

Supplemental Material

Table 1. Classification of adverse events

Type of adverse event	Level of Severity	Symptoms and Signs	Treatment	Infection grade	Adverse event grade
Infection	Low-grade soft-tissue infection	Cellulitis with signs of inflammation (redness, swelling, warmth, stinging pain, pain that increases on loading, tense)		1	Minor
			Oral antibiotics	1A	
			Parenteral antibiotics	1B	
	High-grade soft-tissue infection	Pus collection, purulent discharge, raised level of C-reactive protein	Surgical intervention	1C	Minor
				2	
				2	
	Bone infection	Radiographic evidence of osteitis (periosteal bone reaction), radiographic evidence of osteomyelitis (sequestrum and involucrum)	Oral antibiotics	2A	Major
			Parenteral antibiotics	2B	
			Surgical intervention	2C	
	Septic implant failure	Grade 3 infection and radiographic evidence of loosening Radiographic evidence of a breakage	Oral antibiotics	3	Major
			Parenteral antibiotics	3A	
			Surgical intervention	3B	
Implant breakage Dual-cone breakage	Septic implant failure	Grade 3 infection and radiographic evidence of loosening Radiographic evidence of a breakage	Surgical intervention	3C	Major
			Explantation	4	
			Revision		
	Aseptic loosening	Radiographic evidence of a breakage or clinical signs of breakage (e.g. rotation freedom due to breakage of the single pin used as a fail mechanism)	Revision		Major
Stoma hypergranulation	Stoma redundant tissue	Overgrowth of connective tissue	Chemical cauterization using silver nitrate		Minor
			Surgical refashioning		
Bone fracture		The presence of redundant soft tissue causing repeated stomal irritation and friction at the stoma with the absence of infection			Minor
Bone fracture		Radiographic evidence of a bone fracture			Major
			Conservative or surgical treatment		

Adverse event classification for bone-anchored prosthesis users as described by Al Muderis et al.⁸

Table 2. Results participants with a transfemoral bone-anchored prosthesis

	Baseline (T0) (n= 31) [‡]	T0 Number of participants	Six-month (T1) (n=30) ^{‡, †}	T1 Number of participants	Twelve-month (T2) (n=31) [‡]	T2 Number of participants
Function-level						
Hip abductor strength (Nm/kg) [†]						
Residual limb, mean (sd)	0.69 (0.26)	31	0.80 (0.36)	29	0.86 (0.34)	29
<i>Non-wheelchair-bound</i>	0.72 (0.28)	21	0.91 (0.37)	20	0.97 (0.34)	20
<i>Wheelchair-bound</i>	0.63 (0.21)	10	0.57 (0.19)	9	0.63 (0.23)	9
Sound limb, mean (sd)	0.83 (0.25)	30	0.96 (0.33)	29	1.01 (0.30)	30
<i>Non-wheelchair-bound</i>	0.82 (0.24)	20	1.01 (0.35)	19	1.03 (0.30)	20
<i>Wheelchair-bound</i>	0.86 (0.28)	10	0.86 (0.26)	10	0.99 (0.30)	10
Q-TFA Prosthetic use score (0-100), median (25th PCTL; 75th PCTL)	52 (0; 100)	31	90 (71; 100)	30	100 (90; 100)	31
<i>Non-wheelchair-bound</i>	77 (30)	21	88 (15)	20	95 (9)	21
<i>Wheelchair-bound</i>	0 (0)	10	81 (29)	10	85 (30)	10
Back pain, OR (SE)		31		30		31
No, n (%)	17 (55)		14 (47)		14 (45)	
Yes, with episodes, n (%)	6 (19)		11 (37)		10 (32)	
Yes, chronic, n (%)	8 (26)		5 (17)		7 (23)	
Stump pain		NA		30		31
Pain (0-10), mean (sd)	NA		3.0 (2.7)		2.7 (2.7)	
<i>Non-wheelchair-bound</i>	NA		2.6 (2.7)		2.2 (2.6)	
<i>Wheelchair-bound</i>	NA		3.9 (2.5)		3.8 (2.5)	
Pain location, n (%) [#]		NA		30		31
No location	NA		8 (23)		11 (40)	
Soft tissue stoma	NA		9 (26)		9 (25)	
Circular distal side residual limb	NA		5 (14)		5 (14)	
Ventral side residual limb	NA		2 (6)		4 (11)	
Inguinal area	NA		3 (9)		2 (6)	
Greater trochanteric area	NA		6 (17)		4 (11)	
Other	NA		2 (6)		1 (3)	
Activity-level						
Mobility level						
MFC-level, n (%)		31		30		31
Level 0	10 (32)		0 (0)		0 (0)	
Level 1	3 (10)		1 (3)		2 (7)	
Level 2	1 (3)		6 (20)		3 (10)	
Level 3	11 (36)		11 (37)		16 (52)	
Level 4	6 (19)		12 (40)		10 (32)	
SIGAM-WAP score, n (%)		31		30		31
Grade A	10 (32)		0 (0)		0 (0)	
Grade B	0 (0)		0 (0)		0 (0)	

