Lesser Metatarsophalangeal Joint Instability in the Athlete: Conservative Care Options

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Lesser Metatarsophalangeal Joint Instability (LMTPJI) defines a clinical problem that presents itself as varied degrees of sagittal &/or transverse &/or frontal plane instability of the “internal” toes (2, 3 & 4). Pathology can vary from mild inflammation of periarticular soft tissues with minimal positional changes of toes to more serious subluxation and ultimately dislocation of toes at the MTPJ with partial or complete disruption of supporting soft tissue structures. Typically there is varied injury to the soft tissues including joint capsule, plantar plate and/or collateral ligaments that can become attenuated or torn. Less common can be injury to the extensor and/or flexor tendons which are commonly overlooked. Due to joint instability, chondral and osteochondral joint lesions can be encountered as well. In any athlete who presents with ball-of-foot pain and/or digital deformity, LMTPJI should always be considered. If this entity is not recognized early then progression of deformity can occur making treatment protocols more challenging with outcomes less predictable. This problem can be devastating to the athlete
as morbidity can be significant adversely affecting an athlete’s training and playing ability for an extended period of time. Before treatment options can be considered this diagnosis should be definitively established and validated with imaging studies if possible. It is important early on to acquire pertinent information from the clinical evaluation that will help to establish a rationale treatment program. This information includes: duration of injury, etiology, predisposing factors, pain level, functional activity level and stage/severity of injury.

**Duration of Injury** can be acute, subacute or chronic. For this discussion acute is defined as less than 2 weeks, subacute 2-6 weeks and chronic greater than 6 weeks. There also needs to be differentiation as to whether this is a new or recurrent injury, e.g., acute-on-chronic episode. The longer the duration of articular instability without treatment the more potentially severe the toe deformity and patient’s symptoms. **Etiology** can be due to macrotrauma (sudden hyperextension injury due to fall), microtrauma (overuse), attrition (wear-and-tear) or iatrogenic (intra-articular acetate steroid injection). **Predisposing Factors** can include systemic & mechanical factors. Systemic factors would include generalized ligamentous laxity, rheumatic & neuromuscular diseases. Mechanical factors would include ankle equinus, hallux abducto valgus with bunion deformity, hypermobile 1st ray, excessively long metatarsal, metatarsal transverse plane malalignment with abnormal digital deviation.
angle and forefoot equinus (anterior cavus) deformity. The author feels this last factor is the most common and significant predisposing factor due to the deleterious effects of extensor substitution which cause the single strongest deforming force on the lesser MTPJs. Pain Level is based on the visual analogue scale (VAS) 0-10 which indicates severity of pain. This is an important outcome measure as the more severe the pain the more aggressive the treatment. Functional Activity Level typically parallels pain level as the more pain the patient experiences the more the patient's activity level is compromised.

Return to activity (RTA) protocols are used to determine an athlete's ability to return to specific activities. Staging/Severity of Injury is based on clinical evaluation and diagnostic imaging (weight-bearing x-rays, arthrograms, MRI, ultrasound, etc.) to determine degree of articular instability/injury and which soft tissue structures are involved. Two important clinical tests to assess for sagittal plane instability are based on performance of the Lachman maneuver and toe-purchase test. The Lachman is a sagittal plane stress maneuver applying a dorsal vertical force to the proximal phalanx base and a plantar vertical force to the metatarsal neck/head. Staging is as follows and is based on the Bouché/Heit Classification that has been previously described¹: Stage 0- no instability appreciated on exam but extensus of toe may be present; Stage 1- toe is subluxable on exam. It is

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considered a 1A if < than 50% subluxation is appreciated and 1B if > than 50% subluxation; Stage 2- toe is dislocatable; Stage 3- toe has fixed dislocation. The toe-purchase test evaluates both static position of toe at rest while standing and dynamically evaluates ability of toe to maintain ground contact when performing a pull-out maneuver with a piece of paper or preferably a tongue depressor.

Once this information is carefully considered then a treatment plan can be discussed and established. Paramount to this discussion would be an appreciation of the athlete’s goals and expectations. Typically these patient’s have high expectations & demands with aspirations of returning to full athletic activities in their respective sport without limitations. Treatment plans should be well established, fully understood and agreed upon prior to initiation. Anticipated outcomes for treatment rendered should also be discussed and clearly defined as this pathology will challenge the best of physicians.

Regardless of whether a surgical or non-surgical approach is decided upon, specific conservative care strategies can be initiated and be successful (Table 1). These non-surgical strategies can be used as the primary treatment or they can be used as a temporary “stop-gap” intervention that may “buy time” before surgery can be performed. The purpose of this paper is to share non-surgical treatment options the author has found to be effective in treating symptoms of LMTJI. These treatments have
proven to be very effective in treating pain and functional limitations and mitigating progression of deformity. It must be realized that despite clinical improvement the soft tissue deficiency/toe pathology is not being corrected per se. Though the deformity still exists it is hoped that it can be successfully accommodated. This accommodation period can be short lived or it can be successful over an extended period of time. Beyond this point, if conservative management proves ineffective then persistent symptoms (pain & dysfunction) will dictate whether surgery should be considered.

