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ASSOCIATION OF PROSTHETIC FIT AND USER SATISFACTION WITH FUNCTIONAL MOBILITY AND QUALITY OF LIFE AMONG LOWER-LIMB PROSTHESIS USERS: A SYSTEMATIC REVIEW

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ABSTRACT

Background:

Socket fit and satisfaction with the prosthesis are repeatedly named by lower-limb prosthesis users as their most pressing concerns, yet the strength of their link with functional mobility and quality

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of life (QoL) has not been synthesized across instruments, designs and regions, including the Middle East and Saudi Arabia.

Objective:

To systematically review the association of prosthetic fit/socket comfort and user satisfaction with functional mobility and QoL among people using lower-limb prostheses.

Methods:

PubMed/MEDLINE was searched with 12 structured strings (database inception to 29 September 2026) following PRISMA 2020. Quantitative studies of lower-limb prosthesis users that reported an association between fit, socket comfort or prosthesis satisfaction and mobility, physical function, participation or QoL were eligible. Data were extracted into a standardized form, methodological quality was appraised with a five-criterion checklist, and findings were synthesized narratively with an effect-direction (harvest) summary and a forest plot of correlation coefficients (95% CIs via Fisher z); no pooled estimate was computed.

Results:

Of 309 unique records, 20 reports (19 studies; ≈3,390 participants plus 19,185 registry outcome records) from 10 countries were included; five studies came from the Middle East (Iran, Türkiye, Jordan). Better socket comfort correlated moderately to strongly with QoL ($r = 0.46–0.65$) and satisfaction ($r = 0.49–0.69$), and weakly to strongly with mobility or function ($r = 0.32–0.63$). Six of ten studies showed a significant positive fit–mobility association, two were mixed and two (including a randomized crossover trial) were null. Device satisfaction was independently associated with lower-extremity functional status (standardized $\beta = 0.55$) and, more weakly, with health-related QoL in the largest study ($n = 1,736$). Socket replacement or redesign was followed by improvements in mobility and well-being in longitudinal cohorts. No Saudi study met the inclusion criteria.

Conclusions:

Socket comfort and prosthesis satisfaction are consistently and positively associated with QoL, and less consistently with objectively measured mobility. Most evidence is cross-sectional, so causality cannot be inferred. Routine measurement of socket comfort and satisfaction, and Saudi-specific longitudinal research using Arabic-validated instruments, are recommended.

Keywords: amputation; artificial limbs; lower extremity; mobility limitation; patient satisfaction; prosthesis fitting; quality of life; Saudi Arabia; socket comfort

1. Introduction

Lower-limb amputation is a common and growing cause of long-term disability. Global burden-of-disease estimates suggest that 57.7 million people were living with a limb amputation of traumatic origin in 2017, with North Africa and the Middle East among the regions with the highest prevalence (McDonald et al., 2021). In the United States, the number of people living with limb loss was projected to more than double from 1.6 million in 2005 to 3.6 million by 2050, driven largely by dysvascular disease and diabetes (Ziegler-Graham et al., 2008). Saudi Arabia shares this dual burden. The earliest national rehabilitation data from Riyadh showed that most amputations were of the lower limb and that trauma, particularly road-traffic injury, was the

leading cause (al-Turaiki & al-Falahi, 1993), while more recent hospital series from Jeddah point to diabetes as the dominant cause of major amputation in older adults (AlSofyani et al., 2016; Alkhatieb et al., 2026).

For most people who undergo lower-limb amputation, a prosthesis is the main route back to walking, work and social life. The socket, the interface between the residual limb and the device, determines how load is transferred to soft tissue, how securely the limb is suspended and whether the prosthesis can be worn comfortably for a full day. When asked what matters to them, prosthesis users have long placed the fit of the socket at the top of the list (Legro et al., 1999), and heat, sweating and skin irritation inside the socket are among the problems most often blamed for reduced QoL (Hagberg & Brånemark, 2001). Recent surveys from low- and middle-income settings report that poor fit, residual-limb pain and socket failure remain common (Shahapurkar et al., 2026).

Satisfaction with the prosthesis is a related but broader construct. It reflects the user's appraisal of fit and comfort, but also weight, appearance, durability and the quality of prosthetic services. A previous systematic review found that satisfaction was shaped by appearance, device properties, fit and residual-limb health, but that the questionnaires used to measure it were too varied to allow direct comparison (Baars et al., 2018). Another review of observational studies concluded that well-adjusted, comfortable prostheses are central to independence, but it focused on psychosocial adjustment rather than on functional or QoL outcomes (Luza et al., 2019). Reviews of QoL after lower-limb amputation, for their part, have highlighted pain, comorbidity, employment and prosthesis use as determinants, without isolating the role of the socket (Sinha & Van Den Heuvel, 2011; Sinha et al., 2011).

Two developments justify an updated synthesis. First, patient-reported instruments that target the socket directly, such as the Socket Comfort Score (SCS) and the Comprehensive Lower-limb Amputee Socket Survey (CLASS), are now widely used alongside validated mobility measures such as the Prosthetic Limb Users Survey of Mobility (PLUS-M), and an expert panel has recommended a core set of outcome measures for lower-limb absence (Kohler et al., 2023). Second, several large registry cohorts and randomized trials of new socket designs have been published since 2020. At the same time, the Middle East has begun to produce its own evidence, including Arabic validations of satisfaction instruments in Saudi and Turkish prosthesis users (Bakhsh et al., 2021; Kablan et al., 2021), yet no review has examined whether findings from high-income Western settings hold in the region.

This systematic review therefore asked: among people who use a lower-limb prosthesis, how are prosthetic fit (including socket comfort) and user satisfaction associated with functional mobility and QoL? Secondary aims were to describe the direction and approximate magnitude of these associations by outcome domain, to appraise the methodological quality of the evidence, and to compare the Saudi and wider Middle Eastern evidence with the international literature.

2. Methods

2.1 Design and reporting

The review was designed and reported in line with the PRISMA 2020 statement (Page et al., 2021). The protocol was not registered prospectively; this is acknowledged as a limitation, and registration in PROSPERO is recommended before any update or journal submission.

2.2 Eligibility criteria (PECO)

Population: children or adults with a unilateral or bilateral lower-limb amputation or congenital limb absence (partial foot and above) who used a prosthesis. Studies of upper-limb users only were excluded. Exposure: prosthetic fit or socket comfort (e.g., SCS, CLASS, fit items of the Orthotics and Prosthetics Users' Survey [OPUS] or Prosthesis Evaluation Questionnaire [PEQ]; Legro et al., 1998), socket problems, socket replacement or redesign, or satisfaction with the prosthesis (e.g., OPUS Client Satisfaction with Device, Trinity Amputation and Prosthesis Experience Scales [TAPES], Satisfaction with Prosthesis questionnaire [SAT-PRO], Prosthesis Satisfaction Questionnaire [PSQ]). Comparator: lower levels of the exposure, an alternative socket, or pre-intervention status. Outcomes: functional mobility (self-reported or performance-based, e.g., PLUS-M, Locomotor Capabilities Index, 2- or 6-minute walk test), physical function, community participation or work, and generic or condition-specific QoL (e.g., SF-12/SF-36, EQ-5D, Nottingham Health Profile [NHP], PEQ well-being). Study designs: quantitative observational studies (cross-sectional, cohort, registry), randomized and non-randomized trials, and mixed-methods studies with a quantitative component that reported a statistical association or a within-person change linking the exposure to an outcome. Reviews, case reports, purely qualitative studies, psychometric studies without an association analysis relevant to the question, and studies of clinicians only were excluded, although reviews and regional studies were retained as background.

