Section: Orthopaedics

Original Research Article

A PROSPECTIVE STUDY OF IDIOPATHIC HALLUX VARUS DEFORMITY TREATED WITH 1ST METATARSOPHALANGEAL ARTHRODESIS BY DORSAL PLATING

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ABSTRACT

Background: Hallux varus is medial deviation of the great toe. Great toe plays an important role in gait cycle. So, any deformity of the great toe affects the gait cycle of the person. EHL tendon transfer in case of flexible deformity was found to be successful whereas for rigid hallux varus deformity treatment options include arthroplasty and arthrodesis. In this study we have done 1st MTP arthrodesis using dorsal plating. Very few studies have been conducted to assess the function outcome after this procedure in hallux varus deformity patients, hence the present study was undertaken in view of this. The objective is to assess the functional outcome of idiopathic hallux varus deformity treated with 1St MTP arthrodesis using Dorsal plating technique using AOFAS score.

Materials and Methods: A cross-sectional study was conducted on 23 patients presenting with complaints of deformity of great toe at orthopedics OPD of RajaRajeswari Medical College and Hospital for a period of 2 years. Confirmation of hallux varus deformity was done by the measurement of intermetatarsal angle on weight bearing AP and lateral foot radiographs. Follow up was done at 6 weeks, 3 months and 6 moths and each visit AOFAS and VAS scores were assessed along with measurement of intermetatarsal angle and hallux varus angle at 6th month. Statistical analysis is data collected was compiled and entered into Microsoft excel sheet and was analyzed using SPSS software version 26. Descriptive data was expressed using frequency, percentages, mean and standard deviation. Comparison of mean scores was done using unpaired student t test. P was considered significant at <0.05.

Results: Inter metatarsal angle significantly decreased from pre-operative to post-operative period and hallux varus angle significantly increased from pre-operative to post-operative period (P<0.05) VAS improved from pre to post operative period with a significant reduction in the score at 6tm month follow-up visit. Mean AOFAS significantly increased from pre-operative to post-operative period (P<0.05)

Conclusion: Outcome scores in the study indicate that first MTP joint arthrodesis with a pre-contoured dorsal titanium locking plate is both reliable and reproducible with a very high bony union rate and demonstrates an excellent functional outcome.

Keywords: Hallux varus, idiopathic, orthodesis, great toe, deformity, functional outcome.

INTRODUCTION

Great toe plays an important role in gait cycle. According to Stokes et al,[1] in 1979 about 40% of bodyweight is imposed on the toes in the final stages of forefoot contact and in that most of this is on the great toe. Hutton and Dhanendran,[2] (1979) using dynapod recorded that load carried by the great toe is more than twice that of the other toes. So, any deformity of the great toe affects the gait cycle of the person. Hallux varus is medial deviation of the great toe. It can be congenital or acquired. Idiopathic hallux varus is uncommon whereas acquired hallux varus deformity occurs frequently after either surgical procedure or trauma in which the lateral collateral ligament of the hallux is ruptured.[3] Hallux varus deformity may occur after a distal soft tissue or McBride type of bunionectomy,[4] it is also observed after chevron, Mitchell, Keller and Lapidus procedures.[5] Incidence of idiopathic hallux varus in not known in the literature.[6]

There are various surgical options available based on the flexibility of the deformity. Johnson and Spiegl recommended Dynamic correction using tendon transfers - EHL tendon transfer to the base of proximal phalanx which was proved to be successful in case of flexible deformity.[7] In case of rigid hallux varus deformity, the treatment options available are– arthroplasty and arthrodesis.[8] Arthrodesis of the first metatarsophalangeal (MTP) joint is a valuable procedure for treatment of various abnormalities of the great toe.[9-13] Common indications include severe hallux valgus, hallux rigidus, inflammatory arthritis, neuromuscular disorders, and failure of other first MTP joint procedures.[14] In our study we have done 1st MTP arthrodesis using dorsal plating.

The purpose of our study was to assess for Functional outcome of idiopathic hallux varus deformity treated with 1st MTP arthrodesis using Dorsal plating technique.

Objectives: To assess the functional outcome of idiopathic hallux varus deformity treated with 1St MTP arthrodesis using Dorsal plating technique using AOFAS score.

MATERIALS AND METHODS

A cross-sectional study was conducted on 23 patients presenting with complaints of deformity of great toe at orthopedics OPD of Raja Rajeswari Medical College and Hospital for a period of 2 years i.e., from June 2022 to June 2024.

Patients presented who presented with complaints of deformity, pain over the great toe region, decreased range of motion (ROM), instability were subjected to clinical examination to assess the stiffness of the metatarsophalangeal (MTP) and interphalangeal (IP) joints for which weight bearing radiograph of the foot -anteroposterior and lateral views were taken. The intermetatarsal angle was measured on AP foot radiographs between the long axes of the 1st and 2nd metatarsal shafts. The normal range of intermetatarsal angle is less than 9 degrees. An increased angle is associated with hallux valgus and a decreased angle is associated with hallux varus deformity. Intersection of longitudinal axis of 1st MT and proximal phalanx is measured for hallux valgus angle. The normal hallux valgus angle is less than 15 degrees. An increase in angle is associated with hallux valgus deformity and a decrease in angle or less than 0 degrees is associated with hallux varus deformity.

