



Surgical Treatment of Ankle Equinus Contracture

Selecting the correct procedure often depends on the amount of contracture.

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Introduction

The term “equinus” has become increasingly common when discussing different approaches/remedies to foot and ankle pathology. Its meaning has become synonymous with decreased dorsiflexion at the ankle joint; however, there is dispute as to what constitutes normal or abnormal range of motion. Numerous authors and surgeons report 3-15 degrees with knee extension and 10–20 degrees with knee flexion as within normal limits. Disagreement aside, there is acceptance that ankle equinus contributes to a wide range of conditions, from hallux valgus and progressive flat foot deformity to neuropathic ulceration and Charcot neuro-osteoarthropathy deformity.¹ Several studies have alluded to the fact that approximately 60-80% of patients presenting with midfoot or forefoot symptoms may have an underlying contracture.² Our review will focus on the surgical treatment of

ankle equinus contracture and will be arranged from proximal-to distal-based procedures.

Procedure Selection

When surgeons are determining which type of soft tissue release to perform for ankle equinus, they often refer to the Silfverskiold test.³ The test involves a clinical maneuver to determine the level of contracture based on whether the gastrocnemius muscle or the gastrocnemius-soleus

taneous or endoscopic procedure, if appropriate.

Gastrocnemius Recession Procedures (Mild to Moderate Contracture)

The Baumann procedure was initially described in 1989 and was promoted primarily for equinus relating to a spastic/neuromuscular type condition.⁴ Many foot/ankle surgeons continue to advocate this procedure due to its ability to allow selective

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muscle complex is problematic. If the clinician observes improved ankle dorsiflexion upon knee flexion during an examination, then the soleal muscle is likely not involved in the contracture. These results help to guide the anatomic level or location where the soft tissue release is performed and which structures are addressed.

There are numerous other risk factors or medical co-morbidities which play a role in procedure selection; their details are outside the scope of this article. However, it is worth mentioning that the presence of peripheral arterial disease and/or poorly controlled diabetes should steer the surgeon towards a percu-

lengthening of the gastrocnemius-soleus muscle complex. An incision is typically made at the intersection of the upper and middle thirds of the lower leg. The plane between the gastrocnemius and soleus muscle bellies is bluntly defined. The ankle is dorsiflexed to place the muscle(s) under tension and the aponeurosis is divided by parallel incisions starting proximally and spaced 1-2 cm apart until adequate correction is achieved. If the soleus muscle is also involved a similar lengthening is performed within its aponeurosis. Another advantage of the Baumann procedure is the rather low rate of over-lengthening or calcaneal

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gait compared to other techniques for equinus contracture correction.

Strayer described a procedure in the 1950s to allow lengthening of the gastrocnemius with less disruption of the soleus muscle.⁵ The incision is typically placed at the posterior or posterior-medial lower extremity approximately 2 cm distal to the medial gastrocnemius muscle “run-out.” More precisely, upon division of the lower leg into thirds, the incision is centered at the middle third location.

Dissection continues until the deep fascia is identified; care should be taken to avoid neurovascular injuries as these can often be seen at this location. The deep fascia is then incised exposing the gastrocnemius aponeurosis, which is then transected along with the plantaris tendon. Minimal disruption to the underlying muscle belly is encouraged to prevent unnecessary bleeding.

A significant advantage to this technique is its decreased complexity and operative time as well as avoidance of disruption to the Achilles tendon proper. One disadvantage that has been encountered relates to cosmesis at the incision site post-operatively. Patients will sometimes express concerns about a palpable or unsightly dell or depression where the recession was performed. This tends to be more problematic with thinner individuals that have less adipose or soft tissue bulk.

Vulpus Technique

The Vulpus lengthening or recession, as originally described in 1924, addresses both of the large posterior calf muscles.⁶ The Vulpus technique differs slightly from that of Strayer in two aspects. First, the location of the skin incision/lengthening is performed at the intersection between the middle and distal thirds of the lower leg, meaning the recession now involves the soleal muscle structures. This typically equates to an ability to address a more significant contracture.

Secondly, the actual transection of the aponeurosis is performed with v-type orientation as opposed to straight transversely. This technique may allow for a more expe-

ditioned return to ambulation when prolonged immobilization is not recommended due to confounding patient co-morbidities.⁷

More recently the endoscopic gastrocnemius recession has been gaining popularity in the foot/ankle community. Tashjian described the technique in 2003 utilizing cadaveric limbs, and Saxena presented a small cohort of his patients in 2004.^{8,9} In short, the technique involves two 1-2 cm incisions placed at the anatomic level described by Strayer, with

lengthening or “slide.” However, the predisposition for over-lengthening leading to calcaneal gait, complete tendon rupture, need for large incision/dissection, and prolonged post-operative immobilization have mitigated its usage.