2.3 Information sources and search strategy

PubMed/MEDLINE was searched from inception to 29 September 2026 using 12 complementary search strings that combined terms for the population (amputation, amputee, limb loss, prosthesis users, transtibial, transfemoral), the exposure (socket fit, socket comfort, Socket Comfort Score, prosthetic fit, prosthesis satisfaction, TAPES, OPUS, PEQ) and the outcomes (quality of life, SF-36, EQ-5D, mobility, PLUS-M, Locomotor Capabilities Index, walk tests). Region-specific strings added Saudi Arabia, the Gulf Cooperation Council states and other Middle Eastern countries, and author-targeted strings were used to capture landmark studies. The full strings and the number of records each returned are listed in Supplementary Table S1. No language or date limits were applied.

2.4 Study selection

Records were exported, de-duplicated by PubMed identifier and screened on title and abstract against the PECO criteria. Potentially eligible reports were then assessed in full on their structured abstract and bibliographic record, and the reason for each exclusion was recorded. Two reports from the same Iranian cohort (Alavi et al., 2024; Alavi et al., 2025) were retained because they analysed different outcomes, but were counted as one study.

2.5 Data extraction

A standardized extraction form captured author, year, country, setting tag (Saudi, GCC–Middle East and North Africa [MENA], or International), design, sample size and population, amputation level and cause, exposure and outcome instruments, the statistical method and the key numerical association (correlation coefficient, regression coefficient, effect size or pre–post change with p value). Where studies reported outcomes in which a higher score indicates worse health (e.g., the NHP), the sign of the correlation was reversed so that a positive value always means that better fit or satisfaction accompanies a better outcome. The full extraction table is provided as Supplementary Table S2.

2.6 Quality appraisal

Because the included designs ranged from cross-sectional surveys to randomized trials, a design-neutral five-criterion checklist was applied, with one point for each of the following: (a) the exposure was measured with a validated instrument or an objective socket intervention; (b) the outcome was measured with a validated instrument or performance test; (c) the sample was 100 or more participants, or an a priori sample size was reported; (d) confounding was addressed through multivariable adjustment, randomization or a controlled comparison; and (e) the design was prospective or longitudinal. Scores of 4–5 were rated high, 2–3 moderate and 0–1 low methodological quality. Appraisal was based on the information available in the published abstract and bibliographic record and should be regarded as provisional.

2.7 Synthesis

Because exposures, outcomes and effect metrics were heterogeneous, and following the review plan, no pooled estimate was computed. Instead, findings were grouped into six exposure–outcome domains: fit/comfort and mobility/function, fit/comfort and QoL, fit/comfort and satisfaction, satisfaction and mobility/function, satisfaction and QoL, and fit/comfort and participation or work. For each domain the direction of effect in every study was classified as positive and statistically significant, mixed or partial (significant for some outcomes or subgroups only), or null, and displayed as a harvest-style plot. Correlation coefficients reported by the studies were plotted in a forest plot with 95% confidence intervals computed by Fisher's z-transformation, and interpreted as weak (< 0.30), moderate (0.30–0.49) or strong (≥ 0.50). Analyses and figures were produced in Python 3 (NumPy, Matplotlib) at 300 dpi with a colour-blind-safe palette.

3. Results

3.1 Study selection

The 12 searches returned 407 records, of which 98 were duplicates. Of the 309 unique records screened, 253 were excluded on title and abstract, most commonly because they concerned surgical, vascular or diabetic-foot outcomes rather than prosthesis use. Fifty-six reports were assessed in detail and 36 were excluded, most often because no quantitative association between fit, comfort or satisfaction and a mobility or QoL outcome was reported (n = 23). Twenty reports describing 19 studies were included. The selection process is summarized in Figure 1.

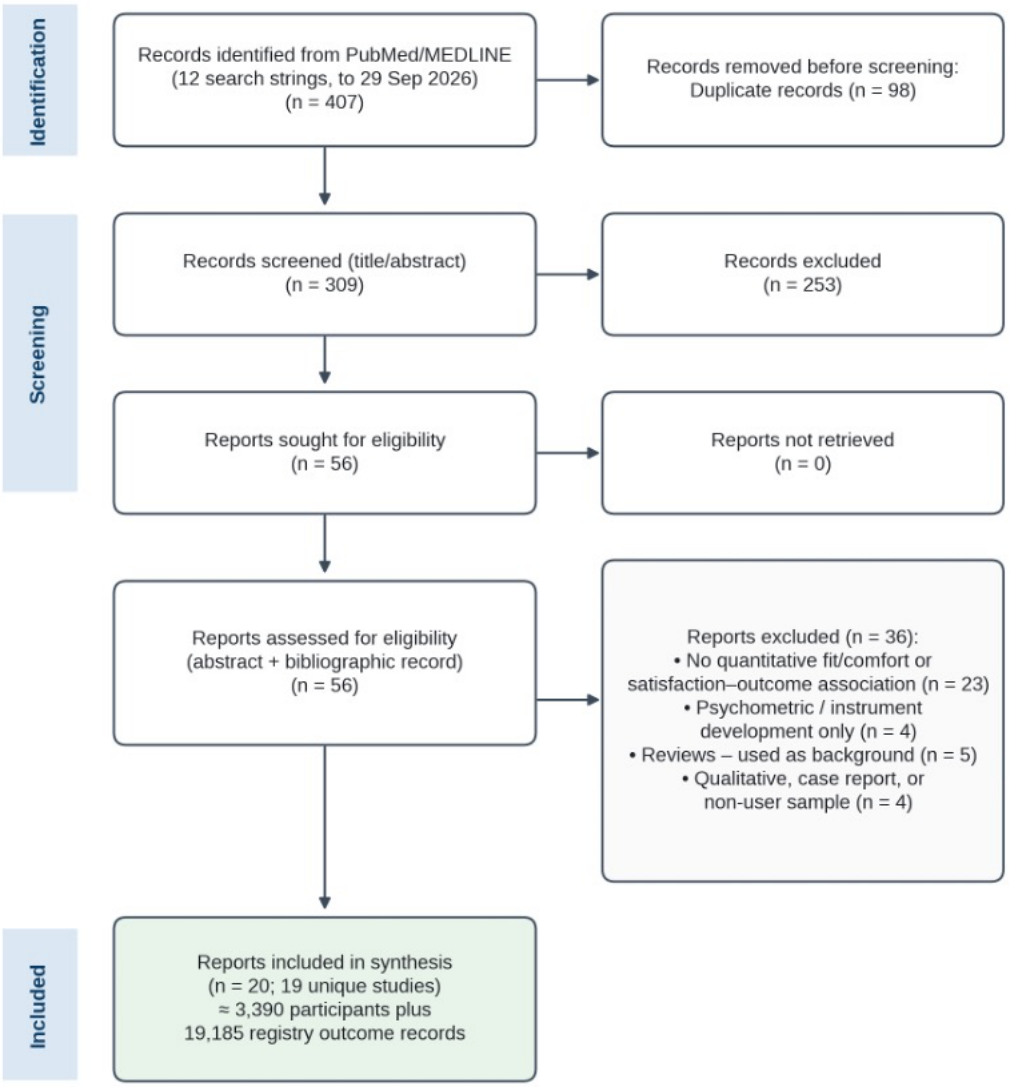


Figure 1. PRISMA 2020 flow diagram of study identification, screening and inclusion. Records were identified through 12 PubMed/MEDLINE search strings to 29 September 2026. Two included reports derived from the same Iranian cohort and were counted as one study.