Image 1: patient presenting with great toe deformity

Image 2: X-ray-foot AP view

3 patients were excluded from the study as they presented with diabetic ulcers of the foot. Inclusion criteria: Rigid hallux varus deformity and arthritis of the first MTP joint.

Exclusion criteria: Those presenting with diabetic ulcers of the foot.

Sample size: 20

Method of collection of data: After Ethical committee clearance and after obtaining informed consent from the patients, a total of 20 subjects were included as per the inclusion and exclusion criteria for further analysis. Along with the initial standard radiographs and a careful clinical examination, in the pre-operative period patients were also evaluated with American orthopedic foot and ankle society (AOFAS) 100 points Hallux MTP-IP Scale and the VAS scoring system.

Statistical analysis: Data collected was compiled and entered into Microsoft excel sheet and was analyzed using SPSS software version 26. Descriptive data was expressed using frequency, percentages, mean and standard deviation. Comparison of mean scores was done using unpaired student t test. P was considered significant at <0.05.

Surgical procedure:

Image 3: Surgical procedure

Under Aseptic precautions, spinal anesthesia was given and then the patient was made to lie supine and the foot was scrubbed, painted and draped. A dorsal longitudinal incision extending through the MTP joint was made just medial to the EHL tendon. The incision is extended from 5 cms proximal to the PIP joint to 5 cms above the MTP joint. The incision is deepened through the extensor retinaculum. The retinaculum is reflected along with the joint capsule dorso-medially. Extensor tendon is retracted laterally. A complete synovectomy of the MTP joint is performed along with the medial and lateral collateral ligaments transected. Medial eminence is removed with small sagittal saw, using concave and convex reamers the 1st metatarsal head and base of proximal phalanx is freshened by removing all the cartilages. The two curved congruent surfaces are rotated into proper alignment. Position of arthrodesis: 15 degrees of valgus and 15 -20 degrees of dorsiflexion in relation to 1st metatarsal shaft. The hallux is detoriorated so there is no pronation. Using 1.8mm K- wire proximal phalanx and metatarsal shaft is stabilized (temporary fixation). A dorsal 5 holed titanium locking plate is placed on the dorsal aspect of the distal MTP joint and stabilized with bi-cortical screws and then the k- wire was removed. Wound washed and closed in layers, capsule was closed beneath the extensor tendon.

Image 4: instruments (plating) used during surgery

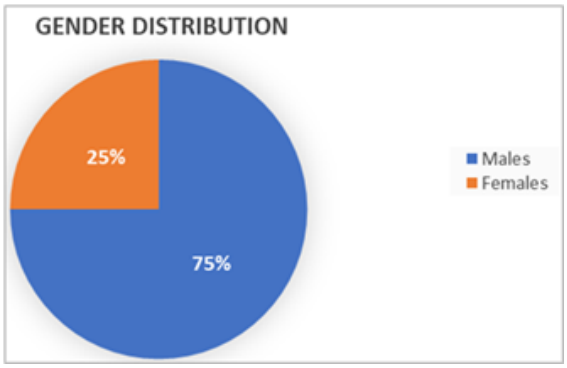
Post op protocol: Toe spica wrap using tape was continued for 6 weeks following surgery. Patients were instructed to bear weight with foot flat and no toe-off in a post operative surgical shoe. They were asked to shift their weight off the first ray and onto the heel and lateral border of the foot for 6 weeks after surgery.

Post op evaluation: All patients were examined at 6 weeks, 3 months and 6 months interval after surgery. They were evaluated radiologically for signs of union and then clinically were evaluated using AOFAS Hallux MTP – IP scale and VAS score. In addition, patients were examined for residual symptoms of hallux varus and complications of treatment.

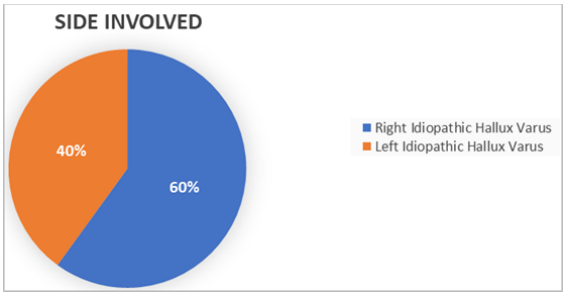
Imaging 5: Follow-up with Xray foot and clinical examination

RESULTS

The study included a total of 20 patients who had presented to the OPD after a mean time of 4 – 5 years following the development of the deformity. Age of the patients ranged from 56 to 70 years with mean age of 62.4+5.12 years. There were 15 (75%) females and 5 (25%) males in the study (GRAPH-1). Idiopathic hallux varus involved right toe (12, 60%) more than the left toe (8, 40%) in the study.