In reviewing the literature on management for LMTPJI, there are a few articles evaluating non-surgical care with papers published being level-of-evidence 4 & 5 with small patient numbers and varied results\textsuperscript{2,3,4,5,6}. There is one level-of-evidence 3 paper, a large prospective comparative case series, published in 2012 that underscores the importance and significance of non-surgical care vs. surgical care for LMTPJI\textsuperscript{7}. The study reviewed 75 patients treated non-surgically (with varied isolated and combined treatments rendered) with 52% of patients being either satisfied or very satisfied with their treatment. The authors were not able to show any difference between non-surgical and surgical intervention with regard to pain and functional outcomes. They thought most patients could be treated successfully with non-operative methods.
The following discussion is based on the author’s personal experience with non-surgical management of LMTPJI in athletes over a 30+ year time period. The reader will find some recommendations and strategies to be familiar and some maybe new and different. Many of these treatments have been discovered serendipidously and as these treatment plans continue to evolve then high level studies will be needed to validate their efficacy in treatment of LMTPJI.

Conservative treatments are divided into 2 categories: acute/subacute and chronic. Most of what the author sees in his sports medicine practice is the chronic variety of instabilities.

**TREATMENT FOR ACUTE/SUBACUTE LMTPJI**

For the acute/subacute category, initially the patient will typically need a period of acute phase treatment to decrease inflammation from the initial insult and to stabilize the injured MTPJ. Strategies would include “PRICE”- Protection, Rest, Ice, Compression & Elevation. Protection can be achieved with a removable short leg walking boot (SLWB) with a flat foot-bed. Flat foot-beds allow the toes to be positioned neutral in the sagittal plane. Commonly used concave shaped foot beds put the toes in an extended position (increased toe spring) which is not desirable as the treatment goal is to take tension off affected plantar soft tissue structures. Within the boot an over-the-counter (OTC) or custom orthoses can be used to accommodate
painful MTPJs. Use of toe taping with ½ inch paper tape or commercial splints can be used to plantarflex affected toes which takes tension off painful plantar soft tissues and limits toe extension. Transverse plane deformities can be treated with toe spacers to realign the digit into a neutral position. Rest is typically relative with the athlete participating in daily activities as tolerated. While in SLW boot patient will not be able to participate in WB sport activities but may be able to participate in select NWB activities. Full non-weight bearing (NWB) immobilization is rarely needed. Ice application should be used when swelling is significant. Compression of forefoot (FF) with small 2” ace wrap or compression stocking works well. Swelling of toes can be mitigated by 1/2” Coban elastic compression wrap application (cut 1” Coban in half). Elevation above heart level when recumbent can also be beneficial when performed on a regular basis. Medications to address inflammation (NSAIDS & oral steroids) and pain (analgesics) can be beneficial and these medications can be applied topically or taken orally. The author does not recommend steroid injections in the acute/subacute phases due to potential deleterious effects on collagen healing. Joint dislocation secondary to intraarticular steroid injection has been documented previously. Acute phase treatment can be continued for 1-4 weeks depending on nature & severity of injury.
TREATMENT FOR CHRONIC LMTPJI

Beyond the acute phase treatment, longer term chronic phase treatment options are initiated. These are based on specific diagnosis and predisposing factors.

Concerning shoewear, an external forefoot rocker (EFFR) will help to unload the ball of foot. An EFFR can be added to an existing shoe or a rigid FF rocker-sole shoe can be purchased primarily (Figure 1). Shoes that are flexible (not rigid) at the toe-break and have adequate intrinsic rocker can be converted to a rigid rocker by placing a pre-cut Carboplast\textsuperscript{R} plate (author's preferred material vs. graphite which the author feels is too rigid) in the shoe. This will render the shoe more rigid by minimizing toe break flexibility. Positive-drop sole design (higher heel than FF) or use of heel lifts in neutral drop shoes would be recommended to accommodate the FF equinus foot type. For patients with bunion/bunionette deformity, split last shoes (wide FF, narrow heel) can be accommodative. Adequate toe box width and depth can also help in accommodating digital deformities. Full-grain leather shoes can also be stretched to accommodate these deformities.

Foot orthoses, either over-the-counter (OTC) or custom can also aid in unloading painful MTPJs and addressing predisposing biomechanical aberrations. FF accommodations on the orthoses can include cushioned extensions, metatarsal head “cut-outs”

\textsuperscript{R} AliMed; Dedham, Massachusetts 02026
with softer backfill, metatarsal pads or “cookies,” etc.. Full-contact semirigid polypropylene custom orthoses with deep heel cup is preferred. Please note: with a FF equinus foot type prescribing “no arch fill” on a polypropylene orthosis will likely result in poor tolerance in the medial arch area. To get the desired full contact with this foot type it is recommended to order a “minimum or moderate arch fill” orthosis (depending on activity) with additional softer cushion buildup in arch to achieve full contact. Feet are scanned or casted in a neutral position with first ray plantarflexed. Orthoses should be low profile to allow use in all shoe types including athletic, casual and dress shoes.