3.2 Characteristics of included studies

The included studies were published between 2001 and 2026, with 18 of the 20 reports appearing since 2021 (Table 1). They came from 10 countries: the United States (n = 8), Iran (two reports, one cohort), Türkiye (n = 2), Jordan (n = 2), and one each from Sweden, the United Kingdom, Canada, Spain, South Africa and Sierra Leone. Five studies (six reports) were therefore from the MENA region; none was conducted in Saudi Arabia or another Gulf state. Thirteen studies were cross-sectional, four were longitudinal cohorts or registry analyses, and two were randomized trials of socket design (Fatone et al., 2021; Gates et al., 2025). Sample sizes ranged from 29 to

1,736 participants, and one registry analysis contributed 19,185 longitudinal outcome records (Castleberry et al., 2026). One study enrolled children and adolescents (Mgwili-Qikani et al., 2026), four focused on transfemoral users and three on transtibial users; the remainder included mixed levels. Fit or comfort was most often measured with the SCS or its variants (eight studies) or CLASS (two studies), while satisfaction was measured with at least six different instruments.

Table 1. Characteristics of included studies (20 reports, 19 studies), ordered by year

Study (country; tag)	Design	Sample	Fit / satisfaction measure	Outcome measure(s)	Key association
Hagberg & Brånemark, 2001 (Sweden; Int.)	Cross-sectional survey	97 TF, non-vascular	Socket problems (structured questionnaire)	SF-36	Socket heat/sweating (72%) and sores (62%) most often cited as reducing QoL; SF-36 below norms in all domains
Turner & McGregor, 2020 (UK; Int.)	Mixed-methods survey + interviews	94 users and clinicians	Perceived socket fit	Perceived rehabilitation impact, QoL	Fit rated the largest factor affecting rehabilitation by 48% of users; users linked fit to QoL and daily tasks
Seth et al., 2021 (USA; Int.)	Cross-sectional (secondary)	48 TT	SCS (pin-lock vs suction)	PEQ-MS, LCI, ABC	Suction users had higher SCS ($p \leq .001$) but similar mobility and balance confidence
Fatone et al., 2021 (USA; Int.)	Randomized crossover trial	30 TF (25 completed)	SCS; OPUS satisfaction	OPUS function & HRQoL; performance tests	Subischial socket: SCS 8.4 vs 7.0 and higher satisfaction; no difference in function or HRQoL
Eskridge et al., 2022 (USA; Int.)	Cross-sectional	86 combat-related LLA	OPUS Satisfaction with Device	QWB-SA	Satisfaction positively associated with QWB ($\beta = 0.0058$; $p = .004$)
DadeMatthews et al., 2023 (USA; Int.)	Cross-sectional online survey; path analysis	1,736 LLA	OPUS device & service satisfaction	OPUS LEFS, HRQoL, ABC, falls efficacy	Device satisfaction associated with LEFS ($\beta = 0.55$), ABC ($\beta = 0.22$), HRQoL ($\beta = 0.08$); $R^2 = 0.47$
Sions et al., 2023 (USA; Int.)	Cross-sectional (secondary)	126 TT/TF	SCS	Community Integration Questionnaire	SCS not retained; activity, balance confidence, prosthesis use explained 50.1%
Unal et al., 2024 (Türkiye; GCC-MENA)	Cross-sectional	63 LLA	PSQ	NHP, HADS, ABIS	PSQ vs NHP physical activity $r = -0.31$, total $r = -0.28$ (better QoL); pain lowered satisfaction
Alavi et al., 2024 (Iran; GCC-MENA)	Cross-sectional	168 non-traumatic TT	CLASS, PEQ	Self-reported mobility	CLASS subscales associated with mobility; SF-12 PCS strongest predictor ($\beta = 0.40$)
Alavi et al., 2025 (Iran; GCC-MENA)*	Cross-sectional	168 non-traumatic TT	CLASS	SF-12	Comfort $r = 0.65$; suspension $r = 0.48$; stability $r = 0.46$; comfort $\beta = 0.51$ (strongest predictor)
Tao et al., 2025 (Canada; Int.)	Cross-sectional (secondary of trial)	72 users ≥ 50 y	SCS	2MWT, step count, LSA	SCS predicted 2MWT ($B = 6.9$ m) and LSA ($B = 4.9$), not step count

Study (country; tag)	Design	Sample	Fit / satisfaction measure	Outcome measure(s)	Key association
Kuzu et al., 2025 (Türkiye; GCC-MENA)	Cross-sectional validation	80 combat-related K3/K4	CLASS, SCS	SAT-PRO, TAPES	CLASS comfort vs SAT-PRO r = 0.62; vs SCS r = 0.74; other domains vs TAPES r = 0.43–0.55
Gates et al., 2025 (USA; Int.)	Randomized controlled trial	29 TF	Adjustable-volume sockets; Socket Fit Comfort Score	PEQ, SF-36	Successful adjustable sockets improved PEQ utility, ambulation, social burden and fit; high abandonment (24–41%)
England et al., 2026 (USA; Int.)	Retrospective longitudinal, multisite	444 LLA	Adjustable-volume socket; SCS	PLUS-M, PEQ-WB QoL & satisfaction	SCS 5.59 → 7.16 (d = 0.64); ΔSCS vs ΔPLUS-M r = 0.32, ΔQoL r = 0.48, Δsatisfaction r = 0.49
Castleberry et al., 2026 (USA; Int.)	Registry longitudinal	19,185 outcome records	Socket or prosthesis replacement	PEQ-WB, PLUS-M	QoL, satisfaction and mobility improved after replacement in all groups ($p < .01$)
Atallah et al., 2026 (Jordan; GCC-MENA)	Cross-sectional	74 unilateral LLA	TAPES-R satisfaction	TAPES-R adjustment & activity restriction	Satisfaction vs psychosocial adjustment r = 0.48; adjustment vs restriction r = −0.52
Al Qaroot et al., 2026 (Jordan; GCC-MENA)	Cross-sectional	119 working-age men	SCS	SIGAM mobility, London Handicap Scale, employment	Employed had higher comfort and mobility; comfort linked to work experience ($p = .03$)
Mgwili-Qikani et al., 2026 (South Africa; Int.)	Cross-sectional, multicentre	52 children (4–17 y)	Perceived comfort (questionnaire)	Perceived functionality, satisfaction	Comfort vs functionality ρ = 0.63; vs satisfaction ρ = 0.69
van der Stelt et al., 2026 (Sierra Leone; Int.)	Prospective cohort	34 TT (27 followed)	AI-designed socket; OPUS satisfaction	OPUS LEFS, D-HRQoL, EQ-5D, steps	LEFS 45 → 52 and D-HRQoL 25 → 31 improved; EQ-5D unchanged
Meouchi et al., 2026 (Spain; Int.)	Prospective comparative cohort	37 TF (16 with socket intolerance)	Severe socket problems → bone-anchored prosthesis	6MWT, VAS pain, EQ-5D-5L, SF-36	After OI: 6MWT 307 → 411 m, QoL improved; similar to successful socket users

*Same cohort as Alavi et al. (2024); counted as one study. Int. = International. ABC = Activities-specific Balance Confidence; ABIS = Amputee Body Image Scale; CLASS = Comprehensive Lower-limb Amputee Socket Survey; D-HRQoL = disease-specific HRQoL; HADS = Hospital Anxiety and Depression Scale; LCI = Locomotor Capabilities Index; LEFS = lower-extremity functional status; LLA = lower-limb amputation; LSA = Life-Space Assessment; NHP = Nottingham Health Profile; OI = osseointegration; OPUS = Orthotics and Prosthetics Users' Survey; PEQ(-MS/-WB) = Prosthesis Evaluation Questionnaire (Mobility Section/Well-being); PLUS-M = Prosthetic Limb Users Survey of Mobility; PSQ = Prosthesis Satisfaction Questionnaire; QWB-SA = Quality of Well-Being Scale, Self-Administered; SAT-PRO = Satisfaction with Prosthesis; SCS = Socket Comfort Score; SIGAM = Special Interest Group in Amputee Medicine; TAPES(-R) = Trinity Amputation and Prosthesis Experience Scales (Revised); TF = transfemoral; TT = transtibial; 2MWT/6MWT = 2-/6-minute walk test.

