

## Treatment of Bilateral Preaxial Polydactyly with Second Digit Ray Amputation and Medial Cuneiform Open Wedge Osteotomy

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### Abstract

**Introduction:** Congenital polydactyly is an autosomal dominant deformity inherited by one generation from another the most commonly cited classification scheme by Wessel which, does not include this particular anomaly (tarsal coalition). In addition, there has been only reference to this type of polydactyly with coalition in hand in the literature. We could classify our case in main type VI but propose subdivision A- not tarsal coalition B-With tarsal coalition.

Medial finger might be hallux even if it is hypoplastic, may disrupt the plantigrade structure of the foot and cause ulcers in the plantar region caused by pressure changes. Tarsal coalitions are frequently seen in preaxial.

**Material and Method:** The patient was admitted to the outpatient clinic with a complaint of inability to put on shoes. His both feet had six toes each. In his radiological examination, extra second digit sprouting from preaxial, arising from medial cuneiform and hallux varus deformity were found in medial. Duplicated thumbs are almost similar, medial thumb was smaller or hypoplastic. Medial finger decided to as Hallux after radiologic and functional investigation.

The treatment is planned that second digit ray amputation and residual hallux varus deformation realigned to normal anatomic relationship with medial cuneiform open wedge osteotomy while the 1<sup>st</sup> intermetatarsal Linsfranc joint relation was restored. Supero-lateral part of medial cuneiform was continue second digit metatarsal bone than ray amputation extended to medial cuneiform. Open wedge osteotomy performed on medial cuneiform and first ray realigned, reduced to angel and linsfranc level metatarsal widening reduced. Moreover, soft tissue procedure was performed (transfer of the adductor and flexor attached tendon to the distal of the 1<sup>st</sup> metatarsus and with lateral capsuloraphy. (Plantar fascia and protected foot incised only dorsally and plantar region as an intact. Foot incised only dorsally was fixed with one cortical screw and short leg was fixed in plaster for six weeks. At week six, plaster was removed.

**Conclusion:** Treatment of congenital deformities like polydactyly at an early age may not always provide positive outcomes. A better clinical-radiological assessment should be made for such deformities. Moreover, They should be treated with a very good preoperative planning before reconstruction. It may be useful to wait for the adolescence period or completion of bone development in these cases like the one in our study.

In this study we describe a method of to make right decision to choose right finger amputation in order foot biomechanics, anatomical relationship of joints. The choice of amputation order in pre- axial polydactyly, as well as the advantages of ray amputation over pre-axial or post-axial ray amputation are discussed. The presence of tarsal coalition could be affecting this decision indicates the presence of a new deformity not found in the existing classifications, and a new classification item has been proposed.

**Keywords:** Polydactyly; Ray Amputation Foot; Tarsal Coalition

## Introduction

Congenital polydactyly is an autosomal dominant deformity inherited by one generation from another. Such deformities are usually treated at early ages [1,2] whereas they are often observed at military service second decade of age in Turkey due to social reasons. The case included in this study was a twenty-year-old soldier, treated in 1998 at Erzurum Mareşal Çakmak Hospital and followed up for 20 years.

## Case Presentation

The patient was admitted to the outpatient clinic with a complaint of inability to put on shoes. His both feet had six toes each. In his radiological examination, extra second digit sprouting from preaxial, arising from medial cuneiform and hallux varus deformity were found in medial. Duplicated thumbs are almost similar; medial thumb was smaller or hypoplastic. Medial finger decided to as Hallux after radiologic and functional investigation.

The treatment is planned that second digit ray amputation and residual hallux varus deformation realigned to normal anatomic relationship with medial cuneiform open wedge osteotomy while the 1<sup>st</sup> intermetatarsal Linsfranc joint relation was restored. Supero-lateral part of medial cuneiform was continued second digit metatarsal bone than ray amputation extended to medial cuneiform. Open wedge osteotomy performed on medial cuneiform and first ray realigned, reduced to angle and linsfranc level metatarsal widening reduced. Moreover, soft tissue procedure was performed (transfer of the adductor and flexor attached tendon to the distal of the 1<sup>st</sup> metatarsus and with lateral capsulorraphy [3-6]. Plantar fascia and protected foot incised only dorsally and plantar region as an intact. Foot incised only dorsally was fixed with one cortical screw and short leg was fixed in plaster for six weeks. At week six, plaster was removed. Six months later, due to the relapse of hallux varus, metatarsophalangeal joint medial relaxation was added to the soft tissue procedure was. The patient could put on his shoes without any problem at year one and it was found out that he got his medial screw removed at another center after three and twenty years.

