

# Results of Dorsal Closing Wedge Osteotomy in Freiberg's Disease

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## ABSTRACT

**Introduction:** Freiberg's disease, the osteochondrosis of the metatarsal seen in our part of the world, usually at late stages, are refractory to the conservative treatment. Objective: The purpose of this study was to evaluate the results of dorsal closing wedge osteotomy and pin fixation besides debridement and synovectomy.

**Material and Methods:** Twenty patients (14 females, 6 Males), mean age 19.3 years; range 14 to 26 years were evaluated and treated by dorsal closing wedge osteotomy and pin fixation besides debridement and synovectomy, between september 2016 to 2018 at our institution. The presenting symptoms were pain on walking or sports, limitation of daily routine activities, footwear problems, cosmetic deformities of forefoot and failed conservative treatment. Three patients had a history of trauma. According to Smillie's classification twelve patients were type IV and eight were Type V. Mean follow-up period was 14.85 months (range 6 months to 24 months).

**Results:** Patients were assessed by the lesser metatarsophalangeal interphalangeal (LMPI) scale by kitaoka et al. At the final follow-up, scoring had changed from (44-66) with an average 54.65 to (76-100) with an average 85.3. There was no case of infection, avascular necrosis, arthritis or pseudoarthrosis.

**Conclusion:** Treatment of Freiberg's disease with dorsal closing-wedge osteotomy shows satisfactory pain relief and improvement in quality of life.

**Keywords:** Freiberg's Disease, Dorsal Closing-Wedge Osteotomy, Metatarsal Head, Osteochondrosis.

dorsal closing wedge osteotomy and pin fixation besides debridement and synovectomy.

## MATERIAL AND METHODS

Study was conducted in Bone and Joint hospital, Srinagar from 2016 to 2018. 20 patients (14 females, 6 males) age group (14-26 years) average 19.3 years that did not respond to conservative treatment such as analgesics, metatarsal bar and splint were admitted for debridement, synovectomy and dorsal closing wedge osteotomy were taken into study from our hospital from sep-2016 to 2018.

Three patients gave history of trauma, usually of minor nature. Patients were assessed both clinically and radiologically using the lesser metatarsophalangeal-interphalangeal (LMPI) scale by kitaoka et al<sup>11</sup> (Table I) and smillie's classification.<sup>10</sup>

Pre-operation score was (44-66) with an average 54.65 and according to the smillie's classification twelve patients were stage IV and eight patients were stage V Freiberg's osteochondrosis. Post-Operative follow-up period ranged from 6 –months to 24-months with an average 14.85-months. Smillie's classification: Five Stages of Freiberg's disease.

**Stage I:** Early fracture of the subchondral Epiphysis.

**Stage II:** Early collapse of dorsal central portion of metatarsal head with flattening of articular surface.

**Stage III:** Further flattening of Metatarsal head with continued collapse of the central portion of articular surface with medial and lateral projection.

**Stage IV:** Loose bodies form from fractures of the lateral projection and separation of the central articular fragment.

**Stage V:** End Stage degeneration arthrosis with marked flattening of the metatarsal head and joint space narrowing.

**Inclusion criteria:** Persistent severe pain that affected walking and daily routine activities and which was not improved by non surgical methods of treatment for more than three months.

## INTRODUCTION

Freiberg's disease, the osteochondrosis of the metatarsal heads is usually found in the dorsal part of second metatarsal head. It presents as painful bony knuckle behind the second toe. It occurs typically during adolescence affecting females more than males (M:F ratio =1:5).<sup>1,2</sup> Osteochondrosis can affect all metatarsal heads, 27% occur in third and 3% in the fourth.<sup>3,4</sup> Bilateral involvement in 6.6% of patients. The exact etiology remains unclear but the multifactorial etiology from a combination of trauma, impaired vascularity, genetic disorder and altered biomechanics is commonly accepted.

Early stage patients are treated conservatively with modification of activities, orthosis, metatarsal bars.<sup>5</sup> Operation is considered when conservative measures cannot relieve the symptoms. Surgical procedures include joint debridement<sup>6</sup>, drilling, metatarsal osteotomies<sup>7,8,9</sup>, joint arthroplasty, elevation of depressed articular fragment and bone graft.<sup>10</sup>

The purpose of this study was to evaluate the results of

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Patient	Sex	Age	Smillie type	Follow-upin months	History of trauma	Pre-op Score	Post-Op Score	Metatarsal Shortening (in mm)	Complications
1	F	16	IV	10	No	54	82	2	None
2	F	21	IV	20	No	60	84	2	None
3	F	24	V	21	Foot sprain	52	80	4	None
4	F	22	V	21	No	64	82	2	None
5	M	14	IV	12	Direct Trauma	44	78	2	None
6	F	17	IV	14	No	51	86	2	None
7	F	16	IV	9	No	50	80	2	None
8	F	20	V	16	Direct Trauma	66	90	13	None
9	F	19	IV	15	No	60	86	2	None
10	M	21	V	18	No	58	76	2	None
11	F	26	V	24	Direct Trauma	64	88	2	None
12	F	23	V	18	No	48	100	3	None
13	M	20	IV	15	No	62	88	2	None
14	F	15	IV	9	Direct Trauma	46	98	2	None
15	F	18	IV	12	No	54	86	3	None
16	M	17	IV	8	Foot Sprain	50	82	2	None
17	F	14	IV	6	No	46	84	2	None
18	M	25	V	24	No	60	86	4	None
19	M	22	V	16	No	56	80	3	None
20	F	16	IV	9	No	48	90	2	None
Average		19.3	12 IV 8 V	14.5		54.65	85.3	2.4	