Grade C	1 (3)		0 (0)		1 (3)	
Grade D	6 (19)		14 (48)		9 (29)	
Grade E	6 (19)		5 (17)		10 (32)	
Grade F	8 (26)		11 (37)		11 (36)	
Use of aids in daily life: Indoors, n (%)		31		30		31
Wheelchair-bound	10 (32)		0 (0)		0 (0)	
Walking frame / rollator	0 (0)		0 (0)		0 (0)	
Two crutches / canes	3 (10)		3 (10)		3 (10)	
One crutch / cane	2 (7)		1 (3)		2 (7)	
None	16 (52)		26 (87)		26 (84)	
Use of aids in daily life: Outdoors, n (%)		31		30		31
Wheelchair-bound	10 (32)		0 (0)		0 (0)	
Walking frame / rollator	1 (3)		0 (0)		0 (0)	
Two crutches / canes	3 (10)		8 (27)		6 (19)	
One crutch / cane	4 (13)		5 (17)		7 (23)	
None	13 (42)		17 (57)		18 (58)	
TUG (sec), mean (sd) ^{ll}	13.0 (8.4)	21	12.8 (5.6)	30	11.3 (5.4)	31
Non-wheelchair-bound	13.0 (8.4)	21	12.2 (5.8)	20	11.2 (6.2)	21
Wheelchair-bound	NA	0	13.9 (5.4)	10	11.3 (3.4)	10
Walking ability						
6MWT (m), mean (sd) ^l	319 (99)	21	284 (108)	30	313 (103)	29
Non-wheelchair-bound	319 (99)	21	301 (109)	20	331 (93)	19
Wheelchair-bound	NA	0	251 (103)	10	280 (119)	10
6MWT (m/s), mean (sd) ^l	0.88 (0.27)	21	0.79 (0.30)	30	0.87 (0.29)	29
Non-wheelchair-bound	0.88 (0.27)	21	0.84 (0.30)	20	0.92 (0.26)	19
Wheelchair-bound	NA	0	0.70 (0.29)	10	0.78 (0.33)	10
Walking distance in daily life (m), median (25th PCTL; 75th PCTL)	400 (0; 1400)	31	1000 (400; 1813)	30	1750 (1000; 3500)	31
Non-wheelchair-bound	1000 (400; 2250)	21	1200 (450; 3000)	20	2000 (1000; 4750)	21
Wheelchair-bound	0 (0; 0)	10	650; (325; 1500)	10	1250 (575; 2125)	10
Health-related quality of life-level						
Q-TFA Global Score (0-100), mean (sd) ^{="}	48 (15)	21	69 (18)	30	70 (21)	31
Non-wheelchair-bound	48 (15)	21	71 (18)	20	69 (22)	21
Wheelchair-bound	NA	0	64 (18)	10	70 (21)	10
Overall situation, n (%)		31		30		31
Extremely poor	1 (3)		0 (0)		0 (0)	
Poor	3 (10)		2 (7)		3 (10)	
Average	7 (23)		3 (10)		5 (16)	
Good	18 (58)		19 (63)		14 (45)	
Extremely good	2 (7)		6 (20)		9 (29)	
Satisfaction-level						
Global perceived effect of BAP		NA		30		31
Strongly disagree	NA		1 (3)		1 (3)	
Disagree	NA		0 (0)		0 (0)	