## Discussion

Boutros., et al. [6] reported that new deformities likewise our unusual case and new classification offered instead of the most

commonly cited classification scheme by Wessel which, does not include this particular anomaly (tarsal coalition) [7]. In addition, there has been only reference to this type of polydactyly with coalition in hand in the literature [7,8]. We could classify our case in main type VI but propose subdivision A-not tarsal coalition B-With tarsal coalition.

In order the Wessel classification of polydactyly preaxial type VI, main point of amputation decision is essential to protect the hallux finger. Removal of the proximal row seems to be easier but not anatomic [9-11].

Medial finger might be hallux even if it is hypoplastic, may disrupt the plantigrade structure of the foot and cause ulcers in the plantar region caused by pressure changes. Tarsal coalitions are frequently seen in preaxial. D'Souza etc al reported that specification of finger formation occurs in leg formation and Hallux formation influenced both dorsal and ventral segmentation that it is possible some coalition.

Usually, the extra-articular relationship in the tarsal coalition is removed in amputation to protect articulation mechanics of foot. In our case, although preaxial polydactyly is duplicated hallux lateral ray in coalition with the medial cuneiform, we detected a medial row to the structure with, which maintains the relationship of the tarsometatarsal joint. That means medial finger define as real Hallux which one should be protected.

In this case with a double thumb structure, the lateral row in the coalition was amputated and the medial thumb in the joint relationship with the cuneiform was preserved. Bacardi., et al. [4] also reported similar biplane osteotomy for realignment residual Hallux varus deformity. However, in order to reduce the varicose deformity and intermetatarsal angle that will develop after the sequence mutation, a queform-closed wedge osteotomy was applied to the 1<sup>st</sup> row [2,3,10,12-16].

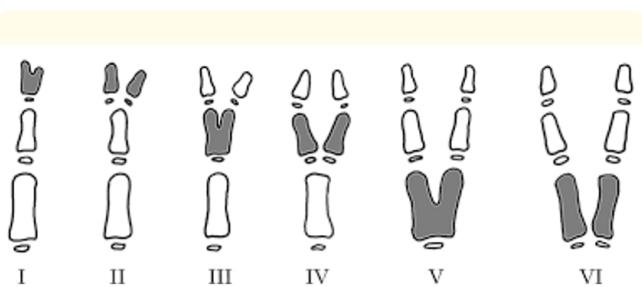
Central ray resections often result in a biomechanically unsound forefoot often accompanied by a cleft wound that is difficult to heal. Narrowing the forefoot enables the surgeon to close the plantar defect primarily, but in our case we have performed only dorsal incision to remove second ray and plantar fascia and skin protected.

Ray amputation is one of favorite treatment for the macrodactyly in children. Intermetatarsal width of forefoot significantly high in macro dactyl and also polydactyly in Children. Ray amputation is clinically more effective and reasonable treatment on polydactyly patient likewise macrodactyle (Kim and at all) present the results of ray amputation surgery and radiologically measured the intermetatarsal width and forefoot area ratios were significantly decreased after surgery. The ray amputation is a clinically effective option which is acceptable to patients. (Fontalis., *et al.* presented that Charcot Neuro-arthropathy (CN) can occur spontaneously in a neuropathic after 1<sup>st</sup> or 5<sup>th</sup> ray leading to increased pressures across the midfoot [17]. Second ray amputatgion protect the plantigrade for mechanic and reduce of CN [8,18-25] Assal M [24] preserving of the First Ray with middle foot ray amputation always better than 1 Transmetatarsal Amputation [19] The preservation of the first ray has functionally benefit with immediate healing without additional flep reconstruction and ischemic for prevented major amputation [5,13,21-27].

