Current trends in Hallux Valgus surgical treatment

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Abstract

Aim: The purpose of this study was to evaluate which of the methods (Scarf osteotomy vs. Chevron osteotomy) selected in patients with moderate or severe hallux valgus results in a better correction of hallux valgus angle (HVA) and intermetatarsal angle (IMA).
Methods: In this study there were included 36 patiensts (16 with Scarf osteotomy and 20 with Chevron osteotomy) at the University Clinic of Orthopedics and Traumatology in Tirana, with all surgical options from skin incision, capsular and bunionectomy to bone reorientation. Deformities of patients were classified as mild, moderate and severe according to clinical and radiological findings. The outcomes were measured using radiographic HVA, IMA and distal metatarsal articular angle (DMAA).
Results: No statistical differences were found for the HVA, IMA and DMAA between Scarf and Chevron osteotomy in mild to moderate hallux valgus. In severe hallux valgus, Scarf osteotomy corrected HVA better than Chevron osteotomy, although this group consisted of twelve patients only. Two patients in the Chevron group and three in the Scarf group developed subluxation of the metatarsophalangeal joint.
Conclusion: In patients with moderate and severe hallux valgus the outcomes of Scarf and Chevron osteotomy have no specific differences. Change to IMA angle with the subluxation of the first metatatarsophalangeal joint was evident in some months after operation which were the main cause for insufficient correction. We suggest the use of Scarf osteotomy because it is more beneficial for the correction of HVA and IMA.

Keywords: Chevron osteotomy, hallux valgus, intermetatarsal angle, orthopedics, Scarf osteotomy, surgical treatment.

Introduction

Hallux valgus is a health condition that affects adults and its incidence increases with age. In orthopedic practice, Scarf osteotomy is considered one of the most effective techniques for correction of hallux valgus, especially in the last two decades (1). This type of corrective intervention is widely used in Europe, especially after continuous improvement and development of osteosyntheses structural materials (1,2). Proximal and distal matatarsal osteotomy technique enables the correction of higher intermetatarsal angle (IMA). On the other hand, use is currently made of Chevron osteotomy technique which is considered a modern procedure for the treatment of hallux valgus, but unlike Scarf osteotomy it has the advantage of intrinsic stability (1-3). In general, radiologic examination of the foot focuses on the hallux valgus angle (HVA), intermetatarsal angle and distal metatarsal angle (DMAA) (1-3). Radiological images enable the definition of some cut-off points for selection of the location where osteotomy will be performed in the distal, proximal or shaft section. IMA points are used in the range between 11-20 degrees for classification of the mild, moderate and severe hallux valgus, but it should be noted that there is no significant difference in the correction of IMA and HVA between tarsometatarsal arthrodesis and distal osteotomy or distal versus shaft osteotomy according to clinical trials in subjects with hallux valgus including not severe deformities (3). It is also important to assess the validity of IMA in preoperative planning.

In many cases, to avoid influence of mild deformities in differences between two techniques (Scarf osteotomy and Chevron osteotomy) (7), it is necessary to include a large number of subjects (4-6). When moderate and severe hallux valgus deformations occur, it is argued the use of aggressive surgical techniques to obtain a more effective correction of HVA. In the daily practice, clinical and radiological parameters are used to evaluate and justify the application of surgery in order to obtain the best possible results in the correction of hallux valgus. Radiological parameters are also important in assessing the quality of the type of corrective intervention in patients with moderate and severe hallux valgus deformities.

The evidence about the differences between Chevron osteotomy and Scarf osteotomy in Albania is scarce. As a matter of fact, there are no scientific reports informing about this issue to date. Therefore, the aim of this study was to evaluate which of the methods (Scarf osteotomy vs. Chevron osteotomy) selected in Albanian patients with moderate or severe hallux valgus results in a better correction of HVA and IMA.