Neutral	NA		1 (3)		0 (0)	
Agree	NA		1 (3)		3 (10)	
Strongly agree	NA		27 (90)		27 (87)	
Prosthetic comfort score (0-10), mean (sd) [‡]	5.4 (1.6)	21	8.1 (1.9)	30	8.2 (1.6)	31
Non-wheelchair-bound	5.4 (1.6)	21	8.0 (1.9)	20	8.2 (1.5)	21
Wheelchair-bound	NA	0	8.3 (2.1)	10	8.1 (1.8)	10

‡ At six-month follow-up one participant was recovering from a pertrochanteric fracture after a fall accident, hence resulting in lower number of participants as at baseline: entire group (n=30), and in the non-wheelchair-bound group (n=20).

‡ Stratification based on wheelchair-boundedness at baseline resulted in the following sample sizes: Non-wheelchair-bound group: baseline (n=21), six-month follow-up (n=20), twelve-month follow-up (n=21). Wheelchair-bound group: baseline (n=10), six-month follow-up (n=10), twelve-month follow-up (n=10);

† The mean strength of both limbs from the participant with a bilateral transfemoral amputation who was treated bilaterally was used as value for residual limb strength, hence resulting in lower number of participants for the residual limb strength. At six- and twelve-month follow-up one participant and two participants, respectively, did not perform the residual limb strength test due to stump pain resulting in a lower number of participants;

Some participants experienced pain in multiple location, hence resulting in higher numbers of scores than the number of participants. At six-month follow-up 8/30= 27% of the participants was pain free. At twelve-month follow-up 11/31=35% of the participants was pain free;

|| Wheelchair-bound participants did not perform the TUG, hence resulting in lower number of participants at baseline;

| Wheelchair-bound participants did not perform the 6MWT, hence resulting in lower number of participants at baseline. At twelve-month follow-up two non-wheelchair-bound participant did not perform the 6MWT (one due to stump pain, one due to wrist complaints) which resulted in a lower number of participants.;

= The Q-TFA global score is not applicable for wheelchair-bound participants with exception of the overall situation item, hence resulting in lower number of participants at baseline;

+ The Prosthetic comfort score is not applicable for wheelchair-bound participants, hence resulting in lower number of participants at baseline;

Q-TFA: Questionnaire for persons with a transfemoral amputation; MFC-level: Medicare Functional Classification Level; SIGAM-WAP score: Special Interest Group in Amputee Medicine Workgroup Amputation and Prosthetics mobility score; TUG: Timed up and go; 6MWT: 6-minute walking test; BAP: bone-anchored prosthesis; NA: Not applicable; n: number of participants; sd: standard deviation; Nm: Newtonmetre per kilogram bodyweight; %: percent; PCTL: percentile; sec: seconds; m: metres; m/s: metre per second

