



Radiographic and functional results of the Lindgren - Turan operation in the treatment of hallux valgus

Halluks valgus deformitesinde Lindgren-Turan ameliyatının radyografik ve fonksiyonel sonuçlarının değerlendirilmesi

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Amaç: Halluks valguslu olgularda Lindgren-Turan ameliyatının sonuçları radyografik ve fonksiyonel yönden değerlendirildi.

Çalışma planı: Yirmi beş hastanın (15 kadın, 7 erkek; ort. yaş 42; dağılım 20-68) 29 ayağı Lindgren-Turan yöntemi ile ameliyat edildi; yeterli takibi yapılabilen 24 ayak değerlendirmeye alındı. Ameliyat öncesi, ameliyat sonrası ve izlem sonunda çekilen ayak ön-arka grafilerinde halluks valgus açısı ve intermetatarsal açı ölçüldü. Ağrı değerlendirilmesi görsel analog skala ile yapıldı. İzlem sonunda birinci metatarsofalangeal eklemin hareket açıklığı değerlendirildi. Ortalama izlem süresi 26.5 ay (dağılım 6-54 ay) idi.

Sonuçlar: Halluks valgus açısında ameliyat sonrası dönemde ortalama 6.9°, intermetatarsal açıda ortalama 5.1° düzelme sağlandı (p<0.05). İzlem sonunda halluks valgus açısında ortalama 1.8°, intermetatarsal açıda ise 0.5° ortalama korreksiyon kaybı oluştu. Ameliyat öncesinde 7.78 olan ortalama ağrı skoru, izlem sonunda 1.35'e düştü (p<0.05). İzlem sonunda birinci metatarsofalangeal ekleme ait hareket açıklıkları ortalama dorsal fleksiyonda 56.8°, plantar fleksiyonda 14.9° olarak ölçüldü. Hastaların eski aktivitelerine dönüş süresi ortalama 44.2 gün (dağılım 30-70 gün) bulundu; %83.3'ü ameliyattan tamamen memnun olduğunu belirtti. Klinik ve radyografik değerlendirmelerde 15 hastada mükemmel (%62.5), yedisinde iyi (%29.2), ikisinde ise başarısız (%8.3) sonuç elde edildi.

Çıkanmlar: Lindgren-Turan ameliyatı, orta derecedeki halluks valgus olgularının cerrahi tedavisinde tercih edilebilir bir seçenektir.

Anahtar sözcükler: Kemik vidası; ayak deformiteleri/cerrahi; halluks valgus/cerrahi/radyografi; metatarsal kemikler/cerrahi; metatarsofalangeal eklem; osteotomi/enstrümantasyon/yöntem; hareket açıklığı, artiküler; ayakkabı.

Objectives: We evaluated the radiographic and functional results of the Lindgren-Turan operation in the treatment of hallux valgus.

Methods: Twenty-nine feet of 25 patients (15 women, 7 men; mean age 42 years; range 20 to 68 years) were treated by the Lindgren-Turan method. Of these, 24 feet with appropriate follow-up were included. Intermetatarsal and hallux valgus angles were measured on preoperative, postoperative, and follow-up anteroposterior radiographs. Pain was evaluated by a visual analog scale. The range of motion of the first metatarsophalangeal joint was measured at the end of follow-ups. The mean follow-up period was 26.5 months (range 6 to 54 months).

Results: Postoperatively, the mean corrections were 6.9 degrees and 5.1 degrees in the hallux valgus and intermetatarsal angles, respectively (p<0.05). At the end of the follow-up period, the mean loss of correction was 1.8 degrees for the hallux valgus angle, and 0.5 degrees for the intermetatarsal angle; the mean pain score decreased from preoperative 7.78 to 1.35 (p<0.05) and the mean range of motion of the first metatarsophalangeal joint was 56.8 degrees dorsiflexion and 14.9 degrees plantar flexion. The mean time to return to presurgery activity levels was 44.2 days (range 30 to 70 days). Of the patient group, 83.3% expressed satisfaction with the surgical outcome. Clinical and radiographic evaluations showed excellent results in 15 (62.5%), good in seven (29.2%), and unsuccessful in two patients (8.3%).

Conclusion: The Lindgren-Turan osteotomy is a preferable method in the surgical treatment of patients with moderate hallux valgus.

Key words: Bone screws; foot deformities/surgery; hallux valgus/surgery/radiography; metatarsal bones/surgery; metatarsophalangeal joint; osteotomy/instrumentation/methods; range of motion, articular; shoes.

