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FOOT ORTHOSIS PEARLS: EFFECTIVE USE OF METATARSAL PADS

Metatarsal pads have been around for many years as either in-shoe additions or as modifications to pre-made or custom foot orthoses. I have been using metatarsal pads for the past four decades in my clinical practice with generally good results. It will be helpful to analyze the biomechanics of these foot orthosis modifications and to share my clinical experiences as to when the properly performed addition of a metatarsal pad to a shoe or foot orthosis may be therapeutically indicated.

Metatarsal pads are designed with a tear-drop shape where the thickest part of the pad is located distal and the thinnest portion of the pad being located proximal. As such, the increased discrete thickness of the metatarsal pad, when added to a specific area of a shoe or orthosis will alter the ground reaction force (GRF) acting on the plantar forefoot during weightbearing activities. When a metatarsal pad is placed inside a shoe or on the dorsal aspect of an orthosis, the metatarsal pad will significantly increase the GRF within the area of the plantar foot where the metatarsal pad is located and will shift GRF away from the areas of the plantar foot adjacent to the metatarsal pad. For example, if the metatarsal pad is placed just proximal to the 2nd metatarsal head on the dorsal aspect of the foot orthosis, there will be an increase in GRF at the area of the plantar foot just proximal to the 2nd metatarsal head and a decrease in GRF plantar just distal to the metatarsal pad at the 2nd metatarsal head. In other words, metatarsal pads can be a highly effective method of transferring GRF from a symptomatic area to an asymptomatic area of the plantar foot adjacent to the metatarsal pad.

How well a metatarsal pad works depends mainly on its thickness and location relative to the plantar foot. Since plantar pressure is defined as GRF divided by surface area, metatarsal pads with increased thickness will cause not only an increase in GRF but also an increase in plantar pressure at the area where the metatarsal pad is located. This increase in plantar pressure which is localized at the area of the metatarsal pad will cause increased compression force on the soft tissues and osseous structures in the area of the metatarsal pad (Fig. 1). As the metatarsal pad thickness is increased, not only are GRF and plantar pressures increased at the metatarsal pad, but also GRF and plantar pressures are decreased surrounding the metatarsal pad. However, it must also be pointed out that a metatarsal pad that is too thick can increase the localized GRF so much that the patient may complain of more plantar discomfort at the area of the metatarsal pad, rather than reporting that they are experiencing fewer symptoms in the painful area of the foot which is being treated.

With this knowledge of how GRF is transferred from one area to another area on the plantar foot by the addition of a metatarsal pad, the podiatrist needs to be aware that metatarsal pads often will not be comfortable for the patient unless they are placed in the proper plantar location. Since metatarsal pads can greatly increase the plantar pressures in relatively small and discrete areas of the forefoot, if the metatarsal pad is placed in an area which increases the pain in an asymptomatic area and doesn't relieve the pain in the foot which the metatarsal pad was intended to treat, the metatarsal pad will become problematic, rather than therapeutic. Therefore, the podiatrist may need to experiment with various metatarsal pad thicknesses and plantar locations in order to decrease the pain within the symptomatic areas of the plantar foot and also minimize the localized plantar pressure and discomfort which can result from the metatarsal pad.

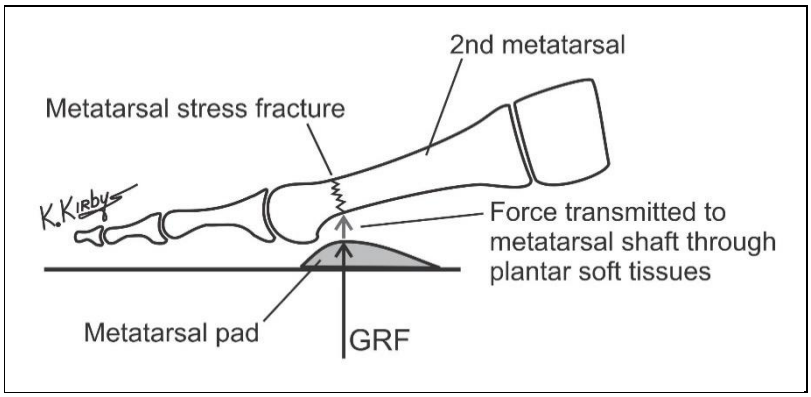

Figure 1. When a metatarsal pad is added to a shoe, shoe insole, or foot orthosis to treat a metatarsal stress reaction or metatarsal stress fracture, the thickest part of the metatarsal pad should be placed directly under the area of the bone injury to reduce the bending moments on the metatarsal and better help reduce the patient's pain during weightbearing activities.

