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Gastrocnemius Recession Leads to Increased Ankle Motion and Improved Patient Satisfaction After 2 Years of Follow-Up

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ABSTRACT

The isolated gastrocnemius contracture present in neurologic healthy patients results in a significant limitation of ankle dorsiflexion causing pathologic gait patterns and a greater risk of further foot disorders. Gastrocnemius recession is an established procedure to increase ankle dorsiflexion. However, little evidence is available of the use of gastrocnemius recession in these patients. Complication rates, recurrence of gastrocnemius contracture, and the prevalence of additional foot disorders needs further evaluation. A study group of 64 operated limbs undergoing gastrocnemius recession was evaluated to determine the prevalence of foot disorders, pre- and postoperative ankle dorsiflexion, and incidence of complications. A subgroup of 15 (23.4%) patients without additional operative procedures was examined regarding ankle dorsiflexion, strength (Janda method), sensitivity in the operated limb, and the pre- and postoperative Foot Function Index scores. The prevalence of foot disorders showed pes planus (41%), hallux valgus (38%), metatarsalgia (19%), hammertoe deformity (13%), and symptomatic Haglund exostosis (11%). At 31 months of follow-up, the patients had significantly benefited from increased ankle dorsiflexion of 13.3° ± 7.9° ($p < .001$). Postoperatively, 16% patients experienced complications. In the subgroup of 15 patients, the follow-up examination after 44 months showed ankle dorsiflexion of 14° ± 7.1°. The plantarflexion strength was 4 of 5 (Janda method). The Foot Function Index score had improved significantly from 65.4 ± 26.5 points to 33.4 ± 19.5 points ($p < .001$). Patients with isolated gastrocnemius contracture seem to have a high prevalence of symptomatic foot disorders. At a mid-term follow-up examination, gastrocnemius recession (Strayer) was shown to be an effective procedure to significantly improve ankle dorsiflexion, functionality, and pain symptoms. More attention should be given to the development of postoperative complications.

Tendon Achilles lengthening is a well-described procedure for improving gait patterns in neurologically impaired patients. Since the first description in the 1800s by Delpech (1), procedures to release muscle tension and relieve equinus contracture have been performed using various techniques. Equinus contracture can be attributed to either both parts of the triceps surae muscle or isolated gastrocnemius contracture (IGC). First described in 1924, Silfverskiöld (2) contrived an examination to determine the presence of IGC. The first gastrocnemius recession (GR) was described by Vulpuis and Stoffel (3) in 1913 and revised by Strayer and Bridgeport (4) in 1950. Although the history of the GR began >1 century ago, little attention had been given to neurologically healthy patients with equinus contracture until the 1970s.

Few studies have examined and defined ankle equinus. Root et al (5) stated that ankle dorsiflexion >10° in the extended knee position is necessary for a normal gait pattern. This definition is comprehensible if attention is given to the middle stance phase of the gait cycle. During the middle stance phase, the body weight shifts ventrally while the knee is fully extended and the gastrocnemius is at maximum strain (6,7). To make this process possible, ankle dorsiflexion must be ≥10° (4,8–11). DiGiovanni et al (8) showed that a cutoff at <5° of maximal ankle dorsiflexion with the knee fully extended leads to better reproducibility (76%) and reliability compared with a cutoff at 10° for IGC.

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If patients have a constriction of flexibility, it is believed that pathologic compensatory mechanisms will develop. Overpronated subtalar and midtarsal joints and early heel off will be the consequences (12,13). These mechanisms lead to a prolonged propulsive phase of gait, placing more stress on the forefoot. Chronically overstrained feet result in shear keratomas, metatarsalgia, and loss of intrinsic stabilization (6,13–15). The IGC is, therefore, considered an etiologic factor of foot diseases and symptoms such as hallux valgus, acquired flatfoot, hammertoe deformity, and plantar fasciitis (8,12,14).

Supporting these assumptions, DiGiovanni et al (8) discovered that patients with foot disorders had less ankle dorsiflexion compared with a matched control group. Additional studies verified the benefit of GR (Strayer) by showing reduced foot symptoms in patients with plantar fasciitis, metatarsalgia, noninsertional Achilles tendinopathy, and/or forefoot nerve entrapment (13,16–24). Comparisons of patient-assessed pre- and postoperative scores showed significant improvement in function and pain relief, enabling patients to experience improved quality of life (19,20,25–28).

Still controversial are the complication rates after the Strayer procedure. Endoscopic approaches have resulted in dysesthesia of the sural nerve in 5 of 47 patients (11%) (26,29). Open procedures have been considered a low complication approach, with no or few complications, such as wound infection or nerve dysfunction, identified (18–20,30). Furthermore, owing to the short history of the Strayer procedure performed in neurologically healthy patients, little evidence is available concerning recurrent IGC.

