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Foot Science

Foot Orthoses and The Knee

Since the mid-1970's podiatrists and other clinicians have used foot orthoses in an attempt to modify conditions affecting the knee. Pathologies around the knee, which have names such as Patello-Femoral Pain Syndrome (PFPS) or Ilio-Tibial Band Syndrome (ITB), were and are frequent presentations, affecting runners, footballers, basketball players and even cyclists. In runners in particular, these symptoms were often lumped together in the lay-term, "runner's knee" and there was a widespread belief during the 1970's (and beyond) that distance running would lead to an epidemic of knee arthritis in the decades to come.

This forecast has thankfully been proven to be in error[1]. Data now clearly show that despite relatively high levels of knee symptomatology amongst athletes, there is, absent direct trauma to the knee, no higher incidence of damage to knee cartilage compared to sedentary individuals, and in fact there is good data that supports the use of exercise in remediation of knee arthritis symptoms[2].

But what about the balance of knee pain? Can orthoses help, even prevent knee pain from developing?

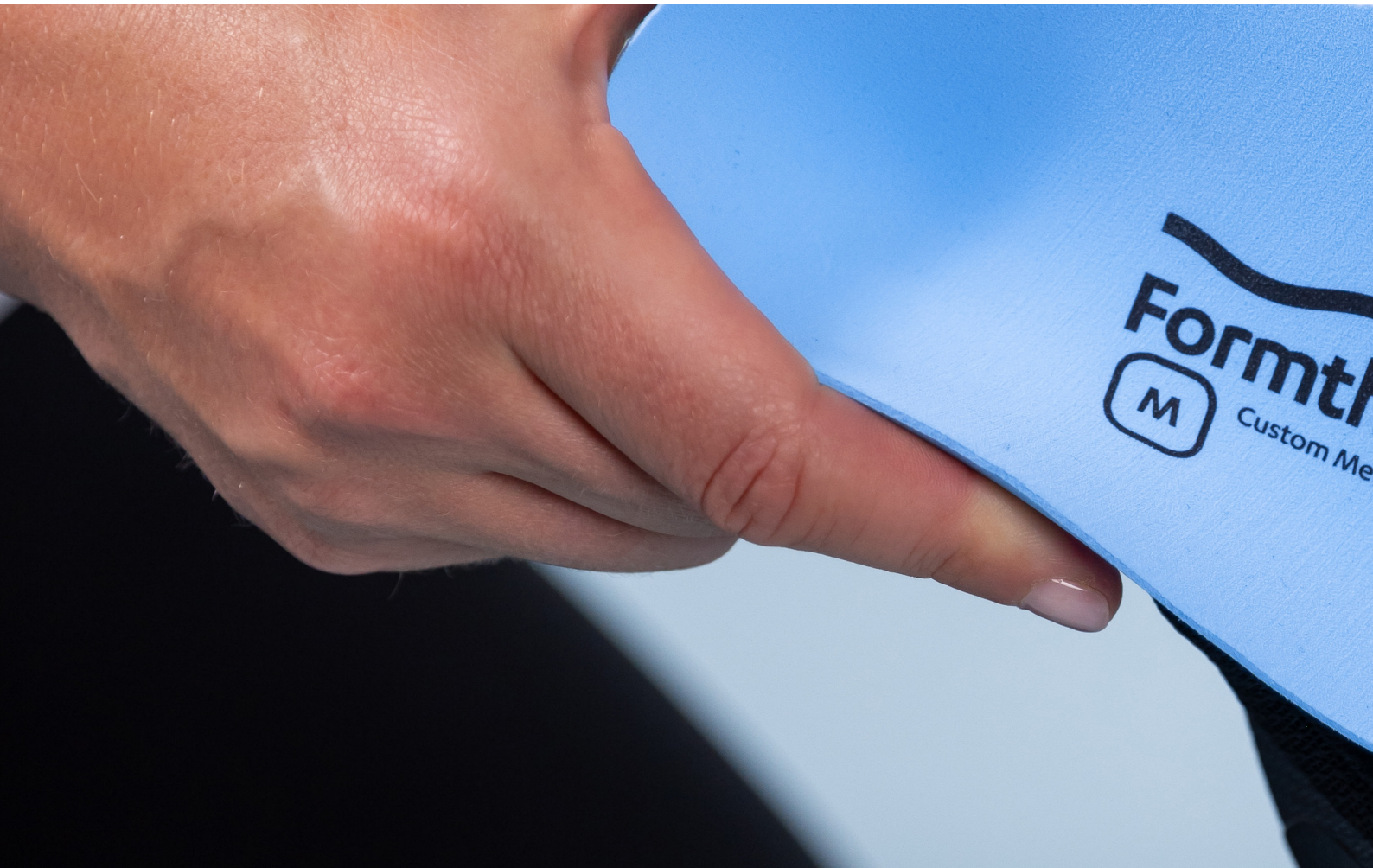
The answer is clearly yes, especially if one focuses on PFPS. For ITB the data is a bit less supportive, but still rather positive[3],[4]. The mechanical basis for these outcomes follows from an understanding that as the hindfoot undergoes eversion movement (pronation), the talus rotates inward (medially). The tibia, directly above this bone, moves along the same plane of motion so that a significant rotation force is created at the knee, many centimetres above the site of excessive or abnormal motion. The knee, which is essentially a hinge-type joint, is therefore subjected to rotation forces during normal flexion and extension, which causes pain within the knee, under the patella, as it attempts to track linearly over the distal femur, and at the lateral side of the knee joint where stabilising structures (ITB) become compressed.