3.3 Methodological quality

Provisional quality scores are shown in Table 2. Nine studies were rated high, seven moderate and three low. The most frequent weaknesses were small samples without a reported power calculation and cross-sectional designs that could not establish temporal order. Eleven studies adjusted for confounders or used a randomized or controlled comparison, whereas eight reported unadjusted associations only. The three lowest-rated studies were an early descriptive survey (Hagberg & Brånemark, 2001), a study using non-validated questionnaires (Mgwili-Qikani et al., 2026) and a perception survey that combined users and clinicians (Turner & McGregor, 2020).

Table 2. Provisional methodological quality of included studies (five-criterion checklist)

Study	(a) Valid exposure	(b) Valid outcome	(c) n ≥ 100 / power	(d) Confounding addressed	(e) Longitudinal	Score	Rating
Hagberg & Brånemark, 2001	–	✓	–	–	–	1	Low
Turner & McGregor, 2020	–	–	–	–	–	0	Low
Seth et al., 2021	✓	✓	–	–	–	2	Moderate
Fatone et al., 2021	✓	✓	–	✓	✓	4	High
Eskridge et al., 2022	✓	✓	–	–	–	2	Moderate
DadeMatthews et al., 2023	✓	✓	✓	✓	–	4	High
Sions et al., 2023	✓	✓	✓	✓	–	4	High
Unal et al., 2024	✓	✓	–	✓	–	3	Moderate
Alavi et al., 2024/2025	✓	✓	✓	✓	–	4	High
Tao et al., 2025	✓	✓	–	✓	–	3	Moderate
Kuzu et al., 2025	✓	✓	–	–	–	2	Moderate
Gates et al., 2025	✓	✓	–	✓	✓	4	High
England et al., 2026	✓	✓	✓	–	✓	4	High
Castleberry et al., 2026	✓	✓	✓	✓	✓	5	High
Atallah et al., 2026	✓	✓	–	–	–	2	Moderate
Al Qaroot et al., 2026	✓	✓	✓	✓	–	4	High
Mgwili-Qikani et al., 2026	–	–	–	✓	–	1	Low
van der Stelt et al., 2026	✓	✓	–	–	✓	3	Moderate

Study	(a) Valid exposure	(b) Valid outcome	(c) n ≥ 100 / power	(d) Confounding addressed	(e) Longitudinal	Score	Rating
Meouchi et al., 2026	✓	✓	–	✓	✓	4	High

✓ = criterion met; – = not met or not reported. (a) validated exposure instrument or objective socket intervention; (b) validated outcome instrument or performance test; (c) ≥ 100 participants or a priori sample size; (d) multivariable adjustment, randomization or controlled comparison; (e) prospective or longitudinal design. Ratings: 4–5 high, 2–3 moderate, 0–1 low. Appraisal was based on abstracts and bibliographic records and requires full-text confirmation.

3.4 Prosthetic fit and socket comfort in relation to quality of life

Nine studies examined fit or socket comfort in relation to QoL, and six found a clear positive association (Figure 3). The strongest cross-sectional evidence came from Iran, where, among 168 adults with non-traumatic transtibial amputation, CLASS comfort showed a strong correlation with SF-12 QoL (r = 0.65) and remained the strongest prosthesis-related predictor in the multivariable model (β = 0.51); socket stability (r = 0.46) and suspension (r = 0.48) showed moderate correlations (Alavi et al., 2025). Longitudinal data pointed the same way. In 444 US adults fitted with adjustable-volume sockets, the mean SCS rose from 5.59 to 7.16 (Cohen's d = 0.64), and gains in comfort correlated with gains in QoL (r = 0.48) (England et al., 2026). In a national registry of more than 19,000 outcome records, replacing either the socket or the whole prosthesis was followed by significant improvements in QoL, satisfaction and daily wear time (Castleberry et al., 2026). Earlier survey data from Sweden showed that heat and sweating (72%) and sores or skin irritation from the socket (62%) were the problems most often held responsible for reduced QoL among transfemoral users (Hagberg & Brånemark, 2001), and UK users ranked socket fit as the largest single factor affecting their rehabilitation (Turner & McGregor, 2020).

Evidence from trials was less consistent. A randomized crossover trial of 25 transfemoral users found that a subischial socket was more comfortable (SCS 8.4 vs 7.0) and produced higher device satisfaction than an ischial-containment socket, but OPUS health-related QoL did not differ (Fatone et al., 2021). A randomized trial of three adjustable-volume transfemoral sockets reported improvements in PEQ utility, ambulation and social-burden scales in participants who tolerated the new design, but many sockets were abandoned during acclimation because of discomfort or instability (Gates et al., 2025). In Sierra Leone, locally produced AI-designed sockets improved condition-specific QoL but not EQ-5D scores (van der Stelt et al., 2026). For users with intolerable socket problems, bone-anchored prostheses that remove the socket altogether improved 6-minute walk distance, pain and QoL to levels comparable with high-functioning socket users (Meouchi et al., 2026), consistent with earlier osseointegration cohorts (Hagberg et al., 2014).

3.5 Prosthetic fit and socket comfort in relation to mobility and function

Ten studies addressed mobility or physical function. Six showed a significant positive association, two showed mixed findings and two found no association (Figure 3). In 72 community-dwelling users aged over 50 years, each one-point higher SCS predicted an additional 6.9 m (95% CI 2.7–11.1) on the 2-minute walk test and a 4.9-point (95% CI 1.1–8.8) higher life-space score, but SCS

did not predict daily step count (Tao et al., 2025). In the adjustable-socket cohort, comfort gains correlated moderately with gains in PLUS-M mobility (r = 0.32) (England et al., 2026), and in South African children, comfort correlated strongly with perceived functionality (ρ = 0.63) (Mgwili-Qikani et al., 2026). In the Iranian cohort, CLASS subscales were associated with mobility in bivariate analysis, but physical health status rather than socket comfort was the strongest predictor after adjustment (β = 0.40) (Alavi et al., 2024).

Two studies found that better comfort did not translate into better function. Transtibial users with suction suspension reported higher socket comfort than those with pin-lock suspension, yet PEQ mobility, Locomotor Capabilities Index and balance confidence were similar (Seth et al., 2021). Likewise, in the subischial-socket trial, comfort improved but performance-based measures of agility and sit-to-stand did not (Fatone et al., 2021). The correlation coefficients available across domains are displayed in Figure 2.