Calf stretching and use of night splints can be beneficial for patients with ankle equinus. Aggressive sustained stretching of the extensor tendons especially the extensor digitorum longus (EDL) tendon can be extremely beneficial especially in patient with FF equinus deformity. Assuming a TV sitting position (butt on feet with knees flexed) provides an effective and aggressive strategy in this regard.

Oral and topical medications to address inflammation (NSAIDS & steroids) and pain (analgesics) especially acute-on-chronic episodes can be beneficial. Concerning intraarticular or periarticular injections of the lesser MTPJs, phosphate steroid is recommended. Acetate steroid should be avoided (especially triamcinolone acetate in this author's opinion) as spontaneous
joint subluxation and dislocation is not uncommon. This concern has been reported previously in podiatric\textsuperscript{1,10} and orthopedic\textsuperscript{11} literature though it is scarcely documented. Depending on severity of symptoms and deformity, temperance of activities should be considered. Weight bearing (WB) activities that are continually painful should be limited or eliminated for a period of time and non-weight bearing (NWB) activities should be considered, i.e., swimming, cycling, rowing, etc.. Return to activity (RTA) evaluation protocols should be considered as this provides objective criteria for return to activities.

Concerning toe splints, various toe splinting techniques are available. Repositioning lesser toes from an extended to a neutral or plantarflexed position can be invaluable especially for flexible sagittal plane deformities & instability of toes. Taping toes with $\frac{1}{2}$" hypoallergenic paper-tape provides a fast and easy method to mitigate sagittal plane deforming forces (Figures 2,3,4). Taping should be applied to each individual affected toe separately. Taping can be used for transverse plane deformities as well but the author prefers use of toe spacers for transverse plane deformities (see below). When taping is contraindicated or not tolerated, use of various commercial splints can be beneficial (Figures 5,6). The Budin-type toe splints can be helpful especially if the toe deformity is flexible and reducible. Bunion splints can also be helpful for addressing lateral drifting or
abductus of hallux by stretching laterally contracted soft tissues. The author typically recommends them for night time use while sleeping.
Toe spacers provide an excellent way to reposition the toe in a neutral tranverse plane position. They generally come in small, medium & large and are made of foam, rubber or silicone of various shapes. Some even have an attached elastic toe sleeve to prevent displacement during activities.
Metatarsal binders or corsettes are soft elastic sleeves either of a fixed “pull on” variety or an adjustable Velcro closure type that fit snugly around the “waist” of foot (between instep & ball). This strategy is used for patients with a wide flexible FF and first ray hypermobility or instability. The sleeve imparts a compression or squeezing effect on the metatarsals in the transverse plane essentially decreasing FF splaying and stabilizing the first metatarsal.
In most cases, multiple treatment strategies are initiated based on specific diagnosis and presence of predisposing factors (Figures 7,8). If a patient decides to live with their problem then these strategies are continued indefinitely to mitigate symptoms in a symptomatic patient and prevent symptoms in an asymptomatic patient. In these patients, due to altered function with gait compensation and guarding they commonly suffer from generalized lower extremity soreness and fatigue despite use of treatments as mentioned above. A variety of soft tissue
mobilization techniques can be beneficial in these cases to complement the treatments already discussed. These include deep massage, augmented massage, muscle activation, active release and myofascial release to name a few. Working in concert with a manual physical therapist and/or massage therapist can result in a winning situation for all involved. Though there is only one level-3 study to validate the efficacy of non-surgical strategies in addressing LMTPJI, the author recommends readers consider treatment strategies discussed in this article as an initial step in dealing with the various clinical presentations of LMTPJI. Results of these treatments have been better than expected when using pain and function as outcome measures. Though soft tissue deficiencies/toe deformities remain present, long-term follow-up will determine if initial success with conservative care can withstand effects of time and allow patients to remain active in their desired athletic activities.
REFERENCES


5) Trepman E, Yeo S: Non-operative treatment for metatarsophalangeal joint synovitis. Foot Ankle 16:771-777, 1995


# Conservative Treatment Strategies

- Toe taping
- Toe spacers
- Metatarsal binders/corsettes
- Commercial toe splints
- Bunion splints
- Full contact orthoses w/ forefoot accommodation
- Rigid FF rocker-sole shoes
- Shoewear modifications
- Carboplast® (preferred) vs. graphite plate
- SLW boot
- Night splint
- Medications: topical & oral NSAIDS & analgesics, injectable steroids
- Stretching (Achilles, extensor tendons)
- Heel lifts
- Temperance of offending activities
- Acute-phase treatment (“PRICE”)
- Deep massage

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**TABLE 1**