Graph 1: Gender Distribution



Graph 2: Side Involved

In the pre-operative period, mean Inter Metatarsal angle was 6.45+1.6 degrees and hallux varus angle was 21.95+8.20 degrees. Mean AOFAS was 54.65+3.16 and mean VAS score was 6.45+0.75 in the pre-operative period. In the post-operative period, mean Inter Metatarsal angle was 13.35+1.35 degrees and hallux varus angle were 16.44+1.56 degrees. Post

operative Mean AOFAS score at 6 weeks was 70.35+4.67, at 3 months was 80.85+4.70 and at 6 months was 91.7+1.95 mean VAS score was 1.55+0.73 in the post-operative period. At follow-up examinations at 6th month with AP view radiographs, the average change in alignment of the hallux measured (correction) was 5.51 degrees, average change in the Inter Metatarsal angle (correction) was 6.9 degrees. Post operative complications noted were wound dehiscence at around 2 weeks.

Inter metatarsal angle significantly decreased from pre-operative to post-operative period and hallux varus angle significantly increased from pre-operative to post-operative period (P<0.05) [Table 1]. VAS improved from pre to post operative period with a significant reduction in the score at 6tm month follow-up visit [Table 2]. Mean AOFAS significantly increased from pre-operative to post-operative period (P<0.05) [Table 3].

Table 1: Comparison of radiologically measured mean inter metatarsal angle and mean hallux varus angle in pre and post operative period.

Measurement	Pre-operative period (Mean +SD)	Post-operative period (Mean +SD)	P value
Inter metatarsal angle	6.45+1.6	13.35+1.35	<0.0001*
Hallux varus angle	21.95+8.20	16.44+1.56	0.0054*

Table 2: Comparison of mean VAS score in pre and post operative period.

Measurement	Pre-operative period (Mean +SD)	Post-operative period (Mean +SD)	P value
VAS	6.45+0.75	1.55+0.73	<0.0001*

Table 3: Comparison of mean AOFAS in pre operative period with mean AOFAS in post operative period at 6 weeks, 3 months and 6 months

PERIOD	AOFAS
Pre operative period	54.65+3.16
Post operative 6 weeks	70.35+4.67
Post operative 3 months	80.85+4.70
Post operative 6 months	91.7+1.95
P value	<0.001*

DISCUSSION

Multiple studies have been performed for flexible hallux varus deformity and its correction but not much literature is available for Rigid hallux varus deformity and corrective procedures done for it. Our study is based on the 1st dorsal MTP arthrodesis and to assess for the functional outcome following the procedure. Multiple retrospective studies have evaluated the results of 1st MTP arthrodesis but no prospective study was done to evaluate the procedure. Many methods have been developed for achieving union which include – Sutures, Cerclage wire, Kirschner wire, Steinmann pins, screws and plates.[15] Politi et al,[16] demonstrated that dome-shaped reamers used for joint preparation and coupled with dorsal plate and a crossed screw was a most stable construct. Hunt et al,[17] performed a cadaveric study on MTP arthrodesis comparing locking to nonlocking plates and found that locking plates exhibited greater stiffness and also reported higher rate of nonunion with locked titanium plate compared to non-locked stainless-steel plate. In our study we reported no such cases of nonunion with 6 months of follow up.

Fitzgerald et al,[18] reported that increasing valgus at fusion site and Coughlin et al,[19] reported that increasing dorsiflexion at the fusion site would reduce the incidence of interphalangeal arthritis. In this study we used dome shaped concave and convex reamers for the metatarsal head and the proximal phalanx articular surface respectively and we used an 8degree pre-contoured titanium locking plate for achieving final dorsiflexion of the phalanx of about 15 degrees. This helped in clearing the toes off the ground and the patients were able to achieve sufficient toe – off during the post operative period. In our study we wanted to achieve a valgus of 15 – 25 degrees and 15 – 20 degrees of dorsiflexion to achieve optimal function in gait cycle. At the final follow up the Inter metatarsal angle significantly decreased from pre-operative to post-operative period and hallux varus angle significantly increased from pre-operative to post-operative period (P<0.05) The AOFAS score (54.65 v/s 91.7) and VAS score showed significant difference pre – op and post operative period.

In a similar prospective study conducted by Goucher et al.[20] on hallux Metatarsophalangeal Joint Arthrodesis using Dome-Shaped Reamers and Dorsal Plate Fixation but for hallux valgus deformity, hallux valgus angle, Inter-metatarsal angle, AOFAS score and VAS score showed significant difference between pre and post operative period. In a prospective study by Doty et al,[21] on hallux metatarsophalangeal joint arthrodesis with a hybrid locking plate and a plantar neutralization screw: AOFAS hallux MTP joint scores improved from a preoperative mean of 45 to a postoperative mean of 77 (t = 9.9498, df = 46, P < .003) which was consistent with the present study and hallus valgus angle also showed significant improvement. In a

study by Myerson et al,[22] on Hallux Varus Correction Using an Extensor Hallucis Brevis Tenodesis similar findings were observed.

CONCLUSION

In this study, hallux varus angle, Inter-metatarsal angle, AOFAS score and VAS score showed significant difference between pre and post operative period. Hence from this study based on the outcome scores we conclude that first MTP joint arthrodesis with a pre-contoured dorsal titanium locking plate is both reliable and reproducible with a very high bony union rate and demonstrates an excellent functional outcome.

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