Heterotopic ossification (HO) is reported as a common complications of partial ray resection [28]. Its highly related some of risk factors in patients with vascular disease. We have no concern during follow up but patient had indomethacin incase of prophylactic further HO.

Wang HJ., *et al.* reported that Central-type eight-toed polydactyly associated with ipsilateral complex rgluteal agenesis: in our case has no significant deformity concomitant ipsilateral muscle complex [29]. Povlsen-UJ., *et al.* reported cephalic concomitant deformity leucoencephalopathia which is followed, intensive training perform rocking movements on the patient [30,31]. Our patient has no face or skull asymmetry. There are many Anomalies associated with polydactyl even Klippel-Trenaunay syndrome, macro dactylics, muscle or skeletal problems.

Lui TH at all describes new techniques Correction of postaxial metatarsal polydactyly of the foot by percutaneous ray amputation and. Osteotomy [32]. Percutaneous ray amputations of middle segment would not be suitable w with cuneiform osteotomy for realignment of virus deformity of first ray. I agree that more effective for correction of postaxial metatarsal polydactyly of the footas well as presented [6,7,10,12,13].



**Figure 1:** Wessel Classification.

**Figure 2:** Preop AP Foot Radiography.

**Figure 3:** Preoperative Oblique Foot Radiography.

**Figure 4:** Posoperative AP Foot Radiography.

tomical relationship of joints. The choice of amputation order in pre- axial polydactyly, as well as the advantages of ray amputation over pre-axial or post-axial ray amputation are discussed. The presence of tarsal coalition could be affecting this decision indicates the presence of a new deformity not found in the existing classifications, and a new classification item has been proposed.

### Bibliography

1. Bader B., et al. "Polydactyly of the foot". *Orthopedics* 28.2 (1999): 125-132.
2. Vispo Seara. "Hallux varus congenitus". *Zeitschrift fur Orthopadie und ihre Grenzgebiete* 136.6 (1998): 542-547.
3. Falliner A., et al. "Hallux varus congenitus in polydactyly patients". *Zeitschrift fur Orthopadie und ihre Grenzgebiete* 126.3 (1988): 239-249.
4. Bacardi-BE and Frankel-JP. "Biplane cuneiform osteotomy for juvenile metatarsus primus varus". *The Journal of Foot and Ankle Surgery* 25.6 (1986): 472-478.
5. Shahcheraghi GH and Javid M MD. "Treatment of the Mirror Foot with Central Ray Resection: Report of 2 Cases". *Iranian Journal of Medical Sciences* 43.5 (2018): 550-553.
6. Boutros S., et al. "An unusual case of polydactyly of the thumb". *Annals of Plastic Surgery* 41.4 (1998): 434-435.
7. Hyo HS., et al. "New Classification of Polydactyly of the Foot on the Basis of Syndactylism, Axis Deviation, and Metatarsal Extent of Extra Digit". *Archives of Plastic Surgery* 40.3 (2013).
8. Aucourt J., et al. "Congenital malformations of the hand and forearm in children: what radiologists should know". *Seminars in Musculoskeletal Radiology* 16.2 (2012): 146-158.
9. Phelps DA and Grogan DP. "Polydactyly of the Foot". *Journal of Pediatric Orthopaedics* 5.4 (1985): 446-451.
10. Blauth W. "Uber die Behandlung angeborener Fussfehlbildungen [The treatment of congenital foot abnormalities]". *Zeitschrift fur Orthopadie und ihre Grenzgebiete* 127.1 (1989): 3-14.

### Conclusion

Treatment of congenital deformities like polydactyly at an early age may not always provide positive outcomes. A better clinical-radiological assessment should be made for such deformities. Moreover, They should be treated with a very good preoperative planning before reconstruction. It may be useful to wait for the adolescence period or completion of bone development in these cases like the one in our study.

