

# Predislocation Syndrome: Is Plantar Plate Repair Better Than Flexor Tendon Transfer?

## Point



While there may be concomitant deformities and other mechanical influences to consider with predislocation syndrome, this author prefers direct plantar plate repair to address the main pathology without altering normal anatomy.

By William Fishco, DPM, MS, FACPAS

Anyone involved with foot surgery struggles with pathology of the second metatarsophalangeal joint. When a patient presents to the office with the chief complaint of pain under the second toe joint and we can see medial drift of the second toe, it is a real gut punch. It just may be the bane of our existence. The reality is that there is no single ideal procedure for this concern. Remember, we are dealing with a soft tissue pathology, which encompasses a host of structural and mechanical influences leading to joint deformity. Once the soft tissue pathology is “fixed,” there is still potential for reinjury or recurrence of the original problem.

As we know it today, predislocation syndrome is a condition that is caused by excessive load to the plantar second metatarsal head. This leads to inflammation of the plantar capsule. At first, patients may relate that they have pain, feel like they are walking on a lump or perceive a grape-like swelling. There may be no visual signs of this but it is what the patient feels.

Over time, if the pressure is not abated, the plantar capsule, including the plantar plate, starts to attenuate. This can lead to instability and deformity of the second toe. If the plantar plate and capsule tissue completely tear, then profound deformity of the second toe will ensue. This typically involves a dislocated hammer toe with or without a crossover toe deformity.

A lot has changed with respect to

treating predislocation syndrome over the years. Many older foot surgeons have treated second metatarsophalangeal joint deformity for years without even a thought about the plantar plate. The plantar plate is not a new anatomic structure but it was not a “thing” until it became a popular topic in the literature in the 1990s. In the podiatric literature, Gerard Yu, DPM introduced the clinical condition of predislocation syndrome in 1995.<sup>1</sup>

In the past, when the plantar plate was not a focus, the typical approach for this condition was to fix the hammertoe, perform a complete extensor hood recession with extensor tendon lengthening, a dorsal capsulotomy of the metatarsophalangeal joint and run a K-wire across the joint. The hope, of course, was that scar tissue would take over to allow for tissue adaptation and stabilization, maintaining correction. One would have to hold his or her breath after pulling the pin at six weeks.

Other common procedures included a partial metatarsal head resection or resection of the base of the proximal phalanx with or without syndactyly of the second toe to the third toe. Surgeons would typically perform these procedures when there was significant dislocation of the toe without room for relocation. Certainly, surgeons still perform these procedures today and they are perfectly acceptable. However, a more anatomic correction without joint destruction is always preferred.

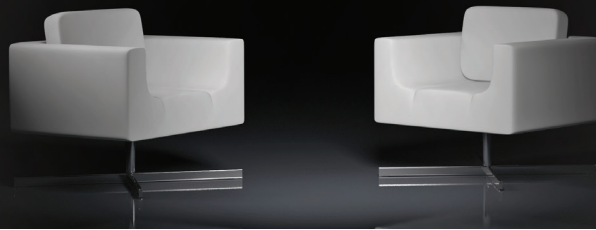
## Analyzing The Benefits Of Plantar Plate Repair For Predislocation Syndrome

I prefer fixing the plantar plate when possible. In my mind, it makes sense to address the pathologic structure causing the problem. One of the many tenets of surgery that E. Dalton McGlamry, DPM instilled upon trainees was not to alter normal anatomy to fix a problem. Instead, he advocated for the surgeon to address the abnormal anatomy.

Despite the clear indication to directly repair the plantar plate, I still think the jury is out on whether the surgeon should do so dorsally or through a direct approach from the plantar side. In my personal experience, I do not think it matters and believe it is up to the comfort level and skill of the surgeon. In my practice, I generally prefer a direct plantar approach. I find it to be easier with better control over the correction.

Many of the instrumentation systems that are available for correction through a dorsal approach seem complicated and cumbersome. I do find that if I have to do a shortening osteotomy of the second metatarsal, I am more likely to perform the plantar plate repair dorsally to avoid multiple incisions. However, I am not a proponent of performing a second metatarsal osteotomy to gain exposure to the plantar plate for repair and then restoring the length of the metatarsal. This approach has multiple unnecessary steps when the direct plantar approach does

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## Counterpoint



Emphasizing that the flexor tendon transfer offers a successful long-term approach to predislocation syndrome, these authors say the procedure comprehensively addresses the biomechanical causes of the deformity, provides predictable outcomes and has limited postoperative complications.