Methods

This was a case-series study conducted in the period from December 2010 to July 2015. Overall, 36 patients were included in this study (of which, there were three bilateral cases). On the whole, there were 20 cases with Chevron osteotomy and 16 cases with Scarf osteotomy, which were al followed-up for three years after surgical intervention.

Preoperative IMA was used to define the patient groups; mild hallux valgus was defined with IMA of 11-16 degrees, moderate hallux valgus was defined with IMA from 16 to 20 degrees, and severe hallux valgus was defined with IMA from more than 20 degrees.

Clinical assessment procedures and radiological data were considered according to the American Orthopaedic Foot and Ankle Society scores. Radiological evaluation was performed according to standardized procedures, with standard dorso-plantar and lateral foot x-ray with weight bearing. The angle between the first and second metatarsals is between 8 to 9 degrees, usually considered to be the upper limits of normal. The valgus angle of the first metatarsophalangeal joint also is more than 15 to 20 degrees, which is considered to be in the upper limits of normal weight bearing (1,2,5).

HVA was measured as the angle between the line connecting the centre of the base to the centre of the head of MT1 and the line connecting the midpoints of the proximal and distal articular surfaces of the proximal phalanx. The IMA is defined as the angle between the longitudinal axis of MT1 and the line bisecting the distal and proximal diaphyseal portions of MT.

The distal metatarsal articular angle (DMAA) was measured according to standard guidelines. Markers were placed at the most medial and most lateral extent of the metatarsal articular surface. A line was drawn connecting the two markers. Another line was drawn perpendicular to this line, according to the literature. We classified subluxation of the first MTP joint if the lateral articular border of the proximal phalanx passed the lateral articular border of the middle phalanx.

Operations were performed using spinal locoregional anestesia or nerve block anesthesia. Also a tourniquet just above the knee joint was used. The standard approach for Scarf osteotomy was via a medial incision, at the junction of the plantar and the dorsal skin, with its proximal part below the surface projection of the metatarse (1,2,4). The joint capsule and the medial collateral ligament of the MPI joint were incised horizontally at the line of the first incision. The medial aspect of the metatarsal head was exposed. The medial eminence of the metatarsal head was partially resected. From an additional small dorsal interdigital approach, the lateral capsule was released longitudinally above the lateral sesamoid, leaving the plantar plate and the adductor tendon intact. The sesamoids were then mobilized trying to turn them back to the anatomic position. In preparation for the three osteotomy cuts, two guiding 1.2-mm K wires were inserted at the corner points of the planned SCARF cut as an entry point of the proximal pin averaged 1 cm distal to the first metatarsal medial cuneiform joint line, over the concavity of the inferior aspect of the metatarsal at the junction of the plantarinferior to the medial aspect. The entrance point of the distal pin crossed the metatarsal head 5 mm proximal to the dorsal cartilage surface in the dorsal to the medial aspect. The translation is greater for larger IM angles. For maximal stability of the osteotomy after translation, it is necessary to orient the proximal and distal osteotomy cut strictly parallel to each-other. Translation and lowering was indicated for hallux valgus with intermittent metatarsalgia or a deficit of the first metatarsal head in weight-bearing. The osteotomy was modified by directing the orientation of the K wires. Translation and shortening of the first metatarsal was performed. Shortening was obtained by increasing the obliquity of the anterior and posterior cuts to the longitudinal axis of the second metatarsal. Additional shortening was indicated in severe forefoot deformity with luxation of the lesser toes at the metatarso-phalangeal joints (1,2). Translation and lengthening were indicated in cases with short first metatarsal combined with metatarsalgia. Fixation of the osteotomy was achieved using two small cannulated bicortical compressive screw of steel or titanium material. A medial capsulorraphy was performed to secure soft-tissue realignment.

