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Titel
Sound and amputated side knee pain and prosthetic function with a powered foot vs. passive prosthetic feet: A cross-sectional exploratory study.

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Zusammenfassung
Use of a powered foot may result in less sound and residual knee pain and increased patient-reported mobility in transtibial amputees compared to a passive foot. The results are consistent with established biomechanical mechanisms of knee unloading and warrant consideration in patient care.

Hintergrund
Biomechanical studies suggest that decreased push-off of the foot reduces the acceleration of the center of mass, resulting in increased collision work and loading of the leading limb during walking. This effect has been shown for both persons with lower-limb amputations and individuals with neurologic conditions (1). Studies with a powered prosthetic foot found a reduction of the first peak of the external knee adduction moment (EKAM) and EKAM rate in the sound knee compared to walking with a passive energy-storage-and-return (ESR) foot, indicative of biomechanical unloading of the sound knee (2, 3). This biomechanical evidence makes anecdotal reports from users of powered feet on improved sound knee pain and pain-free walking distance noteworthy. Therefore, the aim of this study was to systematically survey sound knee, amputated side knee, and low-back pain as well as patient-reported prosthetic mobility in individuals who were fitted a powered prosthetic foot in the past.

Material Methode; Durchführung/ Prozess
250 individuals with transtibial amputation who had been fitted a powered prosthetic foot in the past were invited to an online survey on average sound, amputated side knee, and low-back pain assessed with numerical pain rating scales (NPRS), the PROMIS Pain Interference and the PLUS-M score for patient-reported mobility. Subjects were asked to rate their currently

used prosthetic foot and recall the ratings for their previously used foot. Recalled scores were adjusted for recall bias by clinically meaningful amounts using published recommendations (4). However, adjustments for recall bias were not performed if they would have favored the powered foot. Thus, recalled pain ratings for the powered foot in current passive foot users as well as recalled PLUS-M ratings for the passive foot in current powered foot users were not adjusted. Differences between the powered and passive foot scores were evaluated using Wilcoxon's matched pairs signed ranks test.

Ergebnisse

Forty-six subjects, all male, with unilateral TTA provided data suitable for analysis. Eighteen individuals (39%) identified as current powered foot users, whereas 28 subjects (61%) had returned to using a passive prosthetic foot. Among the 18 current powered foot users, the median ratings indicated significantly lower current sound knee pain (1 [IQR 0-3] vs. 2.5 [IQR 0.75-6; p=0.007), amputated side knee pain (1 [IQR 1-3] vs. 3 [IQR 1-4.5]; p=0.007), and low-back pain (2 [IQR 1-5] vs. 3.5 [IQR 1.75-6.5]; p=0.011) than recalled for passive feet. After recall-adjustment of the pain ratings for the passive feet, only current sound knee pain remained significantly lower with the powered foot (1 [IQR 0-3] vs. 1.5 [IQR 0.75-5]; p=0.036).

The effects of the powered foot were even greater in its 6 current users who recalled sound knee pain #4 NPRS in the recall-adjusted ratings for the passive foot: current median sound knee pain (3 [IQR 2.25-4] vs. 5.5 (IQR 5-7); p=0.038) and amputated side knee pain (3 [IQR 1-3] vs. 6 [IQR 2.75-7]; p=0.042) were significantly improved to a clinically meaningful extent.

The group of 18 current powered foot users reported significantly and clinically meaningfully higher current PLUS-M than they recalled for their previous passive foot (54.9±6.0 vs. 50.3±7.8; p=0.016).

In the group of the 28 current passive foot users, no statistically significant differences were seen between the abandoned powered and the passive feet.

Diskussion/ Schlussfolgerung; Fazit für die Praxis

Patients are known to overestimate past pain and function, which may result in the overestimation of treatment effects. We tried to address this limitation by adjusting recalled ratings by clinically meaningful amounts. The fact that the reduction in sound knee pain in

current powered foot users remained statistically significant even after recall-adjustment (reduction) of the ratings for the passive feet is noteworthy. Even more important was that subjects who recalled moderate to severe pain when using a passive foot experienced statistically significant and clinically meaningful improvements in sound and amputated side knee pain with the powered foot, even after recall-adjustment (reduction) of the recalled pain ratings for the passive feet. These results provide support for the conclusion that the biomechanical unloading of the sound and the residual knee by a powered prosthetic foot may be considered clinically meaningful. The unloading of the residual knee is probably achieved by the ankle range of motion of 22° that is used passively for terrain adaptation (5). In addition, the current powered foot users also reported significantly and clinically meaningfully improved patient-reported mobility compared to what they recalled for their previous passive feet. However, as 61% of the participants in the study had abandoned their powered foot at some point, the definition and identification of candidates who are likely to benefit from a powered foot remains a challenge.

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