The hallux valgus is an orthopedics deformity resulting from a medial deviation in the first metatarsal accompanied by the deviation in the big toe toward the lateral, which may present symptoms and changes involving the entire foot when not well treated. It is common in the societies where people wear western style shoes. Furthermore, neuromuscular diseases, systemic diseases like rheumatoid arthritis, genetic disposition and metatarsus primus varus are among the intrinsic factors involved in the etiology of the hallux valgus.^[1-4]

The hallux valgus is classified as mild, moderate and severe deformity depending on the degrees of the hallux valgus and intermetatarsal angles. Several surgical interventions have been suggested for further evaluating the relation with metatarsophalangeal (MP) joint. The common purpose of these interventions is to remove the deformity and pain without leading to any limitation in the range of motion.^[2-7] The present study evaluated the radiographic and functional results of distal metatarsal oblique osteotomy operations by the Lindgren-Turan method we applied in cases with symptomatic hallux valgus in moderate deformity, but no arthritic changes in the MP joint except four of the cases.

Patients and method

With four being bilateral, twenty-nine feet of 25 patients (15 women, 7 men; mean age 42 years; range 20 to 68 years) who underwent surgery by the Lindgren-Turan method between 1997 and 2002; the evaluations included 24 feet with appropriate follow-up. The surgical indications were pain in the first MP joint region, difficulty in wearing shoes and cosmetic complaints due to deformation. No radiological findings were found in any of the patients for arthropathy in the MP joint.

The hallux valgus and intermetatarsal angles were measured by preoperative, postoperative and follow up front-rear radiography of the foot (Figure 1a). The reduction in the extent of the first metatarsal was measured using the Grace method.^[8] For pain assessment, visual analog scale was used, comparing the preoperative and follow-up pain scores. At the end of follow-up period, the range of motion was evaluated by measuring the passive

motions of the first MP joint. The period to return to daily activities was determined, and patient satisfaction was analyzed. Furthermore, the patients were evaluated using the foot scoring system as suggested by Moeckel et al. including pain, function, objective findings and radiographic evaluations.

Surgical technique

Following the tourniquet application under general or local anesthesia, the subcutaneous layers were passed through dorsomedial skin incision extending app. 5 cm toward the proximal, starting from the surface of the MP joint. Oblique metatarsal osteotomy was performed at 30 degrees to the transverse surface using a drill from the joint part of the metatarsal neck and substance, which was followed by osteosynthesis using by a 2.7 mm cortical screw on the fragment being slid laterally at the required level (Figure 1b). Elastic bandage was applied between the first and second toes by applying folded gauzes after the skin was covered. The patients were postoperatively allowed to walk by pressing on the heel and lateral parts of their foot. The osteosynthesis screws were removed at 4-6 months by local anesthesia following the radiographic identification of bleeding in patients with full load after the third week (Figure 1c, d). The mean follow-up period was 26.5 months (range 6 to 54 months).

The statistical evaluations were based on two-sided p values, using Student's t-test.

Results

The mean hallux valgus pain of the patients was reduced from preoperative $27.1 \pm 3.3^\circ$ (range 25° to 35°) to early postoperative $20.2 \pm 2.4^\circ$ (range 17° to 27°) with a significant improvement ($p < 0.05$). The mean value for hallux valgus pain measured after follow-up period was $22 \pm 3.3^\circ$ (range 10° to 26°), and the mean loss of correction was 1.8° . The mean preoperative intermetatarsal pain decreased from $13.5 \pm 1.5^\circ$ (range 11° to 16°) to early postoperative $8.4 \pm 1.2^\circ$ (range 7° to 10°) with a significant improvement ($p < 0.05$). The mean intermetatarsal pain after follow-up was $8.9 \pm 1.4^\circ$ (range 7° to 12°); and the mean correction loss was 0.5° . A significant difference was found between the preoperative and follow-up measurements of the hallux valgus pain and intermetatarsal pain in spite of the correction error developed ($p < 0.05$). The mean passive range

of motion for the first MP joint was 56.8 degrees dorsal flexion and 14.9 degrees plantar flexion, and when they were compared with the normal range of motion of the joint, no postoperative limitation was found. The reduction in the first metatarsal neck was measured by the Grace method, and a mean 3.2 mm

(range 1 to 5 mm) reduction was found. The pain assessment using visual analog scale showed that the mean pain score decreased from preoperative 7.78 to postoperative 1.35 ($p < 0.05$). The mean period to return to daily activities was 44.2 days (range 30 to 70 days). Of the patient group, 83.3% expressed sat-



Figure 1. (a) Preoperative and (b) early postoperative front-rear radiographies of the fifty-three years old female patient when she was standing; (c) the image of the coalescence in the osteotomy area by front-rear radiography at postoperative fifth month, and (d) the front-rear radiography after removal of the material at postoperative sixth month.

isfaction with the surgical outcome. The results were excellent in fifteen (62.5%), good in seven (29.2%) and unsuccessful in two (8.3%) patients based on the foot scoring system. No complication was seen except the superficial wound infection, which was controlled by oral antibiotics in two patients. Two patients complained about pain due to the correction loss after the follow-up. They had preoperative advanced deformity.