The Chevron osteotomy was described first by Corless in 1976 as a modification of the Mitchell procedure to correct the bunion associated with mild-to-moderate meta-tarsus primus varus. The procedure consists of two parts: correction of metatarsus primus varus by a V-shaped osteotomy in the sagittal plane through the metatarsal head and neck, followed by lateral shifting of the metatar-sal head and trimming of the proximal fragment. In our study, this was performed through a medial incision centered over the first metatarsophalangeal joint (MTPJ1) (6,7). The dorso-medial cutaneus nerve was protected. The medial capsule was opened longitudinally and a strip of capsule was excised. The medial eminence of the first metatarsal head was removed. A trans-articular transverse lateral release was performed until the proximal phalanx was in line with MT1. A 60-

degree V-osteotomy centered in the first metatarsal head was performed; the capita fragment was displaced laterally. The osteotomy was provisionally secured with a percutaneous K-wire. After completing the osteotomy, the distal fragment was displaced laterally in order to reduce the intermetatarsal angle.

Lateral displacement was achieved by pushing the distal fragment laterally while holding the proximal fragment of the first metatarsal in place. The final osteosinthesis was achieved using a cortical steel or titanium screw.

Results

There was significant improvement in correction of the HVA and IMA in Scarf osteotomy and Chevron osteotomy in patients with mild, moderate and severe hallux valgus. In mild and moderate hallux valgus, pre- and postoperative improvement of HVA and IMA between scarf and chevron osteotomy differences did not reach statistical significance. The severe hallux valgus group consisted of twelve patients; a statistically significant difference was reached in favor of Chevron osteotomy in postoperative HVA and the correction of HVA. Scarf osteotomy resulted in a better correction of IMA; yet, this finding was not statistically significant.

All 36 cases of moderate and severe hallux valgus had non-congruent joints preoperative. The cases with preoperative congruent joints were not overcorrected. Of the 36 cases, eight cases developed recurrence of hallux valgus, with an average HVA of 31 degrees, because of dislocation of the MTPJ1 after initial adequate correction. Three of these patients belonged to the Chevron group and all were preoperative classified as moderate hallux valgus. Five of these patients were in the Scarf group, two cases (one of them was 71 year-old), had preoperative severe and five moderate hallux valgus. The remaining cases of the moderate and severe group had an average postoperative HVA of 17 degrees with congruent joints. For patients with recurrence we proposed revision surgery, which they were not inclined to undergo because it was reached a clinically acceptable reduction of pain after the first operative intervention.

As observed in AOFAS scores, no differences between Scarf and Chevron osteotomy were found. In comparison with other studies, the number of patients with increased pain with Scarf osteotomy increased from four to seven patients (of these, six were mild and one case was moderate). Seven patients found that recovery after surgery was quicker in the foot corrected by Chevron osteotomy. However, neither radiology nor AOFAS detected any clinical differences during the follow-up period.

Discussion

This study was carried out to evaluate patients with moderate or severe hallux valgus. Our findings indicate that, overall, Scarf osteotomy results somehow in a better correction of HVA and IMA as compared to Chevron osteotomy. Nevertheless, in patients with moderate and severe hallux valgus, no differences were found between Scarf osteotomy and Chevron osteotomy. In our study, we found no differences between Scarf osteotomy and Chevron osteotomy for the correction of HVA and IMA in patients with moderate and severe hallux valgus. Our findings are consistent with several randomized controlled trials reported in the international literature. However, this is our first study which compared distal versus shaft osteotomy in patients with mild, moderate and severe hallux valgus. Patients with severe hallux valgus experienced a better correction with Chevron osteotomy than patients who received Scarf osteotomy, although a group of twelve patients is too small for definitive conclusions. In any case, Scarf osteotomy was expected to correct moderate and severe hallux valgus better (3,8). Combined

