

Supplementary Table 1: Demographic data and results of patients.

Patient number	Sex	Procedure	Age at operation	Follow-up	Type of thumb		Donor side	Appearances		Radiographic Findings		Parental Satisfaction*		
					Manske	JST		2nd/4th Toe	3rd Toe	2nd/4th Metatarsal	3rd Metatarsal	Appearance	Function	
P1	M	NF4MTT	14m	12m	IV	IIID	L	N	N	Synostosis	Synostosis, widening	5	5	
P2	F	NF4MTT	16m	12m	IIIB	IIIC	R	N	N	N	N	5	5	
P3	M	NF4MTT	15m	15m	IIIB	IIIC	R	N	N	N	Lengthening	2	5	
P4	F	NF4MTT	22m	12m	IV	IV	R	N	N	N	N	4	4	
P5	F	NF4MTT	22m	13m	IIIB	IIIC	L	N	N	N	N	4	4	
P6	F	NF4MTT	21m	17m	IIIB	IIIC	L	N	N	Deformity (angulation)	N	3	3	
P7	M	NF4MTT	17m	26m	IIIB	IIIC	L	N	N	Deformity (deviation)	Synostosis	Synostosis	5	5
P8	M	NF4MTT	20m	23m	IIIB	IIIB	L	N	N	N	N	5	5	
P9	M	NF4MTT	22m	21m	IIIB	IIIC	R	N	N	Synostosis, non-union	Synostosis	5	5	
P10	M	NF4MTT	2y7m	14m	IIIB	IIIC	L	Lengthening	N	N	N	4	5	
P11	F	NF4MTT	2y1m	19m	IV	IIID	R	N	N	N	N	3	3	
P12	M	NF4MTT	16m	30m	IV	IIID	L	N	N	N	N	5	5	
P13	M	NF4MTT	3y	13m	IIIB	IIIB	R	N	N	Shortening	Widening	Widening	4	5
P14	F	NF4MTT	21m	30m	IV	IV	L	N	N	N	N	4	4	
P15	F	NF4MTT	17m	36m	IV	IV	R	N	N	Shortening	Synostosis	Synostosis, deformity (curving)	5	5
P16	M	VF2MTFT	2y3m	17m	IV	IV	R	N	N	N	N	5	5	
P17	F	VF2MTFT	3y10m	12m	IV	IV	L	N	N	N	Synostosis	Synostosis	4	4

P18	M	VF2MTFT	4y5m	13m	IIIB	IIIB	R	N	N	Widening	N	5	4
P19	M	VF2MTFT	4y11m	11m	IV	IIID	L	N	N	N	N	5	5
P20	M	VF2MTFT	10y7m	13m	IIIB	IIIC	L	N	N	N	N	5	5

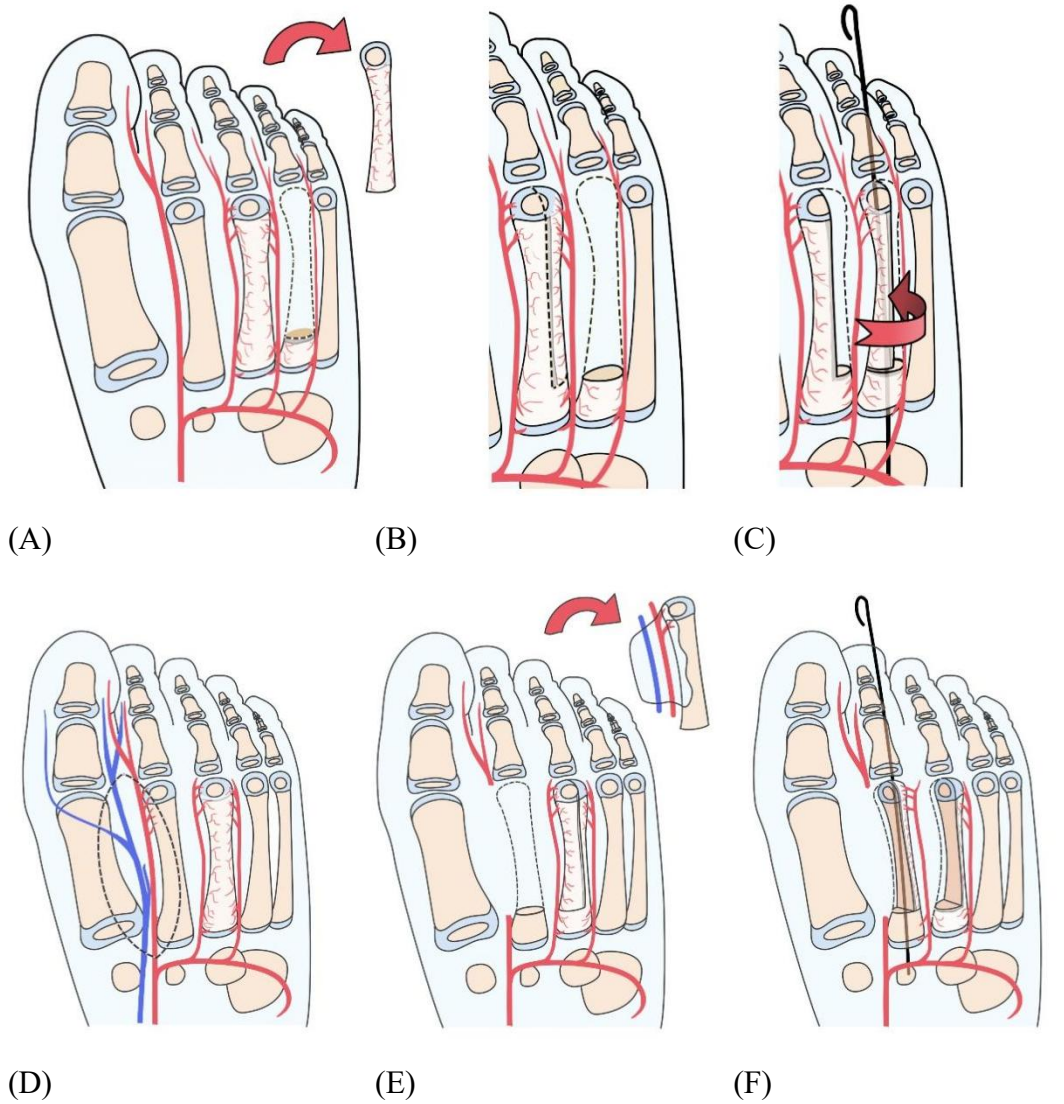
NF4MTT: Non-vascularized full-width 4th metatarsal transfer; VF2MTFT: Vascularized full-width 2nd metatarsal flap transfer; M: Male; F: Female; L: Left; R: Right; N: Normal. The synostosis was between the 2nd/4th metatarsal and the 3rd metatarsal. *Scores of satisfactions and the corresponding answers: 5 – very satisfied, 4 – somewhat satisfied, 3 – fair, 2–4 – somewhat dissatisfied, 1 – very dissatisfied.