Table-1: Clinical outcome

**Exclusion criteria:** A pre existing deformity in the second toe (hallux valgus deformity or malunion). A medical co-morbid disease that prevent surgical intervention. Previous toe pathology or surgery (infection, tumour, etc).<sup>12</sup>

#### Operative Technique

Operation was done under regional anesthesia with patient placed supine. A tourniquet was applied. A dorsal incision was given on the midline of the metatarsophalangeal joint. The extensor tendons were retracted laterally. The joint was debrided, any loose bodies or hypertrophic synovium were removed. The lesion on the articular surface was excised, followed by a dorsal closing wedge osteotomy over the distal normal metaphysis with sufficient bone removal depending upon the size of lesion. The Metatarsal head was rotated dorsally and proximally so as to bring the healthy plantar part of the metatarsal head in to articulation with proximal phalanx. The osteotomy site was fixed with two small K wires (1.5mm). Some osteotomy's which were rotationally stable were fixed with single thick (2.5mm) K-wire. Then the joint capsule was sutured and the skin incision closed.

**Postoperative care:** The foot was immobilized in a short leg walking cast for six weeks, then the cast and pins were removed, soft shoes were advised and running and strenuous activities were avoided upto 8-weeks.

**Postoperative assessment:** Patients were assessed clinically using (LMPI) scale by kitaoka et al and radiologically (anteroposterior and oblique) foot x-rays for joint status and healing of osteotomy site.

#### RESULT

Radiologically solid healing of all osteotomies was observed at an average of 10 weeks (range 8-16 weeks). There was no evidence of displacement, osteolysis, sinus formation or progression of osteonecrosis at the final follow-up.

Scoring system at the final follow-up scoring has changed from (44-66) with an average 54.65 to (76-100) with an average 85.3. Pain relief was complete and all were able to do daily routine activities. Loss of MTP joint passive flexion was 15 Degree (range 0-30degree) and loss of MTP joint passive extension 10degree (range 0-30degree) with no gait disturbance. The metatarsal bone was shortened by 2.4mm (range 2-4mm). There was no complaint of pain transfer to the adjacent metatarsals. There was no case of infection, avascular necrosis, arthritis or pseudo arthrosis. (Table 1)

#### DISCUSSION

Freibergs disease is fourth most common osteochondrosis exceeded by kohlers disease, panners disesse and sever's disease. Previously the etiology was attributed to trauma, but later research shows that trauma has less significant role. Conservative treatment can be applied at the earlier stages of the disease. Dorsal closing wedge osteotomy was done on late stages of disease (Smillie's stage III, IV, and V). Many different surgical methods have been devised, like osteochondral plug transfer, metatarsal neck shortening osteotomy and fixation with a mini T-plate, arthroscopy, or arthroplasty but dorsal wedge osteotomy has stood the test of time. Dorsal closing wedge osteotomy was first applied by Gauthier and Elbaz<sup>7</sup> in 1979.

In order to achieve good articulation between the metatarsal

head and the proximal phalanx base, we did joint debridement and gentle soft tissue dissection to avoid aseptic necrosis. Osteotomy was done through distal metaphysis with normal cancellous bone. The osteotomy site was fixed with two small K-wires (cross-pinning). Some osteotomies which were rotationally stable were fixed with single thick K-wire. Young patients had greater improvement in score in Kitaoka et al<sup>11</sup> scoring system in our study as was seen by Bruno S Pereira et al.<sup>13</sup> Gauthier and Elbaz<sup>7</sup> in their study on 53 patients treated by dorsiflexion osteotomy found only one patient with persistent pain.

Chao and co-workers<sup>12</sup> reported two poor results from thirteen patients with all stages of Freiberg's disease who were treated with dorsal closing wedge osteotomy.

Lee et al<sup>14</sup> reported one delayed union among 12 patients who were treated with dorsal wedge osteotomy.

Capar et al<sup>9</sup> reported poor results in two patients among 19 patients who were treated with dorsal wedge osteotomy.

We observed an average loss of 15 degree in flexion and an average loss of 10 degree in extension. But this loss had not resulted in any loss of ability to perform daily routine activities like walking or running.

## CONCLUSION

Dorsal closing wedge osteotomy of metatarsal neck aided with synovectomy, thorough debridement of lesion gives good results in Freiberg's disease. Fixation of osteotomy site with K-wires provides adequate stability. Thorough debridement of joint restores congruity of the metatarsophalangeal joint. The operative technique is simple, less costly, little operative complications and results are very good.

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