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the endoscope and cannulated knife system used to isolate/incise the gastrocnemius aponeurosis.

Although proponents of this technique elude to decreased operative time and improved cosmesis as major advantages, the initial learning curve and increased potential for sural nerve injuries should discourage widespread implementation. The current focus on healthcare funding and cost-effectiveness should also be mentioned when determining if the endoscopic instrumentation is medically necessary.

Tendo-Achilles Lengthening or TAL Procedures (Moderate to Severe Contracture)

The procedures performed within the Achilles tendon proper can be classified as open or percutaneous lengthening.¹⁰ The utilization of the open TAL seems to have decreased in the surgical community, but still has numerous indications/advantages worth mentioning. The procedure allows for correction of more severe equinus deformities due to its ability to treat the gastrocnemius and soleus muscles. The surgeon is also afforded the capacity to precisely determine the amount of correction gained due to the same parameters that accompany the traditional z-type tendon

cm proximal to the tendon insertion. The knife is rotated medially and approximately half of the tendon is transected. This is then repeated at two separate incision locations 2-3 cm proximal to the previous, with the next directed laterally, and the final again directed medially.¹

Force is then applied to the lower extremity in a controlled manner to complete the TAL. Extreme care should be taken to avoid traumatic/iatrogenic rupture.

Achilles Tenotomy (Severe Contracture)

The concept of complete surgical transection of the Achilles tendon has fallen out of favor; nonetheless, there are several surgical scenarios where it is advantageous. The details of the procedure will not be discussed due to its lack of widespread usage. Patients who are non-ambulatory and/or require complex near-total foot amputations often benefit from tenotomy due to its ability to balance the residual “stump.” Finally, patients requiring complex rear foot arthrodesis, tibio-talo-calcaneal arthrodesis, or Charcot/post-traumatic deformity correction can benefit from tenotomy to allow for intra-operative positioning of a plantar-grade foot.

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Conclusion

When patients present to the foot and ankle reconstructive surgeon with foot/ankle deformity, plantar ulceration, or neuromuscular disease/spasticity, ankle equinus contracture must be considered. The clinician should then determine the degree of contracture present and the structures involved in order to select the appropriate procedure.

Complicating patient diseases and co-morbidities are equally important when selection involves open versus percutaneous or endoscopic techniques. Ultimately, successful treatment of ankle equinus contracture should be defined as the posterior lengthening that provides a stable and plantar-grade foot, while minimizing patient-specific complications and loss of push-off power. **PM**

References

- ¹ Schweinberger, M. H. and T. S. Roukis (2008). "Surgical correction of soft-tissue ankle equinus contracture." *Clin Podiatr Med Surg* 25(4): 571-585, vii-viii.
- ² Barske, H. L., et al. (2012). "Current Concepts Review: Isolated Gastrocnemius Contracture and Gastrocnemius Recession." *Foot & Ankle International* 33(10): 915-921.
- ³ Singh, D. (2013). "Nils Silfverskiold (1888-1957) and gastrocnemius contracture." *Foot Ankle Surg* 19(2): 135-138.
- ⁴ Svehlik, M, et al. (2012). "The Baumann procedure to correct equinus gait in children with diplegic cerebral palsy." *J Bone Joint Surg (Br)* 54(8): 1143-1147.
- ⁵ Strayer, L. M. (1950). "Recession of the gastrocnemius; an operative to relieve spastic contracture of the calf muscles." *J Bone Joint Surg (Am)* 32: 671-676.
- ⁶ Chen, L. and J. Greisberg (2009). "Achilles lengthening procedures." *Foot Ankle Clin* 14: 627-637.
- ⁷ Takahashi, S. and A. Shrestha (2002). "The vulpius procedure for correction of equinus deformity in patients with hemiplegia." *J Bone Joint Surg Br* 84(7): 978-980.

⁸ Tashjian, R. Z., et al (2003). "Endoscopic gastrocnemius recession: evaluation in a cadaver model." *Foot Ankle Int* 24:607-613.

⁹ Saxena, A. and A. Wittfeldt (2004). "Endoscopic gastrocnemius recession: preliminary report on 18 cases." *J Foot Ankle Surg* 43: 202-206.

¹⁰ Greenhagen, R. M., et al. (2012). "Gastrocnemius recession or tendo-Achilles lengthening for equinus deformity in the diabetic foot?" *Clin Podiatr Med Surg* 29(3): 413-424.



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