Table 3. Results participants with a transtibial bone-anchored prosthesis

	Baseline (T0) (n= 9) [‡]	T0 Number of participants	Six-month (T1) (n=9) [‡]	T1 Number of participants	Twelve-month (T2) (n=9) [‡]	T2 Number of participants
Function-level						
Hip abductor strength (Nm/kg)						
Residual limb, mean (sd)	0.78 (0.33)	9	1.03 (0.31)	9	0.96 (0.32)	9
<i>Non-wheelchair-bound</i>	0.80 (0.37)	7	1.04 (0.36)	7	0.94 (0.36)	7
<i>Wheelchair-bound</i>	0.70 (0)	2	1.00 (0.28)	2	1.00 (0.28)	2
Sound limb, mean (sd)	0.97 (0.26)	9	1.01 (0.30)	9	1.10 (0.26)	9
<i>Non-wheelchair-bound</i>	0.97 (0.28)	7	0.99 (0.32)	7	1.09 (0.25)	7
<i>Wheelchair-bound</i>	0.95 (0.21)	2	1.10 (0.28)	2	1.15 (0.35)	2
Q-TFA Prosthetic use score (0-100), median (25th PCTL; 75th PCTL)	100 (36; 100)	9	100 (95; 100)	9	100 (90; 100)	9
<i>Non-wheelchair-bound</i>	94 (11)	7	99 (4)	7	96 (5)	7
<i>Wheelchair-bound</i>	0 (0)	2	95 (7)	2	100 (0)	2
Back pain, OR (SE)		9		9		9
No, n (%)	4 (44)		4 (44)		4 (44)	
Yes, with episodes	1 (11)		3 (33)		4 (44)	
Yes, chronic	4 (44)		2 (22)		1 (11)	
Stump pain		NA		9		9
Pain (0-10), mean (sd)	NA		4.0 (2.8)		1.2 (2.7)	
<i>Non-wheelchair-bound</i>	NA		4.4 (3.3)		1.6 (3.0)	
<i>Wheelchair-bound</i>	NA		2.5 (3.5)		0 (0)	
Pain location, n (%) [#]		NA		9		9
No location	NA		3 (27)		7 (78)	
Soft tissue stoma	NA		4 (36)		0 (0)	
Circular distal side residual limb	NA		1 (9)		2 (22)	
Ventral side residual limb	NA		0 (0)		0 (0)	
Inguinal area	NA		0 (0)		0 (0)	
Greater trochanteric area	NA		0 (0)		0 (0)	
Other	NA		3 (27)		0 (0)	
Activity-level						
Mobility level						
MFC-level, n (%)		9		9		9
Level 0	2 (22)		0 (0)		0 (0)	
Level 1	0 (0)		0 (0)		0 (0)	
Level 2	0 (0)		0 (0)		0 (0)	
Level 3	5 (56)		3 (33)		0 (0)	
Level 4	2 (22)		6 (67)		9 (100)	
SIGAM-WAP score, n (%)		9		9		9
Grade A	2 (22)		0 (0)		0 (0)	
Grade B	0 (0)		0 (0)		0 (0)	

Grade C	0 (0)		0 (0)		0 (0)	
Grade D	2 (22)		0 (0)		0 (0)	
Grade E	0 (0)		1 (11)		1 (11)	
Grade F	5 (56)		8 (89)		8 (89)	
Use of aids in daily life: Indoors, n (%)		9		9		9
Wheelchair-bound	2 (22)		0 (0)		0 (0)	
Walking frame / rollator	0 (0)		0 (0)		0 (0)	
Two crutches / canes	0 (0)		0 (0)		0 (0)	
One crutch / cane	0 (0)		0 (0)		0 (0)	
None	7 (78)		9 (100)		9 (100)	
Use of aids in daily life: Outdoors, n (%)		9		9		9
Wheelchair-bound	2 (22)		0 (0)		0 (0)	
Walking frame / rollator	0 (0)		0 (0)		0 (0)	
Two crutches / canes	1 (11)		0 (0)		0 (0)	
One crutch / cane	1 (11)		1 (11)		0 (0)	
None	5 (56)		8 (89)		9 (100)	
TUG (sec), mean (sd) ^{ll}	7.6 (1.0)	7	7.1 (1.3)	9	5.7 (0.8)	9
Non-wheelchair-bound	7.6 (1.0)	7	7.3 (1.3)	7	5.9 (0.8)	7
Wheelchair-bound	NA	0	6.2 (0.5)	2	5.2 (0.5)	2
Walking ability						
6MWT (m), mean (sd) ^l	363 (35)	7	398 (99)	8	461 (67)	9
Non-wheelchair-bound	363 (35)	7	386 (110)	6	449 (70)	7
Wheelchair-bound	NA	0	434 (71)	2	503 (40)	2
6MWT (m/s), mean (sd) ^l	1.01 (0.10)	7	1.11 (0.27)	8	1.28 (0.19)	9
Non-wheelchair-bound	1.01 (0.10)	7	1.07 (0.30)	6	1.25 (0.19)	7
Wheelchair-bound	NA	0	1.20 (0.20)	2	1.40 (0.11)	2
Walking distance in daily life (m), median (25th PCTL; 75th PCTL)	350 (50; 450)	9	1000 (440; 4000)	9	3000 (1000; 6500)	9
Non-wheelchair-bound	400 (300; 500)	7	1000 (180; 3000)	7	3000 (1000; 5000)	7
Wheelchair-bound	0 (0; 0)	2	NA (1000; 3000)	2	NA (3000; 6500)	2
Health-related quality of life-level						
Q-TFA Global Score (0-100), mean (sd) [™]	41 (17)	7	70 (21)	9	78 (16)	9
Non-wheelchair-bound	41 (17)	7	67 (22)	7	74 (15)	7
Wheelchair-bound	NA	2	84 (12)	2	92 (12)	2
Overall situation, n (%)		9		9		9
Extremely poor	0 (0)		0 (0)		0 (0)	
Poor	4 (44)		0 (0)		0 (0)	
Average	0 (0)		2 (22)		1 (11)	
Good	5 (56)		4 (44)		6 (67)	
Extremely good	0 (0)		3 (33)		2 (22)	
Satisfaction-level						
Global perceived effect of BAP		NA		9		9
Strongly disagree	NA		0 (0)		0 (0)	
Disagree	NA		0 (0)		0 (0)	