Supplementary Table 2: The length and width of the metatarsals at postoperation and follow-up.

Metatarsal	Number of patients	Postoperation				Follow-up			
		Donor side (mm)	Contra lateral side (mm)	Statistics	P-value	Donor side (mm)	Contra lateral side (mm)	Statistics	P-value
Length									
4th metatarsal	12	25.67 (3.60)*	25.44 (3.35)*	Z = -0.4 71 [†]	0.63 8	34.66 ± 6.23	33.48 ± 5.62	t = 2.633	0.023
2nd metatarsal	4	43.94 ± 11.53	42.17 ± 11.12	t = 3.301	0.04 6	48.52 ± 7.46	47.65 ± 9.02	t = 0.836	0.465
3rd metatarsal	16	27.30 (10.34) *	27.52 (10.97) *	Z = -0.7 76 [†]	0.43 8	37.33 ± 8.10	36.54 ± 8.95	t = 2.179	0.046
Width									
4th metatarsal	12	N/A	N/A	N/A	N/A	4.37 ± 0.82	4.31 ± 0.41	t = 0.396	0.699
2nd metatarsal	4	N/A	N/A	N/A	N/A	6.18 ± 0.79	5.70 ± 0.97	t = 0.944	0.415
3rd metatarsal	16	N/A	N/A	N/A	N/A	4.96 ± 1.14	4.77 ± 0.88	t = 0.926	0.369

; N/A: Not applicable. *Medians (interquartile spacing) were calculated.

[†]Wilcoxon signed-rank test was used.



Supplementary Figure 1: Surgical techniques. The harvest of full-width graft of the 4th metatarsal (A), the osteotomy of the 3rd metatarsal (B), and the reconstruction of donor bone defect using the lateral half of the 3rd metatarsal (C) in non-vascularized 4th metatarsal transfer. The design of flap (D), the osteotomy of the 2nd and the 3rd metatarsals (E), and the reconstruction of the donor bone defect using the medial half of the 3rd metatarsal (F) in vascularized 2nd metatarsal transfer.



Supplementary Figure 2: The measurement of the length and the width of metatarsal on Anteroposterior X-ray film. The longitudinal axis of the metatarsal (line 1) was defined as the longitudinal axis of the bone shaft and line 2 was the midperpendicular of line 1. The length of metatarsal was the distance between the proximal and the distal margins of the articular surface on line 1 and the width of metatarsal was the distance between the medial and the lateral margins of the cortex on line 2. The lengthening and shortening of a metatarsal were defined as a difference of >3 mm in length from the corresponding contralateral metatarsal, and the difference was $>10\%$; the widening or narrowing of a metatarsal were defined as a difference of >1 mm in width from the corresponding contralateral metatarsal, and the difference was $>20\%$ of the length of the contralateral metatarsal.



(A)



(B)



(C)



(D)



(E)

Supplementary Figure 3: Appearances of the donor foot. (A) Normal right foot. (B) The lengthening of the left 4th toe. (C) The shortening of the right 3rd toe. (D) The 2nd toe overriding on the 3rd toe after right 4th metatarsal transfer. (E) The lateral deviation of the left 4th toe. The lengthening of a toe was defined as the tip of the toe being longer than that of its medial toe. The shortening of a toe was defined as the tip of the toe being shorter than that of its lateral toe. For patients whose 2nd toe was longer than the big toe in the contralateral foot, the donor 2nd toe was defined as “lengthening” if the difference between the tips of the 2nd toe and big toe in the donor site was more than twice that of the contralateral side; and as “shortening” if the tip of the 2nd toe was shorter than that of big toe.



(A)



(B)



(C)



(D)

Supplementary Figure 4: The radiographic findings of donor metatarsals. (A) Normal 3rd and 4th metatarsals. (B) The lengthening of the 4th metatarsal. (C) The angulation deformity of the 4th metatarsal. (D) The synostosis between the 4th and 3rd metatarsals.