Orthoses work[5] here because of their ability to reduce the extent and/or velocity of tibial rotation. Based on careful physical assessment of the patient, clinicians may modify and calibrate the orthotic “effect” on the tibia with varying levels of wedging and “control” built into the device. And to some extent these efforts can be augmented by selected athletic footwear which may also restrain or control foot motion.

Knee Arthritis

Circling back to knee arthritis, it is fair to say that there is a global epidemic of knee osteoarthritis. In Australia for example, the lifetime risk for knee replacement surgery amongst women is 1:5, for men, 1:7[6]. The burden of this condition on the world-wide medical economy is staggering; in the US, there is a projected increase in the rate of implantation (compared to 2014) of over 400% to the year 2040[7],[8], with annual costs exceeding 4.1B for revision knee implantation alone. There is therefore, a need for non-operative solutions which address at least the pain and disability of the condition; the cost of knee implantation (USD $25,000-$40,000) when viewed against the number of people with degenerative knee conditions will put this option out of reach for many people.

Two methods are proposed; the first option, based on an association between knee osteoarthritis and pes valgus[9] utilises foot orthoses to modify the position and rotation of the tibia (again) to reduce stress on the medial side of an arthritic knee joint. The second method is aimed at the common and most frequent precursor to total knee replacement, the Varus knee. In this application, an eversion force is applied to the tibia/knee joint through the use of an everted foot orthosis. Again, careful calibration of wedging and construct against physical examination findings allow for the most optimum results. Mechanically, this method creates a modest decompression at the medial knee compartment and therefore a reduction in pain[10].



Whilst knee implantation resolves a large percentage of pre-operative pes valgus[11], there may even be value in the use of foot orthoses after knee implantation, where it has been shown that a residual valgus or everted foot position is associated with higher rates of implant failure[12],[13].

So in the end, clinicians should have a high level of confidence in their ability to intervene at the knee. Careful application of orthotic devices based on physical assessment will offer protective and rehabilitative effects for athletes and others who suffer from overuse or degenerative symptoms at the knee.

References

1. **Low Ponzio, DY et al.** Low Prevalence of Hip and Knee Arthritis in Active Marathon Runners. The Journal of Bone and Joint Surgery. 2018
2. **Wu et al.** Weight-Bearing Physical Activity, Lower-Limb Muscle Mass, and Risk of Knee Osteoarthritis. JAMA Open Network. April 30, 2024
3. **Finestone, et al.** A prospective study of the effect of foot orthoses composition and fabrication on comfort and the incidence of overuse injuries. Foot and Ankle International. July, 2004
4. **Bonanno, et al.** Effectiveness of foot orthoses and shock-absorbing insoles for the prevention of injury: a systematic review and meta-analysis. British Journal of Sports Medicine. 2017.
5. **Landorf, K, AM Keenan,** Efficacy of Foot Orthoses: What does the literature tell us? Journal of the American Podiatric Medical Association. Vol 90, 2000
6. **Ackerman, IN et al.** Actual versus Forecast Burden of Primary Hip and Knee Replacement Surgery in Australia; Analysis of Data from the Australian Orthopaedic Association National Joint Replacement registry. Journal of Clinical Medicine. February 2022
7. **Patel A, Pavlou G, Mújica-Mota RE, Toms AD.** The epidemiology of revision total knee and hip arthroplasty in England and Wales: a comparative analysis with projections for the United States. A study using the National joint registrydataset. Bone Joint J. 2015;97-B(8):1076–1081.
8. **Singh, JA et al.** The Journal of Rheumatology. Rates of Total Joint Replacement in the United States: Future Projections to 2020-2014 Using the National Inpatient Sample
9. **Gross, KD et al.** Association of Flat Feet with Knee Pain and Cartilage Damage in Older Adults. Arthritis Care and Research. July, 2011
10. **Arnold et al.** Lateral Wedge Insoles for Reducing Biomechanical Risk Factors for Medial Knee Osteoarthritis Progression: A Systematic Review and Meta-Analysis. Arthritis Care Research. July 2016.
11. **Cho W-S, Cho H-S, Byun S-E.** Changes in hindfoot alignment after total knee arthroplasty in knee osteoarthritic patients with varus deformity. Knee Surg Sports Traumatol Arthrosc. 2017;25(11):3596–3604.
12. **Meding JB, Keating EM, Ritter MA, et al.** The planovalgus foot: a harbinger of failure of posterior cruciate-retaining total knee replacement. J Bone Joint Surg Am. 2005;87 Suppl 2(Suppl 2):59–62
13. **Ritter MA, Davis KE, Meding JB, et al.** The effect of alignment and BMI on failure of total knee replacement. J Bone Joint Surg Am. 2011;93(17):1588–1596

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