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11. D'Souza D., et al. "A polydactylous human foot with 'double-dorsal' toes". *Journal of Anatomy* 193 Pt 1.1 (1998): 121-130.
12. Gianfortune P., et al. "Ray resections in the insensitive or dysvascular foot: a critical review". *The Journal of Foot and Ankle Surgery* 24.2 (1985): 103-107.
13. Bulut M., et al. "Ray amputation for the treatment of macrodactyly in the foot: report of three cases". *Acta Orthopaedica et Traumatologica Turcica* 45.6 (2011): 458-462.
14. Chiang H and Huang SC. "Polydactyly of the foot manifestations and treatment". *J Forms Med Assoc* 96.3 (1997): 194-198.
15. Masada K., et al. "Treatment of preaxial polydactyly of the foot". *Plastic and Reconstructive Surgery* 79.2 (1987): 251-258.
16. Meltzer RM. "Polydactyly". *Clinics in Podiatric Medicine and Surgery* 4.1 (1987): 57-62.
17. Fontalis A., et al. "Midfoot Charcot Neuro-arthropathy Precipitated by First or Fifth ray Amputation". *Foot and Ankle Surgery* 27.6 (2021): 673-676.
18. Kim J., et al. "Ray amputation for the treatment of foot macrodactyly in children". *The Bone and Joint Journal* 97-B.10 (2015): 1364-1369.
19. Suh YC., et al. "Is Reconstruction Preserving the First Ray or First Two Rays Better Than Full Transmetatarsal Amputation in Diabetic Foot?" *Plastic and Reconstructive Surgery* 143.1 (2019): 294-305.
20. Shahcheraghi GH MD and Javid M MD. "Treatment of the Mirror Foot with Central Ray Resection: Report of 2 Cases". *Iranian Journal of Medical Sciences* 43.5 (2018): 550-553.
21. Häller TV., et al. "Outcome of Ray Resection as Definitive Treatment in Forefoot Infection or Ischemia: A Cohort Study". *The Journal of Foot and Ankle Surgery* 59.1 (2020): 27-30.
22. Riandini T., et al. "National Rates of Lower Extremity Amputation in People With and Without Diabetes in a Multi-Ethnic Asian Population: A Ten Year Study in Singapore". *European Journal of Vascular and Endovascular Surgery* 63.1 (2022): 147-155.
23. Roukis TS. "Minimum-incision metatarsal ray resection: an observational caseseries". *The Journal of Foot and Ankle Surgery* 49.1 (2010): 52-54.
24. Assal M., et al. "Realignment and extended fusion with use of a medial column screw for midfoot deformities secondary to diabetic neuropathy. Surgical technique". *The Journal of Bone and Joint Surgery* 92.1 Pt 1 (2010): 20-31.
25. Bevilacqua NJ., et al. "The narrowed forefoot at 1 year: an advanced approach for wound closure after central ray amputations". *Clinics in Podiatric Medicine and Surgery* 25.1 (2008): 127-133.
26. Cohen MS. "Thumb Duplication". *Hand Clinics* 14.1 (1998): 17-27.
27. Akn S. "An unusual and nonclassified central polydactyly of the foot". *Annals of Plastic Surgery* 53.1 (2004): 86-88.
28. Boffeli TJ., et al. "Incidence and Clinical Significance of Heterotopic Ossification After Partial Ray Resection". *The Journal of Foot and Ankle Surgery* 55.4 (2016): 714-719.
29. Wang HJ., et al. "Central-type eight-toed polydactyly associated with ipsilateral complex renogluteal agenesis: a case report with 8 years' follow-up". *Journal of Pediatric Surgery* 31.3 (1996): 444-446.
30. Poulsen Kajaer L and Arlien SP. "Locked-in syndrome following cervical manipulation". *Acta Neurologica Scandinavica* 76.6 (1987): 486-488.
31. Sobel E., et al. "Longitudinal epiphyseal bracket: associated foot deformities with implications for treatment". *Journal of the American Podiatric Medical surgery* 4.1 (1987): 57-62.
32. Lui TH. "Correction of postaxial metatarsal polydactyly of the foot by percutaneous ray amputation and osteotomy". *The Journal of Foot and Ankle Surgery* 52.1 (2013): 128-131.