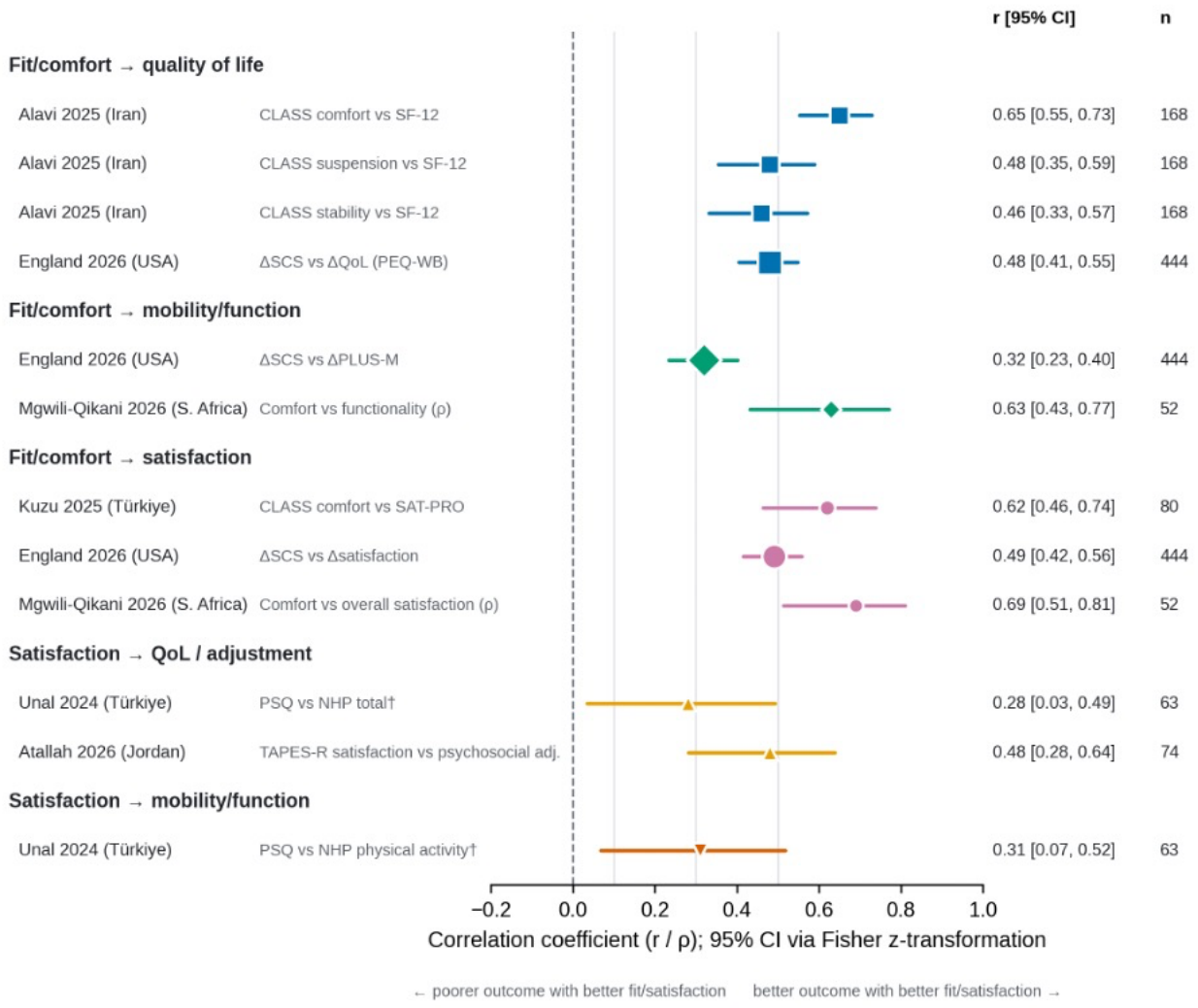


Figure 2. Forest plot of correlation coefficients between prosthetic fit/socket comfort or satisfaction and outcomes, grouped by exposure–outcome domain. Points show the reported Pearson r or Spearman ρ; horizontal lines show 95% CIs calculated by Fisher z-transformation;

marker size is proportional to √n. No pooled estimate was computed. Vertical grey lines mark 0.1, 0.3 and 0.5 (weak, moderate, strong). †Sign reversed because higher NHP scores indicate worse health. Δ = change score. CLASS = Comprehensive Lower-limb Amputee Socket Survey; NHP = Nottingham Health Profile; PEQ-WB = Prosthesis Evaluation Questionnaire–Well-being; PLUS-M = Prosthetic Limb Users Survey of Mobility; PSQ = Prosthesis Satisfaction Questionnaire; SAT-PRO = Satisfaction with Prosthesis questionnaire; SCS = Socket Comfort Score; TAPES-R = Trinity Amputation and Prosthesis Experience Scales–Revised.

3.6 Fit and comfort in relation to satisfaction

All four studies that linked fit or comfort with satisfaction found a positive association. In Turkish veterans, CLASS comfort correlated strongly with SAT-PRO satisfaction ($r = 0.62$) and with the SCS ($r = 0.74$) (Kuzu et al., 2025). Comfort gains predicted satisfaction gains in the US adjustable-socket cohort ($r = 0.49$) (England et al., 2026), comfort correlated with overall satisfaction in children ($\rho = 0.69$) (Mgwili-Qikani et al., 2026), and the more comfortable socket in the crossover trial also yielded higher OPUS satisfaction with device (Fatone et al., 2021). Taken together, these data support treating comfort as a principal component of satisfaction rather than as a separate construct.

3.7 Prosthesis satisfaction in relation to mobility and quality of life

The largest included study, an online survey of 1,736 civilians, veterans and service members, used path analysis and found that lower-extremity functional status was the strongest correlate of device satisfaction (standardized $\beta = 0.55$), followed by balance confidence ($\beta = 0.22$), with a small independent contribution from health-related QoL ($\beta = 0.08$); together these explained 47% of the variance in satisfaction (DadeMatthews et al., 2023). Among 86 US service members with combat-related amputation, higher OPUS satisfaction was associated with higher Quality of Well-Being scores ($\beta = 0.0058$ per point, $p = 0.004$) (Eskridge et al., 2022). In Türkiye, PSQ satisfaction correlated with better NHP physical activity ($r = 0.31$) and total NHP scores ($r = 0.28$, sign-harmonized), and residual-limb and phantom pain independently predicted lower satisfaction (Unal et al., 2024). In Jordan, TAPES-R satisfaction correlated with psychosocial adjustment ($r = 0.48$), which in turn correlated inversely with activity restriction ($r = -0.52$), and phantom limb pain was linked to lower satisfaction (Atallah et al., 2026).

3.8 Participation and work

Two studies looked beyond mobility. Among 126 US adults, the SCS was among the candidate factors for community participation but was not retained in the final model, which was driven by physical activity, balance confidence, prosthesis use and absence of neuropathy (Sions et al., 2023). In a Jordanian study of 119 working-age men, only 34.5% had returned to work; employed participants reported greater socket comfort and mobility, and socket comfort was associated with work experience among those in employment ($p = 0.03$) (Al Qaroot et al., 2026). The overall pattern of effect direction across all six domains is shown in Figure 3.