Scarf osteotomy with open lateral release and Akin osteotomy is possible in selected cases (4). These additional operative procedures are considered more important in obtaining results than the type of osteotomy. In cases with a wide metatarsal shaft, more translation could be achieved with the Scarf osteotomy; a wide subcapital fragment was seen more often, which allowed more translation in Chevron osteotomy. In Scarf osteotomy, rotation of the distal fragment is possible; this allows more correction of the distal fragment with a small increase in distal metatarsal articular angle. This was performed in a part of the moderate and severe cases. We could not find an influence of the refining technique in these cases. Clinical improvement between patients who received Scarf or Chevron osteotomy did not change. Recovery was between six weeks to six months. The extra-soft tissue damage in the Scarf osteotomy seems small in comparison to the Chevron procedure. During the follow-up period, no radiographic or clinical significant differences were found in our study. More extensive surgery should be taken into consideration in preoperative planning if severe cases are contingent to treatment. In previous studies, complications between both procedures have been reported to be equal. Avascular necrosis occurring in the Chevron group in the early phase, as referred in other studies (6,7), was not evident in our study. By refining our technique this complication could be intercepted by taking care of plantar vasculair blood supply. The lower incidence of complications is now in favor of the Chevron group. The IMA is acknowledged as an important factor in the prediction of the possible reduction of the hallux valgus deformity and, therefore, it is used as a parameter for classification by algorithms. In patients with moderate and severe hallux valgus, 90% good correction was achieved with Scarf osteotomy and Chevron osteotomy. In the remaining 10% of the patients with moderate and severe hallux valgus, recurrences occurred in 10% of the circumstances, which corresponds with the international literature (2,3,5). Pain reduction for these patients was acceptable, and more aggressive surgery was indicated. Subluxation of the sesamoid on the plantar anterior X-ray might be an option, although other studies found it less reliable on the X-rays because of rotational deformity. A possible explanation for secondary subluxation could be that transarticular release was insufficient. Hence, it is likely that the lateral sesamoid and the adductor hallucis were not completely released. Patients with moderate to severe hallux valgus and subluxation are usually corrected with shaft or proximal osteotomy including a distal soft tissue procedure (DSTP). However, this concerns short-term follow-up, and patients with subluxated joints might be predisposed to artritis. It is clinically relevant to lower subluxation rate (19% in moderate and severe hallux valgus in other studies), without exposing patients to excessive operative procedures (81% in the same group), because of possible complications like hallux varus and CRPS. The other possibility for secondary subluxation could be that the biomechanical axis was insufficiently restored, because translation of the distal fragment in distal and shaft osteotomy was limited. Another reason was the insufficient osteosinthesis of the ostheotomy. Alignment of the first ray was restored after surgery, and cases of recurrence occurred after three months of follow-up. A proximal osteotomy does allow more translation and rotation of the distal fragment, although recurrences of hallux valgus of 4% and more are still described in these procedures. Another option would be to perform an Akin osteotomy to enhance alignment in the proximal phalanx. Knowledge and guidelines regarding hallux valgus correction surgery did improve quality of correction (9).

In our study IMA was correlated with HVA outcome; however, cut-off points were less accurate to predict cases that develop recurrences. Radiological parameters used in algorithms provide insight of factors to consider in preoperative

planning of hallux valgus surgery. However, there is still a lack of evidence about the most suitable cut-off point and the preferable operative procedure. Operative strategy should provide an optimal balance between adequate correction and prevention of recurrences. Possible complications of more aggressive surgery should be considered carefully with their possible benefits for achieving a better correction. A downside of more extensive foot procedures seems the slow recovery because of increased swelling and pain. Further research is necessary to improve identification of patients that are predisposed to secondary subluxation. An optimal operative strategy should be evidence-based, should provide information on the structures that need to be released laterally, on the type of osteotomy and on the necessity of an Akin osteotomy.

In conclusion, among patients with moderate and severe hallux valgus, the results of Scarf osteotomy and Chevron osteotomy differ slightly. Subluxation of the MTPJ1 was the main cause for insufficient correction. We favor the Chevron osteotomy because it is less invasive, without sacrificing correction of HVA and IMA. The rate of CRPS in the scarf osteotomy group did raise concern. The use of IMA to predict recurrences was limited.

Conflicts of interest: None declared.

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