations examining the effects of custom orthoses of patellofemoral pain syndrome.[2] Future research should employ true control groups. Based on the evidence above the use of orthoses over regular insoles may only provide a short term benefit in pain relief.[2] Orthoses have not been proven more effective on outcome measures than physical therapy or to have an additive effect.[2] Therefore the prescription of orthoses rather than physical therapy must be based on clinical decision making and patient preference.[2]

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Plantar Fasciitis Background

The plantar fascia is the fibrous connective tissue that reaches from the inferior heel to the toes and supports the arch of the foot.[5] Plantar fasciitis (PF), inflammation of the fascia, is a frequent injury in runners (10% of all recreational runners) and the military population but can also be seen in sedentary individuals.[5,6] PF may develop because of a collapsed arch or rearfoot eversion which increases tension and strain on the fascia during gait.[6]

Pain with PF typically presents with greater severity in the morning due to stiffening of the fascia and can lead to limits in an individual's training schedule or daily mobility.[6] About 90% of PF patients respond well to conservative treatment with 4 to 6 months.[6] Foot orthoses are a common treatment option used for PF.[6] Orthoses are thought to aid in the reduction of PF symptoms by supporting the arch and decreasing rearfoot pronation by realigning the foot.[5,6]

The plantar fascia inserts at the calcaneus and spans the length of the foot.

Plantar Fasciitis Literature

A meta-analysis of foot orthoses for the treatment of plantar fasciitis in adults revealed only six high quality investigations.[6] Although measurements tools varied between studies, all reported pain outcomes and three provided self-report function outcomes.[6] Pain measures included the Visual Analogue Scale, Verbal Pain Scale, Foot Function Index (pain scale), Foot and Ankle Outcome Score (pain section), and Foot Health Status Questionnaire (pain score) while function measures consisted of the Foot Function Index (disability scale) and Foot and Ankle Outcome Score (ADL section).[6]

In order to compare the investigations the results from the different measures were all converted into percentages of the total possible score.[6] The values were then standardized with lower scores representing less pain and function.[6]

The six studies were inconsistent in duration therefore they were separated into by length into short (less than 6 weeks), intermediate (6-12 weeks), and long (more than 12 weeks) in order to examine outcomes.[6] Since the majority of studies did not have a true control group (no treatment) all outcomes were compared to the night splint condition of the Roos et al investigation.[6]

The meta-analysis revealed that there was a significant amount of pain reduction for all time periods as well as a significant decreased in pain at 12 weeks for the night splint treatment.[6] Foot function, as determined by the results of three investigations, improved at all time periods.[6] However, the night splint treatment did not improve foot function.[6]

The meta-analysis of the six investigations demonstrated that although the orthotic type and duration varied between studies the end result was decreased pain and improved function at both short and long term follow ups.[6] The control group, night splint group, may limit the ability to generalize these results because of a sample size (15 controls).[7]

Types of Orthotics Used for Plantar Fasciitis[6]

- Magnetized
- Nonmagnetized
- Medial Arch support (+ Forefoot Posting)
- Customized Heel Pad
- Prefarbriacted
- Customied
- Accommodatiove
- Functional

Pain at the insertion of the plantar fascia can occur during gait and limit an individual's activity level.

Plantar Fasciitis Conclusion

Although individually the six investigations included had their design flaws, no blinding of the participants/examiners/assessors, collectively they provide strong evidence for the use of orthoses for plantar fasciitis.[6] To improve future research attempts should be made to be more effective at blinding examiners and using a true control group (although not always possible).[6]

To conclude orthotics appear to provide clinically meaningful reductions in pain and improvement in function in both the short and long term. Therefore the use of orthoses for patient with PF is recommended.

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