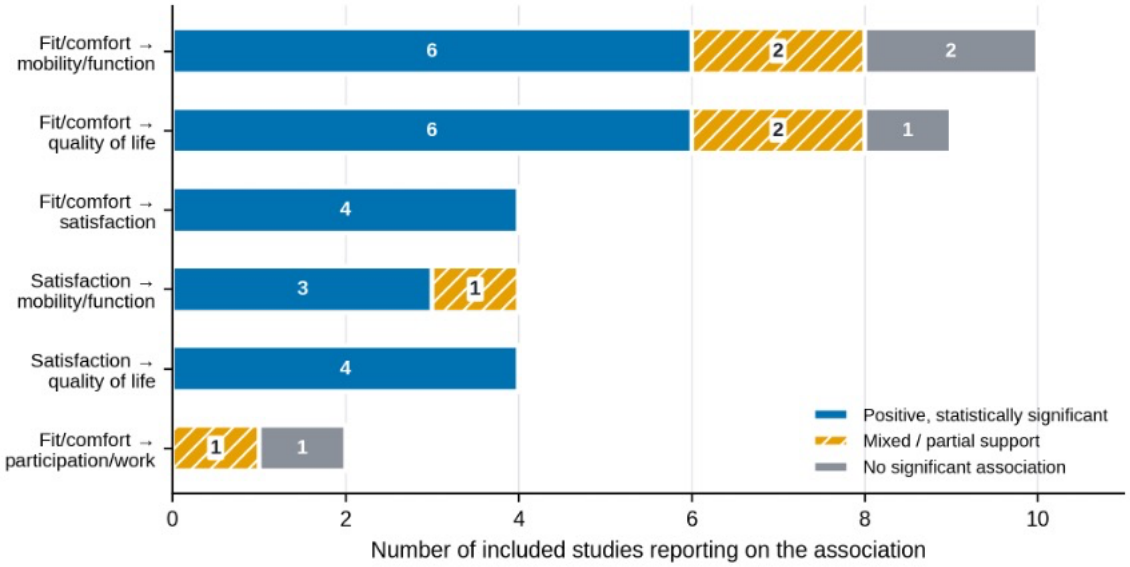


Figure 3. Effect-direction (harvest) summary of included studies by exposure–outcome domain. Each bar segment counts the studies that reported a positive, statistically significant association (solid blue), mixed or partial support (hatched orange; significant for some outcomes or subgroups only) or no significant association (grey). A study may contribute to more than one domain.

4. Discussion

4.1 Principal findings

This review brings together 19 studies from 10 countries on how socket fit and prosthesis satisfaction relate to mobility and QoL in lower-limb prosthesis users. Three findings stand out. First, the association between socket comfort and QoL is consistent and of moderate to strong magnitude, both cross-sectionally and in longitudinal data where comfort improves over time. Second, comfort and satisfaction are closely linked, which fits the view that users judge a prosthesis first by how the socket feels. Third, the link between comfort and mobility is weaker and less consistent: comfort predicts self-reported mobility, walking capacity and life-space, but in two controlled comparisons a more comfortable socket did not improve performance-based function. The most plausible reading is that socket comfort is necessary but not sufficient for good mobility, which also depends on physical capacity, balance, comorbidity and pain (Alavi et al., 2024; Sions et al., 2023; Tao et al., 2025).

4.2 Comparison with previous reviews

These results extend earlier syntheses. Baars et al. (2018) identified fit as one of several factors influencing satisfaction but could not quantify the relationship because of instrument heterogeneity. By harmonizing effect direction and plotting the available correlations, the present review shows that comfort–satisfaction correlations cluster between 0.49 and 0.69 across three countries and two age groups. Luza et al. (2019) highlighted pain and prosthesis use as drivers of psychosocial adjustment; the Turkish and Jordanian studies included here confirm that phantom and residual-limb pain lower satisfaction (Atallah et al., 2026; Unal et al., 2024), suggesting that

pain may partly mediate or confound the fit–outcome relationship. Earlier QoL reviews could not separate socket effects from those of prosthesis use in general (Sinha & Van Den Heuvel, 2011); the longitudinal registry and adjustable-socket cohorts included here make that separation more credible, because the same individuals reported better QoL after their socket was changed (Castleberry et al., 2026; England et al., 2026). A recent review of socket interface pressure also found that loading at bony regions can distinguish comfortable from uncomfortable sockets, which offers a biomechanical explanation for the patient-reported findings (Armitage et al., 2026).

4.3 Saudi Arabian and regional evidence compared with the international picture

No study conducted in Saudi Arabia met the inclusion criteria, and this is the clearest gap identified. The Saudi literature that exists is either descriptive or methodological (Table 3). A survey of 220 traumatic amputees at the Medical Rehabilitation Hospital in Madinah reported that three quarters were satisfied with the durability of their prostheses and almost all were satisfied with clinical services, but it did not relate satisfaction to mobility or QoL (Bari et al., 2022). Arabic versions of the OPUS Client Satisfaction with Device, the Quebec User Evaluation of Satisfaction with Assistive Technology and the Activities-specific Balance Confidence scale have been validated in Saudi and Turkish prosthesis users (Bakhsh et al., 2021; Bakhsh et al., 2024; Kablan et al., 2021), so the measurement tools needed for association studies are now available. A retrospective study from Jeddah found that independent mobility was associated with better health-related QoL after diabetic-foot amputation, but prosthetic fit was not assessed (Alkhatieb et al., 2026). Qualitative work from a large Saudi rehabilitation centre highlights family support, religious coping and body image as central to adjustment (Abouammoh et al., 2021), and a regional survey found that most prosthetists in Saudi Arabia, Jordan and Malaysia still rely on traditional, largely subjective alignment methods (Malaheem et al., 2025).

Table 3. Saudi Arabian and regional (GCC–MENA) evidence relevant to prosthesis satisfaction, fit and outcomes (contextual; not included in the synthesis unless marked)

Study	Setting (tag)	Design / sample	Main finding	Relevance to this review
al-Turaiki & al-Falahi, 1993	Riyadh, Saudi Arabia (Saudi)	Retrospective; 3,210 amputees	Lower-limb amputations predominated; trauma (52.9%) the leading lower-limb cause; transtibial most common level	Defines the traditional Saudi user profile: young, male, traumatic
AlSofyani et al., 2016	Jeddah, Saudi Arabia (Saudi)	Retrospective; 121 major LLA	Diabetes caused 63.6%; only 32.2% completed rehabilitation; mobility improved after rehabilitation	Shift toward older diabetic users; rehabilitation gaps
Bakhsh et al., 2021; Kablan et al., 2021	Saudi Arabia & Türkiye (Saudi/MENA)	Rasch validation; 183 users	Arabic OPUS-CSD and A-QUEST 2.0 valid and unidimensional	Arabic satisfaction instruments ready for association studies
Bari et al., 2022	Madinah, Saudi Arabia (Saudi)	Cross-sectional; 220 traumatic LLA	75% satisfied with prosthesis durability; 97% satisfied with services	Only Saudi satisfaction survey; no link to mobility or QoL (excluded)
Bakhsh et al., 2024	Saudi Arabia & Türkiye (Saudi/MENA)	Rasch validation; 155 users	Arabic ABC-5 scale fits Rasch model	Arabic balance/mobility-related outcome available

Study	Setting (tag)	Design / sample	Main finding	Relevance to this review
Abouammoh et al., 2021	Saudi rehabilitation centre (Saudi)	Qualitative; 13 LLA	Family support, religious coping and body image shape adjustment	Cultural context for satisfaction and QoL
Malaheem et al., 2025	Saudi Arabia, Jordan, Malaysia (Saudi/MENA)	Cross-sectional; prosthetists	86.8% rely on traditional, qualitative alignment methods	Fit quality depends on practitioner methods
Alkhatieb et al., 2026	Jeddah, Saudi Arabia (Saudi)	Retrospective cross-sectional; DFU-related LLA	Independent mobility linked to better HRQoL; depression and anxiety to worse	Mobility–QoL link in Saudi users; fit not measured
Alavi et al., 2024, 2025; Unal et al., 2024; Kuzu et al., 2025; Atallah et al., 2026; Al Qaroot et al., 2026	Iran, Türkiye, Jordan (GCC-MENA)	See Table 1	Comfort–QoL r = 0.65; comfort–satisfaction r = 0.62; satisfaction–adjustment r = 0.48	Included: regional associations concordant with international data

ABC = Activities-specific Balance Confidence; A-QUEST = Arabic Quebec User Evaluation of Satisfaction with Assistive Technology; DFU = diabetic foot ulcer; LLA = lower-limb amputation; OPUS-CSD = Orthotics and Prosthetics Users' Survey Client Satisfaction with Device.