Neutral	NA		0 (0)		0 (0)	
Agree	NA		1 (11)		2 (22)	
Strongly agree	NA		8 (89)		7 (78)	
Prosthetic comfort score (0-10), mean (sd) [†]	4.0 (2.2)	7	8.4 (1.4)	9	9.1 (1.1)	9
<i>Non-wheelchair-bound</i>	4.0 (2.2)	7	8.1 (1.5)	7	9.0 (1.2)	7
<i>Wheelchair-bound</i>	NA	0	9.5 (0.7)	2	9.5 (0.7)	2

‡ Stratification based on wheelchair-boundedness at baseline resulted in the following sample sizes: Non-wheelchair-bound group: baseline (n=7), six-month follow-up (n=7), twelve-month follow-up (n=7). Wheelchair-bound group: baseline (n=2), six-month follow-up (n=2), twelve-month follow-up (n=2);

Some participants experienced pain in multiple location, hence resulting in higher numbers of scores than the number of participants. At six-month follow-up 3/9= 33% of the participants was pain free. At twelve-month follow-up 7/9=78% of the participants was pain free;

|| Wheelchair-bound participants did not perform the TUG, hence resulting in lower number of participants at baseline;

| Wheelchair-bound participants did not perform the 6MWT, hence resulting in lower number of participants at baseline. At six-month follow-up one non-wheelchair-bound participant did not perform the 6MWT (due to stump pain) which resulted in a lower number of participants;

= The Q-TFA global score is not applicable for wheelchair-bound participants with exception of the overall situation item, hence resulting in lower number of participants at baseline;

+ The Prosthetic comfort score is not applicable for wheelchair-bound participants, hence resulting in lower number of participants at baseline;

Q-TFA: Questionnaire for persons with a transfemoral amputation; MFC-level: Medicare Functional Classification Level; SIGAM-WAP score: Special Interest Group in Amputee Medicine Workgroup Amputation and Prosthetics mobility score; TUG: Timed up and go; 6MWT: 6-minute walking test; BAP: bone-anchored prosthesis; NA: Not applicable; n: number of participants; sd: standard deviation; Nm/kg: Newtonmetre per kilogram bodyweight; %: percent; PCTL: percentile; sec: seconds; m: metres; m/s: metre per second

Table 4. Back pain

	Transfemoral bone-anchored prosthesis			Transtibial bone-anchored prosthesis		
	Baseline (T0) (n= 31)	Six-month (T1) (n=30) [‡]	Twelve-month (T2) (n=31)	Baseline (T0) (n= 9)	Six-month (T1) (n=9)	Twelve-month (T2) (n=9) [‡]
<i>Non-wheelchair-bound</i>						
No	10 (48)	10 (50)	11 (52)	2 (29)	3 (43)	3 (43)
Yes, with episodes	4 (19)	6 (30)	7 (33)	1 (14)	2 (29)	3 (43)
Yes, chronic	7 (33)	4 (20)	3 (14)	4 (57)	2 (29)	1 (14)
<i>Wheelchair-bound</i>						
No	7 (70)	4 (40)	3 (30)	2 (100)	1 (50)	1 (50)
Yes, with episodes	2 (20)	5 (50)	3 (30)	0 (0)	1 (50)	1 (50)
Yes, chronic	1 (10)	1 (10)	4 (40)	0 (0)	0 (0)	0 (0)

[‡] At six-month follow-up one non-wheelchair-bound participant with a transfemoral bone-anchored prosthesis was recovering from a pertrochanteric fracture after a fall accident, hence resulting in lower number of participants as at baseline: entire group (n=30), and in the non-wheelchair-bound group (n=20).