The pedal pathologies which metatarsal pads are generally helpful in treating include any condition that is caused by excessive plantar pressures on the forefoot,

such painful plantar calluses, metatarsophalangeal joint (MPJ) capsulitis (i.e., plantar plate injuries) and neuropathic ulcerations. Intermetatarsal neuromas can also be effectively treated with a metatarsal pad added to a foot orthosis. In addition, pathologies caused by excessive bending moments acting on the metatarsals, such as metatarsal stress reaction or stress fractures can be made less symptomatic with the application of a metatarsal pad to a foot orthosis (Fig. 1).

There are many possible shoe/orthosis options whereby the above pathologies may be effectively treated with a metatarsal pad. A metatarsal pad may simply be placed on a shoe insole or sockliner without any orthosis being used, which is especially useful when the patient must wear relatively tight-fitting shoes which have little extra room for any form of foot orthosis. Also, a metatarsal pad may be placed on a pre-made orthosis in an attempt to relieve pain when custom foot orthoses are not available or necessary to treat milder forefoot pathologies. Generally, however, adding a properly-sized and properly-placed metatarsal pad to a custom foot orthosis is the treatment method of choice for many forefoot symptoms since the custom orthosis and metatarsal pad can be used together to synergistically reduce abnormal forefoot pressures and also improve the abnormal gait function which may be the cause of the patient's forefoot pathology.

One of the most common conditions which I use metatarsal pads for are for the treatment of MPJ capsulitis (i.e., plantar plate injuries). After decades of trial-and-error applications of metatarsal pads to orthoses in cases of MPJ capsulitis, my clinical observations suggest that the metatarsal pad that is adhered to the custom orthosis so that it extends past the distal edge of the orthosis by 15 mm will be the most comfortable location and best location to help relieve the plantar pain and swelling of the affected MPJ. Placing the metatarsal pad more proximal than this causes the patient to report that they feel the metatarsal pad uncomfortably in the longitudinal arch of their foot. However, if the metatarsal pad is positioned so far distal that the thickest part of the pad is directly plantar to the metatarsal head, then the metatarsal head pain will increase, rather than decrease. Obviously, the optimum therapeutic position of the metatarsal pad on the orthosis for each individual patient may require some trial-and-error repositioning of the metatarsal pad. It is for this reason that I will often add a metatarsal pad to an orthosis only after the orthosis has been fabricated by the orthosis laboratory, so that proper metatarsal pad placement may be individualized in my office.

When treating intermetatarsal neuromas, such as a Morton's neuroma, with a metatarsal pad, the apex of the pad should be placed directly plantar to the neuroma. In this fashion, the thickest part of the metatarsal pad will push and spread the metatarsals on either side of the neuroma away from the symptomatic neuroma. Of course, when treating intermetatarsal neuroma, it is important also to ensure that the orthosis with metatarsal pad is being worn in a shoe with adequate length, width and depth. By ensuring adequate shoe volume, the external shoe compression force acting on the medial and lateral forefoot will be minimized so that the resulting internal pressure on the neuroma will also be reduced to optimize patient comfort.

One of the other uses of metatarsal pads is in the treatment of metatarsal stress reactions and/or metatarsal stress fractures (Fig. 1). By proper positioning of the apex of the metatarsal pad direct plantar to the area of metatarsal bone-stress injury, the bending moments acting across the stress reaction/fracture site will be minimized so that symptoms will be reduced during the patient's weightbearing activities. In the initial visit of a patient with a suspected metatarsal stress reaction/fracture, I will often add a metatarsal pad to either a post-operative shoe, a rigid-sole clog or a rigid-sole shoe (e.g., Hoka Bondi or Gaviota) with a rocker sole in order to reduce the bending moment on the injured metatarsal. The metatarsal pad can then be added to a custom orthosis later after the patient's injury has healed in order to help prevent further stress injuries to the lesser metatarsals. By using the metatarsal pad and orthosis to specifically reduce the metatarsal bending moments in the area where metatarsal stress injury has occurred, not only will pain with walking be immediately reduced, but the likelihood of metatarsal stress injuries in the future will be significantly reduced.

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