The five included MENA studies broadly agree with the international findings. The Iranian correlation between socket comfort and QoL (r = 0.65) was the strongest in the review (Alavi et al., 2025), and the Turkish CLASS validation reproduced the comfort–satisfaction link seen in the United States (Kuzu et al., 2025). Two features of the regional evidence are distinctive. Satisfaction in the Jordanian sample was only moderate (Atallah et al., 2026), and the low return-to-work rate in Jordan suggests that structural barriers such as workplace access and the absence of vocational rehabilitation may blunt the benefit of a well-fitting socket (Al Qaroot et al., 2026). Conflict-related amputations, highlighted in Syrian prosthesis users (Khadour et al., 2026), and the rising share of diabetic amputations in the Gulf create a user population whose needs may differ from the mainly traumatic, working-age samples studied in the West. Transferring international findings to Saudi practice therefore requires local confirmation.

4.4 Implications for practice and service quality

For prosthetic services, the findings support routine, repeated measurement of socket comfort. The SCS is quick to administer, its minimal detectable change has been described at key clinical milestones (Pousett et al., 2024), and it predicts outcomes that users value. Services should consider pairing it with a validated satisfaction measure (Arabic OPUS or QUEST in Saudi settings) and a mobility measure such as PLUS-M, in line with expert recommendations (Kohler et al., 2023). Earlier time to first fitting has been linked to greater prosthesis use and satisfaction (Pezzin et al., 2004), and timely socket replacement appears to improve well-being (Castleberry et al., 2026). From a quality-improvement perspective, socket comfort and satisfaction could serve as patient-reported key performance indicators for accredited rehabilitation centres in the Kingdom, alongside process measures such as waiting time to fitting.

4.5 Strengths and limitations

Strengths of this review include a transparent, multi-string search with explicit regional terms, harmonization of effect direction across instruments, visual display of all extractable correlation

coefficients with confidence intervals, and a deliberate comparison of Saudi, regional and international evidence.

Several limitations must be acknowledged. Only PubMed/MEDLINE was searched; studies indexed solely in Embase, CINAHL, Scopus or regional databases (for example, the Saudi Digital Library or Arabic-language journals) may have been missed. Screening, extraction and quality appraisal were performed by a single reviewer on titles, abstracts and bibliographic records, and full texts were not retrieved for all reports, so some numerical details, covariates and risk-of-bias features may be incomplete; full-text verification by a second reviewer is required before submission. The protocol was not registered. Most included studies were cross-sectional, instruments were heterogeneous, and several correlations came from change scores rather than levels, which limits comparability; a pooled estimate was therefore not attempted. Two reports share one cohort, and two US reports come from the same national provider network, which may overlap. Finally, publication bias could not be assessed formally.

4.6 Recommendations for research

Future studies should (a) use prospective designs that measure socket comfort and satisfaction repeatedly alongside both self-reported and performance-based mobility; (b) adjust for pain, comorbidity and physical capacity, which may confound or mediate the associations; (c) report standardized effect sizes to enable meta-analysis; and (d) include Saudi and Gulf populations using the Arabic-validated instruments already available, with attention to diabetic and older users.

5. Conclusion

Across 19 studies, better socket comfort and higher prosthesis satisfaction were consistently associated with better QoL and, less consistently, with better functional mobility among lower-limb prosthesis users. Comfort and satisfaction are closely linked, and improvements in comfort after socket replacement or redesign are accompanied by gains in well-being. Because the evidence is largely cross-sectional and no Saudi study met the inclusion criteria, these associations should not be read as causal, and locally generated longitudinal evidence is needed. Measuring socket comfort and satisfaction routinely is a practical, low-cost step that prosthetic services, including those in Saudi Arabia, can take now.

Declarations

Ethics approval and consent: Not applicable. This review analysed published, de-identified data only.

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Data availability: The search strings, extraction table and the data underlying Figures 2 and 3 are provided in the Supplementary Tables and are available from the author on request.

Author contribution: A.A.A: conceived the review; approved the final manuscript.F.A.A.: defined the eligibility criteria; approved the final manuscript. H.F.A: interpreted the findings; approved the final manuscript. T.A.A: approved the final manuscript. A.H.A: approved the final manuscript. B. S.A: approved the final manuscript.

Use of AI tools: An AI assistant (Claude, Anthropic) was used to support literature retrieval from PubMed, data extraction, figure generation and language drafting. All sources were retrieved from PubMed with their DOIs; the author is responsible for verifying the content, the extracted data and the interpretation.

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Supplementary Material

Supplementary Table S1. PubMed/MEDLINE search strings (inception to 29 September 2026) and records returned

#	Search string (PubMed syntax, abbreviated where the translation was automatic)	Records
S1	(prosthesis OR prosthetic) AND (lower limb OR amputation OR amputee) AND (socket fit OR socket comfort) AND (quality of life OR mobility OR satisfaction)	40
S2	(lower limb amputation OR amputee) AND prosthesis satisfaction AND (quality of life OR mobility)	40
S3	(amputee[tiab] OR amputation[tiab] OR prosthesis users[tiab]) AND (Saudi Arabia OR Saudi OR Jordan OR Egypt OR Iran OR Kuwait OR Qatar OR Emirates OR Oman OR Iraq OR Lebanon OR Turkey [tiab]) AND (lower limb OR transtibial OR transfemoral)	60
S4	socket comfort score[tiab] AND (amputee OR prosthesis)	35
S5	(Trinity Amputation and Prosthesis Experience Scales OR TAPES OR Orthotics and Prosthetics Users Survey OR OPUS OR Prosthesis Evaluation Questionnaire) AND lower limb AND satisfaction AND (quality of life OR mobility)	40
S6	(prosthesis OR prosthetic) AND satisfaction AND lower limb amput* AND systematic review[pt]	12
S7	(socket fit OR socket problems OR socket comfort OR prosthetic fit) AND (quality of life OR SF-36 OR WHOQOL OR EQ-5D) AND (amputee OR amputation)	40
S8	Author-targeted landmark studies (Baars EC; Hagberg K; Legro MW; Sinha R) combined with satisfaction, socket or quality-of-life terms	15
S9	(amputation OR amputee OR prosthesis) AND Saudi Arabia[tiab] AND (lower limb OR lower extremity OR transtibial OR transfemoral)	38
S10	(socket comfort score OR prosthesis satisfaction OR prosthetic fit) AND (PLUS-M OR Locomotor Capabilities Index OR 6-minute walk OR Amputee Mobility Predictor OR K-level) AND correlation	7
S11	(amputee OR amputation OR prosthesis) AND (Saudi OR Arab OR Egypt OR Jordan OR Kuwait OR Emirates OR Oman OR Qatar OR Bahrain OR Iran OR Pakistan) AND (quality of life OR prosthesis satisfaction OR socket comfort) AND lower; 2010 onward	40

#	Search string (PubMed syntax, abbreviated where the translation was automatic)	Records
S12	Author-targeted (Gallagher P; Dillingham TR; Pezzin LE; Bekrater-Bodmann R; Turner S; Hafner BJ) AND (satisfaction OR socket) AND lower limb	40
	Total records (before de-duplication) / unique records	407 / 309

Records per string are the relevance-ranked records exported for screening. tiab = title/abstract; pt = publication type.