*By Lawrence A. DiDomenico, DPM, FACFAS, Ajay Ghai, DPM, and Jacob Carmichael, DPM*

**P**redislocation syndrome has been described as a focal pain under a lesser, (most often the second), metatarsophalangeal joint (MPJ). Patients with the disorder often report symptoms such as a ‘grape-like’ swelling under the affected toe joint and feeling as if there is a bruise on the ball of the foot. An examination may reveal what looks like an otherwise normal foot with no deformity or callus formation. While predislocation syndrome is a disorder of instability that can progress to gross deformity, its early presentation is much more subtle and requires a thorough physical examination.

The treatment goals with predislocation syndrome are to reduce the deformity, provide pain relief, improve function and prevent the progression of the existing deformity. One may modify the surgical approach to address the extent of the condition including any digital deformity associated with MPJ pathology, hallux abductovalgus, first ray instability and posterior muscle tightness.<sup>1</sup>

### **Pertinent Tips On Examination And Evaluation Of The Patient With Predislocation Syndrome**

Physical examination of the patient with predislocation syndrome will reveal pain upon palpation of the plantar plate. Unlike other disorders in the ball of the foot, pain with range of motion of the affected digit is present along with a positive Lachman’s test. Plain film radiographs may

reveal dorsal subluxation of the proximal phalanx on the metatarsal head but may also present with minimal to no notable deformities. Similarly, while magnetic resonance imaging (MRI) may reveal rupture of the plantar plate at the affected MPJ, predislocation syndrome can present without rupture, reinforcing the importance of a thorough physical exam.

Conditions associated with predislocation syndrome can include a gastrocnemius equinus contracture, hallux abductovalgus (HAV), first ray insufficiency, hallux limitus and extensor recruitment of the extensor digitorum longus tendon. This condition may be isolated to the second toe or may involve more of, or all, the lesser toes. These deformities in combination typically cause a biomechanical fault that leads to predislocation syndrome of the second metatarsophalangeal joint.

### **When And Why We Choose The Flexor Tendon Transfer For Patients With Predislocation Syndrome**

There are multiple options for conservative treatment of predislocation syndrome such as non-steroidal anti-inflammatory drugs (NSAIDs), offloading, decrease in activity level, physical therapy and orthotic management. When conservative measures fail, it is our preference to perform a comprehensive surgical correction consisting of a flexor digitorum longus (FDL) tendon transfer to the extensor hood of the toe. Surgeons commonly perform this

tendon transfer in combination with a gastrocnemius recession to lengthen the posterior muscle group, which, in turn, also offloads the forefoot.

The first ray is supposed to accept approximately 60 percent of the forefoot load.<sup>2</sup> By stabilizing the first ray via a Lapidus procedure, the weight is transferred back to the first ray, offloading and decreasing stress to the lesser metatarsals. Transferring the extensor digitorum brevis (EDB) into the extensor digitorum longus (EDL) tendon (modified Hibbs procedure) along with a complete MPJ capsulotomy removes the retrograde buckling. Finally, when completing the flexor digitorum longus tendon transfer to the extensor hood (modified Girdlestone-Taylor procedure), the toe is stabilized and maintains plantar flexion of the digit. Essentially, this is a combination of stabilization and muscle-tendon balancing. In most scenarios, either some or all of the aforementioned procedures may be necessary based on the extent of the deformity and the associated conditions.

### **Raising Questions About The Role Of The Metatarsal In Predislocation Syndrome**

Predislocation syndrome and associated deformity do not pertain to the bone and we continue to note success without performing any type of digital or metatarsal osseous procedure. When considering the theory that the second metatarsal

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not interfere with normal anatomy.

Even though I prefer direct plantar plate repair for predislocation syndrome, at times I will perform a flexor tendon transfer. My main concern, however, with the flexor tendon transfer is potential development of lesser metatarsophalangeal joint limitus. That can ultimately lead to chronic pain and arthrosis of the joint. Due to this, I am more likely to reserve the flexor tendon transfer for older, more sedentary patients. Moreover, a flexor tendon transfer does not address the pathologic condition of plantar plate dysfunction and does alter the normal anatomy.