The question arises regarding whether a single muscle lengthening procedure such as GR can actually lead to improvement of function and symptom release in patients with complex foot disorders. The results of Monteagudo et al (24) showed evidence supporting such improvement. Their patients with chronic plantar fasciitis benefited significantly from GR compared with patients undergoing plantar fasciotomy (24). Case studies have provided indications that isolated GR can dramatically ease symptoms resulting from forefoot nerve entrapment and chronic noninsertional Achilles tendinosis (22,23).

The aim of the present study was to assess the prevalence of foot disorders in neurologically healthy patients with IGC and the midterm results of postoperative dorsiflexion range of motion (ROM). The complication rate and incidence of recurring gastrocnemius equinus were recorded. Completing the evaluation of the Strayer procedure, we also assessed postoperative function, pain, and patient satisfaction.

Patients and Methods

The data from 150 patients who had undergone GR (Strayer) from August 13, 2001 to December 20, 2010 were retrospectively evaluated. These patients had complained about foot pain during the day and at night, functional restriction due to the pain during walking, and callus formation. All patients had a preoperative diagnosis of IGC using the Silfverskiöld test (2). The patients were only candidates for surgery after conservative therapy had been tried for ≥6 months, including nonsteroidal anti-inflammatory drugs, orthotics, a stretching program, and weight reduction, if necessary. Patients were included if they were available for a follow-up examination ≥6 months after GR at this specific hospital. The exclusion criteria were previous surgery to the same limb, the presence of osteoarthritis or systematic diseases, including diabetes or rheumatologic conditions and spastic contracture secondary to neurologic disease and trauma. Considering these criteria, the study group included 55 patients (42 females, 13 males) with 64 operated limbs. The average age was 43 (range 17 to 82) years.

Group Criteria

The patients were divided into 3 groups according to the foot surgeries performed in addition to GR. The prevalence of foot disorders diagnosed in addition to IGC was retrospectively analyzed.

Subgroup

A subgroup of 23 operated limbs was formed to evaluate the quality of the GR, without the effects of the additional surgical procedures. Of these 23 patients (group 3), 15 were available for a follow-up examination at which the clinical outcomes and patient satisfaction were measured.

Surgical Procedure

All patients underwent GR using the Strayer technique. The patients underwent surgery by different surgeons of the orthopedic department. With the patient supine and narcotized, a dorsomedial skin incision (3 to 5 cm) was made. The fascia was incised and the gastrocnemius identified and separated from the soleus by blunt dissection. The sural nerve and small saphenous vein were identified and protected throughout the procedure. The gastrocnemius tendon was cut transversally under direct vision. After dissection, a dorsal extension test with an extended knee joint was performed. The gastrocnemius was sutured onto the soleus tendon. The area was then jetted with sodium chloride solution. The fascia and skin were closed as the standard procedure requires.

Postoperative care included lower leg splints for 2 weeks. Afterward, the patients were allowed weightbearing as tolerated and were instructed to wear the splint at night. Patients with osteotomies were allowed partial weightbearing for 6 weeks. The standard protocol for analgesia and thrombosis prophylaxis was followed for all patients.

Functional Assessment

Study Group

The study group included 64 patients.

Dorsiflexion ROM. Dorsiflexion ROM was measured in full knee extension pre- and postoperatively using a goniometer. To prevent excessive dorsiflexion due to pathologic motion, the examiner placed the subtalar joint in a neutral position. This was secured by placing the thumb over the talonavicular joint and placing adduction force across the lateral forefoot with the other hand. Using the correct examination technique, the visual goniometer is a reliable and reproducible method (31).

Complications. All complications occurring after GR were documented in the patients' medical records. Special attention was given to sural nerve lesions, wound infection, and muscle cramps.

Subgroup

The subgroup included 15 patients.

Foot Function Index. In the subgroup analysis, the German Foot Function Index (FFI) was used to measure function and pain pre- and postoperatively. Preoperative status was assessed retrospectively using the FFI. During the follow-up examination, the patients were asked to complete the FFI regarding their present status. The FFI is a reliable and valid questionnaire for the self-assessment of pain and disability in patients with foot complaints (32,33).

Strength Testing. The plantarflexion strength of the triceps surae was tested using the method of Janda and was performed by the same examiner for all 15 patients (34). For the patients with 1 operated limb, the contralateral limb was used as the control reference.

Patient Satisfaction. To assess the patients' subjective satisfaction, they were asked to evaluate their satisfaction with the GR using the German grading scale (scale of 1 to 6, with 1 indicating the best outcome).

Results

Study Group

Prevalence of Foot Disorders

The foot disorders in the 64 patients constituting the study group included a majority of deformities in the forefoot and rearfoot. These included hallux valgus in 24 (38%) and pes planus in 26 (41%). Also, 12 patients had a diagnosis of metatarsalgia (19%), 8 patients had hammertoe deformity (13%), and 7 (11%) had symptomatic exostosis (Fig. 1).