Supplementary Table S2. Evidence extraction table for included reports (setting tag: Saudi / MENA = GCC–Middle East and North Africa / Int. = International)

Author, year	Country	Tag	Design	Sample	Objective	Methods / analysis	Key findings	Limitations	Relevance	DOI
Hagberg & Brånemark, 2001	Sweden	Int.	Cross-sectional mailed survey	97 unilateral TF, non-vascular	Describe HRQoL, prosthetic use and problems	SF-36 vs norms; structured questionnaire	Socket heat/sweating 72%, sores 62% most cited as reducing QoL	Descriptive attribution; no correlation statistics	High – socket problems and QoL	10.1080/03093640108726601
Turner & McGregor, 2020	United Kingdom	Int.	Mixed-methods survey + interviews	94 users and clinicians	Perceived effect of socket fit on rehabilitation	Online survey; thematic interviews	Fit the biggest factor for 48% of users, 65.7% of clinicians	Perception data; mixed sample	Moderate – user perception of fit	10.1016/j.arrct.2020.100059
Seth et al., 2021	USA	Int.	Cross-sectional (secondary)	48 unilateral TT	Compare pin-lock vs suction on self-report	Group comparison of SCS, PEQ-MS, LCI, ABC	Higher SCS with suction; mobility similar	Small; unadjusted	High – comfort without mobility gain	10.1097/PXR.0000000000000007
Fatone et al., 2021	USA	Int.	Randomized crossover trial	30 TF (25 completed), K3/K4	Compare ischial-containment vs subischial socket	Linear mixed models; SCS primary	SCS +1.7 points; higher OPUS satisfaction; no function/HRQoL difference	Small; short (7-week) periods	High – experimental fit contrast	10.1016/j.apmr.2021.05.016
Eskridge et al., 2022	USA	Int.	Cross-sectional	86 combat-related major LLA	Assess satisfaction and QoL	Linear regression OPUS-SD → QWB-SA	$\beta = 0.0058$, $p = .004$	Military sample; small	High – satisfaction–QoL	10.1097/PXR.0000000000000054
DadeMatthews et al., 2023	USA	Int.	Cross-sectional online survey	1,736 LLA (civilian, veteran, service)	Relate satisfaction, HRQoL and function	Path analysis	LEFS β 0.55, ABC β 0.22, HRQoL β 0.08 with device satisfaction; R^2 0.47	Self-selected online sample	High – satisfaction–function–QoL	10.1097/PXR.0000000000000285
Sions et al., 2023	USA	Int.	Cross-sectional (secondary)	126 TT/TF ≥ 1 y	Predict community participation	Correlation + stepwise regression	SCS not retained; model R^2 50.1%	Single clinic	Moderate – participation	10.1097/PHM.0000000000002209
Unal et al., 2024	Türkiye	MENA	Cross-sectional pilot	63 LLA	Satisfaction, psychology and QoL	Correlation; regression	PSQ vs NHP physical activity r −0.31, total r −0.28; pain β −0.41 on PSQ	Small pilot	High – satisfaction–QoL (regional)	10.7547/22-154

Author, year	Country	Tag	Design	Sample	Objective	Methods / analysis	Key findings	Limitations	Relevance	DOI
Alavi et al., 2024	Iran	MENA	Cross-sectional	168 non-traumatic TT	Prosthesis/health factors of mobility	Correlation + multiple regression	CLASS associated with mobility; PCS β 0.40 strongest	Same cohort as 2025	High – fit–mobility (regional)	10.1097/PXR.0000000000000378
Alavi et al., 2025	Iran	MENA	Cross-sectional	168 non-traumatic TT	Prosthesis predictors of QoL	Correlation + multiple regression	Comfort r 0.65 (β 0.51); suspension r 0.48; stability r 0.46	Cross-sectional	High – fit–QoL (regional)	10.1371/journal.pone.0327781
Tao et al., 2025	Canada	Int.	Cross-sectional (trial baseline)	72 users > 50 y	Does comfort predict walking?	Multiple regression	SCS → 2MWT B 6.9 m; LSA B 4.9; not steps	Older sample; small	High – fit–mobility	10.1177/02692155251374927
Kuzu et al., 2025	Türkiye	MENA	Validation (test–retest)	80 combat-related K3/K4	Turkish CLASS validity	ICC; Pearson correlations	Comfort vs SAT-PRO r 0.62; vs SCS r 0.74	Veterans only	High – fit–satisfaction (regional)	10.1097/MRR.0000000000000683
Gates et al., 2025	USA	Int.	Randomized controlled trial	29 TF	Adjustable sockets vs laminated	Within-person comparisons	Improved PEQ utility/ambulation/ social burden when tolerated; 24–41% abandonment	Small; attrition	High – experimental fit contrast	10.1016/j.apmr.2025.08.018
England et al., 2026	USA	Int.	Retrospective longitudinal, multisite	444 LLA	Effect of adjustable-volume socket	Paired tests; change-score correlations	SCS d 0.64; ΔSCS–ΔPLUS-M r 0.32, ΔQoL r 0.48, Δsatisfaction r 0.49	No control group	High – longitudinal fit–outcomes	10.1002/pmrj.70175
Castleberry et al., 2026	USA	Int.	Registry longitudinal	19,185 outcome records	Outcomes after socket/prosthesis replacement	t-tests; estimated marginal means	QoL, satisfaction, mobility improved ($p < .01$)	Provider database; possible overlap with England	High – socket replacement	10.1186/s41687-026-01021-4
Atallah et al., 2026	Jordan	MENA	Cross-sectional	74 unilateral LLA	Arabic TAPES-R profile	Pearson correlations; t-tests	Satisfaction–adjustment r 0.48; adjustment–restriction r −0.52	No direct satisfaction–mobility r reported	High – regional Arabic data	10.3390/jcm15031291
Al Qaroot et al., 2026	Jordan	MENA	Cross-sectional	119 working-age men	Return to work after LLA	Group comparison; regression	RTW 34.5%; comfort associated with work experience ($p = .03$)	Men only	Moderate – participation (regional)	10.1007/s10926-026-10388-6
Mgwili-Qikani et al., 2026	South Africa	Int.	Cross-sectional, 3 centres	52 children	Comfort, function, satisfaction	Spearman; multiple regression	Comfort–function ρ 0.63; comfort–satisfaction ρ 0.69	Non-validated tool; proxy report	Moderate – paediatric	10.3390/children13081013
van der Stelt et al., 2026	Sierra Leone	Int.	Prospective cohort	34 TT (27 followed)	AI-designed sockets in rural LMIC	Pre–post (10 weeks)	LEFS 45→52; D-HRQoL 25→31; EQ-5D unchanged	No control; short follow-up	Moderate – LMIC socket intervention	10.1016/j.apmr.2026.02.499

Author, year	Country	Tag	Design	Sample	Objective	Methods / analysis	Key findings	Limitations	Relevance	DOI
Meouchi et al., 2026	Spain	Int.	Prospective comparative cohort	37 TF	Osseointegration for socket intolerance	Pre–post and between-group	6MWT 307→411 m; QoL improved; pain lower than socket users	Small; selected sample	Moderate – consequence of socket failure	10.1016/j.apmr.2026.02.012

No Saudi study met the inclusion criteria; Saudi contextual evidence is summarized in Table 3. Abbreviations as in Table 1. DOIs resolve at https://doi.org/.