Table 5. Adverse events

Type of adverse event	Transfemoral osseointegration implants						Transtibial osseointegration implants					
	All implant types		Integral leg prosthesis (Chromium-cobalt-molybdenum)		Osseointegrated prosthetic limb (Titanium)		All implant types		Patient-specific implant (Chromium-cobalt-molybdenum)		Patient-specific implant (Titanium)	
	Participants	Events	Participants	Events	Participants	Events	Participants	Events	Participants	Events	Participants	Events
	(n=31)		(n=17)		(n=14)		(n=9)		(n=1)		(n=8)	
Infection												
Total	9 (29)	13	7 (41)	11	2 (14)	2	4 (44)	8	1 (100)	1	3 (38)	7
Grade 1	9 (29)	12	7 (41)	10	2 (14)	2	4 (44)	7	1 (100)	1	3 (38)	6
A	9 (29)	12	7 (41)	10	2 (14)	2	4 (44)	7	1 (100)	1	3 (38)	6
B	-	-	-	-	-	-	-	-	-	-	-	-
C	-	-	-	-	-	-	-	-	-	-	-	-
Grade 2	1 (3)	1	1 (6)	1	-	-	1 (11)	1	-	-	1 (11)	1
A	-	-	-	-	-	-	-	-	-	-	-	-
B	-	-	-	-	-	-	-	-	-	-	-	-
C	1 (3)	1	1 (6)	1 (6)	-	-	1 (11)	1	-	-	1 (11)	1
Grade 3	-	-	-	-	-	-	-	-	-	-	-	-
A	-	-	-	-	-	-	-	-	-	-	-	-
B	-	-	-	-	-	-	-	-	-	-	-	-
C	-	-	-	-	-	-	-	-	-	-	-	-
Grade 4	-	-	-	-	-	-	-	-	-	-	-	-
Implant breakage	-	-	-	-	-	-	-	-	-	-	-	-
Dual-cone breakage	2 (6)	2	2 (12)	2	-	-	1 (11)	1	-	-	1 (11)	1
Aseptic loosening	-	-	-	-	-	-	-	-	-	-	-	-
Stoma hypergranulation	2 (6)	2	1 (6)	1	1 (7)	1	-	-	-	-	-	-
Stoma redundant tissue	2 (6)	2	2 (12)	2	-	-	-	-	-	-	-	-
Bone fracture	4 (13)	4	2 (12)	2	2 (14)	2	-	-	-	-	-	-
Reimplantation	2 (6)	2	2 (12)	2	-	-	1 (11)	1	-	-	1 (11)	1
Bone fracture treatment	4 (13)	4	2 (12)	2	2 (14)	2	-	-	-	-	-	-
Conservative	3 (10)	3	1 (6)	1	1 (7)	1	-	-	-	-	-	-
Surgical	1 (3)	1	1 (8)	1	1 (7)	1	-	-	-	-	-	-
Uneventful course	19 (61)	NA	9 (53)	NA	10 (71)	NA	4 (44)	NA	0 (0)	NA	4 (50)	NA

Number of participants who had an adverse event is expressed in exact numbers and in percentage of the total (sub)group (in parentheses); NA: Not applicable; The three broken dual-cones (two fractures of the proximal safety pin and one fracture of the screw thread on the distal part) were successfully replaced; All bone fractures (3 residual limb (medial column fracture, pertrochanteric femoral fracture, periprosthetic fracture) and 1 lumbar spine fracture) were caused by a fall accident and were successfully treated.