Discussion

The hallux valgus is a complex foot deformity resulting from the deviation of the first toe toward lateral and the medial deviation of the first metatarsal. For indication, the clinical complaints of the patient should be considered as well as the radiographic measures.^[1, 2, 9] The primary complaints of our patients included pain and difficulty in wearing shoes. Unaesthetic appearance due to deformity was also significant.

The methods used in the treatment of Hallux valgus include soft tissue reconstructions of the MP joint, distal or proximal osteotomy of the first metatarsal, cuneiform osteotomy, MP joint arthrodesis, excisional arthroplasty and joint prosthesis.^[1, 6, 7, 10] Whichever method is preferred, the aim is to permanently correct the deformity and relieve the pain without leading to any limitation in the range of motion. One of the major factors affecting the success is the complication level of the technique and the competence of the surgeon with this technique.^[5] The distal metatarsal osteotomy has been suggested for cases with a hallux valgus pain up to 30 degrees and intermetatarsal pain up to 15 degrees, and no remarkable arthrosis in the first MP joint for efficient correction in the deformity.^[1-5] All patients participated in the study were in compliance with these criteria except the four cases, who had a hallux valgus pain over 30 degrees and intermetatarsal pain over 15 degrees; both cases also complained about pain as well as correction loss after the follow-up.

Among the current distal metatarsal osteotomies, the Lindgren-Turan osteotomy is distinct since it enables the correction of lateral deviation and rotation simultaneously, it allows early activity by means of a stable osteosynthesis, and it is an easy-to-use technique.^[6, 9, 16-19] The soft tissue interventions on the first MP joint are criticized for limited range of

motion developed after the surgery and formation of an avascular necrosis at the head of the metatarsal.^[1, 5, 19] The MP joint capsule was not opened and the extracapsular anastomoses, which are important for the nutrition of the head of the metatarsal (no comma), were not damaged in any of the patients. Furthermore, there was no limitation in the range of motion of the first MP joint after the follow-up period. However, it has been reported that the range of motion was limited in cases in which soft tissue loosening was performed together with the Chevron osteotomy and distal osteotomy.^[4, 10, 20]

The major complications reported with the Wilson-type distal metatarsal osteotomy are the angle to the dorsal, instability of distal fragment and excessive reduction in the extent of the metatarsal.^[5] In the Lindgren-Turan osteotomy, the instability and angle to dorsal are avoided by implementing a stable osteosynthesis by screw; and the reduction is offset by decreasing the osteotomy gradient from 45 degrees to 30 degrees.^[6] In our study, the mean reduction (3.2 mm) in the extent of the metatarsal was considered within limits.^[1, 9, 18, 19, 21] In the literature, there exists a consensus that the angle of hallux valgus and of intermetatarsal are satisfactorily corrected, and successful functional results are achieved by the Lindgren-Turan procedure.^[6, 9, 17-20] In our study, both the postoperative and the follow-up angles of the hallux valgus and intermetatarsal were significantly corrected; the pain scores were significantly reduced, and 91.7% of the patients expressed excellent-good results in functional aspect. In cases where the distal metatarsal osteotomy is applied where advanced hallux valgus is prevalent, it can cause reversion of the deformity.^[14, 21-23] Fokter et al.^[22] reported a 33% reduction in the excellent results at 2-11 years follow-up of patients who underwent Mitchell osteotomy. Canale et al.^[14] evaluated the results of cases with a mean 15 years follow-up after Mitchell osteotomy, and they indicated that the reversion of the deformity played a part in the unsuccessful-poor results. In our study, there was also a reduction in the correction, although less, in the hallux valgus and intermetatarsal angles of the patients with a mean 26.5 months, and a relation was found between the deterioration of the functional results and the correction loss in two patients with advanced deformity.

In conclusion, the Lindgren-Turan procedure enables a full and stable correction of the deformity in hallux valgus patients with moderate deformity. It is a method of choice with its technical ease, satisfactory functional results, and shorter period to return to former daily activities, and high patient satisfaction.

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