### Addressing Concomitant Deformities, Patient Expectations And Potential Complications

It would be an injustice to discuss predislocation syndrome surgery without elaboration on concomitant deformities and mechanical influences that ultimately lead to the condition. As podiatrists, we have the unique training and experience to not only fix the pathology but address all structural and mechanical influences causing pathology. We can also ultimately prevent recurrence after surgical intervention. Since we know that equinus deformity, an excessively long second metatarsal, a short first ray, hallux valgus, instability of the medial column and retrograde buckling of a hammertoe all contribute to excessive pressure to the second metatarsophalangeal joint, it is our job to address these pathologies in the correction of plantar plate dysfunction.

In my mind, it is hard to determine what a “successful outcome” is when dealing with second metatarsophalangeal joint pathology. At the end of the day, it is all about realistic expectations for your patient with this condition. I personally believe that it is perfectly acceptable to explain to your patient that surgery should resolve the pain. However, there may be some residual deformity such as medial drift and/or a floating toe. I

discuss with my patients that these are known consequences of the surgery that should not be surprises, but rather, expectations. If we get lucky and the toe does not float or drift, then that is a bonus.

The only reason to do foot surgery is for pain resolution. I think it is unrealistic to expect a perfect result with no residual deformity, no pain and unrestricted range of motion of the joint. No matter what we do, range of motion will always have some restriction. After second metatarsal osteotomies, there is typically loss of flexor power to the toe. Therefore, floating toes are common. A flexor tendon transfer is designed to prevent the toe from dorsiflexing, again restricting motion. Resection of the base of the proximal phalanx or partial metatarsal head resection destabilizes the joint. I feel that the surgery that will provide the least amount of joint interference, if you will, is direct repair of the plantar plate.

### Final Thoughts

In conclusion, only time will tell what the best way is to address this very complicated pathologic condition of the foot. Unfortunately, it is not just one thing. That would be way too easy. A myriad of structural and biomechanical influences lead to the breakdown of the second metatarsophalangeal joint. Therefore, a solution is also not straightforward. However, direct repair of the plantar plate as the underlying abnormal structure is the best start. ■

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is involved, one must ask: When does a metatarsal become long or plantarflexed? Most of these patients are adults who have reached skeletal maturity. How does the metatarsal then become long or change angles? It is our opinion that it is a combination of the radiographic appearance of biomechanical faults and abnormalities along with the position of the foot in relation to the X-ray beam. In cases of pes cavus, does the metatarsal look short (divergent from the weightbearing surface)? In cases of pes planus, doesn't the metatarsal lay more parallel to the ground, leaving an impression of a long metatarsal? In reality, the metatarsal does not become short or long after skeletal maturity.

Another common thought is that the metatarsal is plantarflexed. However, this theory is flawed when there is no previous history of trauma or surgery. With deep transverse intermetatarsal ligaments and interosseous musculature (lumbricals and interossei) all intact in a fully weightbearing patient, the deep transverse intermetatarsal ligament acts like a tie-bar system. Therefore, the metatarsal cannot become plantarflexed.<sup>3</sup> Based on this information, it is our opinion that second metatarsal osteotomies for predislocation syndrome are not necessary.

### Step-By-Step Insights On The Surgical Technique

The flexor tendon transfer surgery should balance the flexors and extensors to prevent recurrence and/or continued progression of the deformity. Once one has removed the deforming forces, there should not be a reoccurrence. The senior author does not believe that plantar plate repair, metatarsal osteotomy or arthroplasty/arthrodesis are the best treatment choices to address predislocation syndrome as these procedures do not treat the underlying pathology. Also, if the attempted soft tissue procedures fail, the surgeon can always move to a bony procedure in the future.

As we stated previously, one can uti-

“With deep transverse intermetatarsal ligaments and interosseous musculature all intact in a fully weightbearing patient, the deep transverse intermetatarsal ligament acts like a tie-bar system. Therefore, the metatarsal cannot become plantarflexed.”

lize the isolated modified Girdlestone-Taylor procedure to transfer the flexor digitorum longus tendon to the extensor hood. The isolated modified Hibbs procedure will release the extensor pull as well as the medial/varus pull of the pathologic position of the second toe. This procedure also decreases the extensor tendon retrograde buckling of the second digit on the second metatarsal, resulting in a decrease in plantar plate pressure and excellent exposure to the metatarsophalangeal joint intraoperatively.