Appendix A

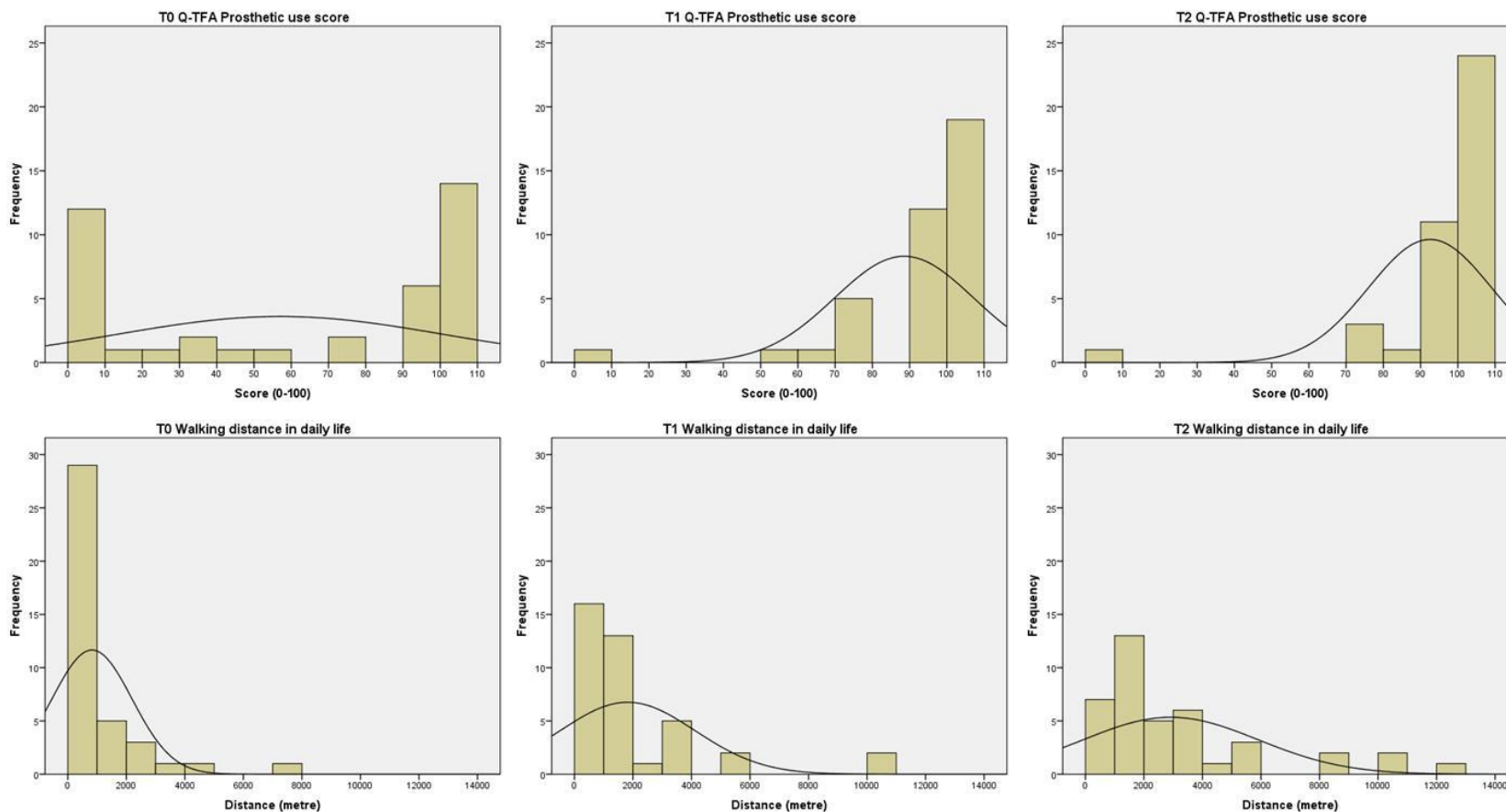


Figure A.1. Histogram not-normally distributed continuous variables

Questionnaire for persons with a transfemoral amputation (Q-TFA) Prosthetic use score, mean (standard deviation) median (range): T0: 57 (44) 81 (0-100), T1: 89 (19) 90 (4-100), T2: 93 (17) 100 (4-100). The Wilcoxon signed-rank test revealed that the prosthesis wearing time increased significantly at both follow-ups compared to baseline ($p < 0.001$). Walking distances in daily life, mean (standard deviation) median (range): T0: 826 (1369) 400 (0-7000), T1: 1816 (2303) 1000 (100-10000), T2: 2913 (2984) 1900 (80-12500). The Wilcoxon signed-rank test revealed that the walking distance in daily life increased significantly at both follow-ups compared to baseline (T1-T0: $p = 0.001$, T2-T0: $p < 0.001$). T0: baseline; T1: six-month follow-up; T2: twelve-month follow-up