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Efficacy of proximal crescentic, supination osteotomy in the surgical treatment of moderate and severe hallux valgus deformity

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Abstract

Proximal crescentic, supination osteotomy is used to treatment of the hallux valgus correction, and favorable outcomes has been reported. This retrospective study aimed to evaluate the radiological results, patient satisfaction and recurrence rate in patients underwent proximal crescentic supination osteotomy using headless screws. Between 2013 and 2019,in our clinic, patients whose treated with proximal crecentic, supination osteotomy due to mild to moderate hallux valgus deformity included the study. Radiographic parameters and functional scores were evaluated preoperatively, at six weeks, six months and annually. The functional evaluation was based on the American Orthopedic Foot and Ankle Society scale score(AOFAS). The mean age of the patients included in the study was 53.3 ± 11.6, F: M 17: 3. The mean AOFAS scale improved significantly from a preoperative average of 38,5 to a postoperative average of 92,8 ($p<.005$). The mean intermetatarsal angle and hallux valgus angle decreased from preoperatively 39,6±9,7 ° and 16±2° to 8,6±2,5° and 6,6±2° postoperatively, respectively ($p<.005$).In conclusion, proximal crescentic, supination osteotomy, using headless screws, performed to obtain the normal anatomy of the foot express good anatomical and clinical results. Cases with patient dissatisfaction were patients with non-compliance to treatment and recurrences.

Keywords: Hallux valgus, metatarsal osteotomy, supination osteotomy, toes

Introduction

Hallux valgus is a complex deformity and includes various pathologies such as varus deformity of the first metatarsal, enlarged medial side at the distal end of the metatarsal, bunion, lateral deviation of the thumb, static subluxation of the first metatarsophalangeal joint (MTPJ)and subluxation of sesamoids [1, 2]. Women tend to be affected more than men [3]. Factors affecting the development of hallux valgus include achilles tendon contracture, diffuse joint laxity, hypermobility of the first metatarso-cuneiform joint, neuromuscular disorders (cerebral paralysis, etc.), and narrow shoes [4-6].

Classification of the severity of hallux valgus was done by using Mann's criteria and is essential in terms of planning treatment [1]. The two main measurement, and the position of a medial sesamoid are assessed by weight-bearing radiographs. These measurments are the hallux valgus angle and the intermetatarsal angle, whereas the hallux valgus angle is generally below 15 degrees [2], the intermetatarsal angle is usually below nine degrees [7]. In some classifications, angular values show slight differences but commonly have been defined as mild, moderate and severe deformity [6]. The sesamoid position was evaluated by measuring the position of the medial sesamoid relative to a longitudinal line bisecting the first metatarsal shaft and was classified as grade 1 -7. Here, 1 and 4 degrees was considered normal [2, 8-10]. The purpose of this retrospective study is to review the results of all patients who underwent proximal first metatarsal crescentic supination osteotomy with distal soft tissue releases in our clinic.

Materials and Methods

This study was approved by the Institutional Review Board (IRB: 2020-113. Ethical Committee of Ministry of Health ,University of Health Science, Antalya Research and Education Hospital.) of our hospital, and informed consent was obtained from all patients. Proximal crescentic supination osteotomy was performed in patients with moderate and severe hallux valgus who did not respond to conservative treatment between 2013 and 2019. The number of patients included in the study was 20, and three were male, and 17 were female. The average age was 53,3±11,6 years old. Weight-bearing anteroposterior and lateral foot radiographs and clinical American Orthopedic Foot and Ankle Society scale score(AOFAS) were evaluated preoperatively and postoperatively.

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Hallux valgus angle, the intermetatarsal angle and the position of medial sesamoid relative to the longitudinal axis of the first metatarsal were evaluated on X-rays.

Surgical techniques

According to the technique described by Okuda R et al. U-shaped metatarsophalangeal(MTP)joint capsulotomy (based distally) was performed, followed by bunionectomy [8]. Through a 2 cm second incision in the dorsal first web space, the skin and subcutaneous soft tissues are incised to expose the abductor hallucis tendon. The adductor hallucis tendon were transected at the attachment site. The transverse metatarsal ligament is released carefully so as not to injure the neurovascular bundle located directly under this ligament. The lateral capsule is perforated with several punctures to allow for lateral capsular correction of the hallux valgus deformity. A third incision was made at the base of the first metatarsal, and crescentic osteotomy was performed 1.5 cm distal from the metatarsocuneiform joint. Gentle axial traction is applied by pulling on the great toe, and then supination stress is manually applied to the great toe, and temporary fixation was performed with K- wire, under fluoroscopic view. Permanent fixation was then performed with headless screws. In the first incision, the U-shaped capsule was repaired, and all sites were closed.