Surgeons can perform the modified isolated Hibbs procedure for predislocation syndrome with an approximately two to three cm incision starting at the second MPJ, extending proximally and slightly laterally. One can deepen

the incision in the same plane to the level of the extensor digitorum longus tendon and the extensor digitorum brevis tendon, which lies lateral to the extensor digitorum longus tendon. Transect the extensor digitorum longus as far as possible proximally within the incision site and transect the extensor digitorum brevis as far as possible distally within the incision. Exposure to the second MPJ is now possible. With sharp dissection and a McGlamry elevator, one can perform a complete capsulotomy, which releases the contracted, fibrous and deformed capsular tissue. The MPJ should now be in a neutral position as all the deforming forces are gone.

Directing attention to the medial aspect of the second digit, the surgeon can perform a modified Girdlestone-Taylor procedure through a midline incision on the medial aspect of the toe. We recommend using fine double-prong skin hooks for retraction in order to avoid soft tissue compromise. Proceed to deepen the incision in the same plane, taking care to avoid the neurovascular bundles. Carry the incision deep to identify the flexor digitorum longus and dissect distally to its insertion on the distal phalanx. Detach this distal insertion and direct it proximally to the digital web space.

The surgeon can subsequently perform a tenotomy of both the medial and lateral slips of the flexor digitorum brevis tendon, along with a capsulotomy (if necessary) at the proximal and/or distal interphalangeal joints for a flexion contracture. Proceed to place the second toe into the desired anatomic neutral position and insert a 0.062 inch Kirschner wire (K-wire) from the distal tip of the distal phalanx through the base of the second metatarsal to stabilize and align the digit. With all the deforming forces gone and the digit in the desired anatomic position, suture the flexor digitorum longus to the extensor hood under

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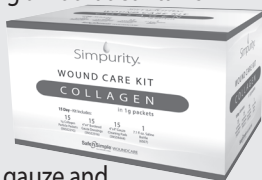
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## Counterpoint

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physiologic tension. It is imperative to suture this under physiologic tension as this tendon transfer will assist the lumbricals with plantarflexion, allowing the toe to purchase the ground postoperatively.

Finally, at the dorsum of the second MPJ, the surgeon transfers the distal end of the proximal stump of the extensor digitorum brevis tendon into the distal end of the extensor digitorum longus tendon via a weave graft under physiologic tension. Again, the physiologic tension is important in order to allow for the extensor digitorum brevis to dorsiflex the toe. Essentially, this weakens the dorsiflexor of the second digit. The modified Hibbs procedure is indicated for patients who exhibit isolated extensor substitution/recruitment or global extensor substitution/recruitment to the forefoot.

### Key Advantages Of The Girdlestone-Taylor Procedure Over Plantar Plate Repair

There are multiple advantages to this approach to predislocation syndrome. Scars with the Girdlestone-Taylor procedure are on the medial aspect of the second digit, therefore leaving a much more cosmetically-pleasing result. Postoperatively, there is a much more natural appearance to the digits in comparison to more traditional procedure with a dorsal approach. Additionally, there is no shortening of the toe and the medial and lateral collateral ligaments are left intact, limiting frontal or transverse plane complications. The cubic volume of bone is not altered, preventing instability and shortening. Lastly, because dissection is limited to soft tissue, postoperative edema is minimal in relation to bony procedures.

The senior author has found tendon balancing procedures to be successful long-term approaches for second MPJ predislocation syndrome. If indicated, we also perform a modified Lapidus and an endoscopic gastrocnemius recession. Our approach addresses the

biomechanical cause of the deformity, unlike some of the more traditional or novel surgical procedures. Performing this forefoot joint-sparing procedure and, if necessary, a posterior muscle lengthening along with first ray stabilization provide a long-term predictable outcome with limited post-operative complications. ■

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*Editor's note: For related articles, read "Emerging Concepts In Plantar Plate Repair" in the February 2015 issue of Podiatry Today, "What Makes The Plantar Plate So Challenging To Treat?" in the November 2015 issue, "Expert Insights On Treating Plantar Plate Tears" in the March 2016 issue, "Preventing Complications Of Plantar Plate Repair" in the September 2017 issue and "Understanding The Biomechanics Of Plantar Plate Injuries" in the April 2017 issue.*