After surgery, short leg plaster stab fixation was applied over the foot to maintaining the positioning of the great toe and reduction of postoperative swelling. Patients are followed up with no–weight-bearing for five weeks, full weight-bearing on the anterior foot region was permitted at eight weeks after surgery.

Statistical analyses

All results were presented as means ± standard deviation (SD). Differences between preoperative and postoperative data were analyzed with student t-test. Statistical analyses were calculated using GraphPad Prismversion 7.04 for windows (GraphPad Software,San Diego California, the USA). $P<0.05$ was considered significant.

Results

Pain, function and alignment on the AOFAS scale were significantly improved postoperatively. Mean total score improved from 38,5 to 92,8. Preoperative mean hallux valgus angles decreased from 39.6 ± 9.7 degrees to 8.55 ± 2.5 degrees ($p <.0001$), and preoperative intermetatarsal angle decreased from 16 ± 2 degrees to 6.6 ± 1.6 degrees($p <.0001$). Statistically, significant improvement was achieved. Well-positioned sesamoids (grade 3 or less) were obtained in all patients postoperatively, with a complete Hallux rotational correction (Figure 1).

Preoperative AP weight-bearing radiograph showing an IMA of 19°, an HVA of 42°, and a medial sesamoid position of grade VII. (B) Lateral weight-bearing radiograph. (C) Dorso-plantar radiographs made one year postoperatively showing a hallux valgus angle of 12°, an intermetatarsal angle of 5°, a grade III position of the medial sesamoid, and angular lateral edge of the first metatarsal head (D) At 12-month follow-up, a lateral weight-bearing radiograph showing no dorsiflexion deformity.

In three patients (15%) at the fourth-week follow-up, hallux valgus angle was measured above 20 degrees, and it was accepted as recurrence.

Figure 1. Graphical relationship between the number of days of hospitalization in the intensive care unit and drug costs in SE patients

Discussion

Although many surgical techniques for correcting hallux valgus deformity have been described in the literature, there is very little method to correct all deformity components at the same time. Complications should be taken into consideration when choosing the appropriate surgical plan. The complication rate of hallux valgus surgery is between 10% and 55% [11, 12]. One of them is recurrence. Recurrence rate in hallux valgus surgery ranges from 2% to 16% [13-15]. The recurrence of hallux valgus may occur from various causes, including improper patient selection, inappropriate technique, rheumatoid arthritis, gout, hypothyroidism, joint laxity, neuromuscular diseases, diabetic neuropathy, Parkinson's diseases [9, 16, 17]. A significant relationship between incomplete reduction of the medial sesamoid and hallux valgus recurrence has been reported [9, 16]. Inadequate correction of the intermetatarsal angle is also a cause of recurrence [18, 19]. In the follow-up after hallux valgus surgery, the fact that the angle of hallux valgus is above 20 degrees is considered recurrence [16]. There was a significant relationship between recurrence and severe hallux valgus. Recurrence rate was 20% in our cases. These were patients with severe hallux valgus deformity. Sesamoid position decreased from grade six to three postoperatively. One of the patients with relapse insisted on wearing narrow shoes, and another patient developed fracture of the metatarsal base during fixation of the osteotomy site with a headless screw was seen. Two patients are known to have familial severe hallux valgus deformity. No recurrence was seen in five diabetic patients. Our results show a similar recurrence rate with X-plate fixation despite headless screw fixation [20].

The small number of patients included in the study is the limited aspect of this study

Conclusion

A significant proportion of patients who underwent proximal crescentic supination osteotomy using self-taping headless screws were satisfied. Recurrence was observed due to non-optimized patient selection and technical defects. Therefore, specific patient selection, rigid fixation, reduction of sesamoids, postoperative shoe modifications and consideration of additional diseases will increase the potential of reaching successful outcomes.

Conflict of interests
The authors declare that they have no conflict of interest.

Financial Disclosure
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Ethical approval
This study was approved by the Institutional Review Board(IRB: 2020-113. Ethical Committee of Ministry of Health ,University of Health Science,Antalya Research and Education Hospital.)

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