Impact of Sports Prostheses on Sports Participation for Children with Lower Limb Loss/Difference

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Clinical Question: Does receiving sports specific prostheses increase sports participation for children with lower limb loss/difference compared to those with only everyday prostheses?

Background: Participation in sports offers psychosocial benefits for children with physical disabilities, including increased health-related quality of life, athletic competence, social acceptance, and self-efficacy.[1] Children with limb differences specifically have reported feelings of accomplishment, satisfaction, confidence, and fulfillment when involved in sports.[2] Despite these benefits, participation in sports among individuals with lower limb amputation remains relatively low, ranging from just 11-60% in comparison to 58.4% of able-bodied children participating in sports.[3] [4]

Sports-specific prostheses are designed to meet the functional demands of an individual's chosen sport, often featuring increased energy storage and return, increased shock absorption, and greater propulsion.[5,6] However, only an estimated 13.5% of lower limb prosthesis users utilize a secondary sports prosthesis.[7] To evaluate medical necessity and support children with limb differences, it is important to determine whether receiving a sports specific prosthesis increases the extent of sports participation in this population.

Search Strategy:
Databases Searched: PubMed, Google Scholar, CINAHL
Search Terms: "Artificial Limbs"[Mesh] AND "Pediatrics"[Mesh] AND (sport OR activity OR recreation OR run)
Inclusion Criteria: Published within the last 10 years, peer-reviewed, participants under age 18 using a lower limb sports prosthesis, available in English, primary evidence

Synthesis of Results: Three descriptive qualitative studies evaluated the use and experience of children with limb differences who use sports prostheses.[2,8,9] All three studies utilized convenience sampling,[2,8,9] with sample sizes ranging between 8[8] and 19[2] children and/or their parents. Study populations included both upper[2,9] and lower limb[2,8,9] involvement at varying levels. All studies used semi-structured interviews to gather data,[2,8,9] and one included an online survey.[8]

Conclusions are limited by small sample sizes,[2,8,9] lack of member checking of identified themes,[2,8] restricted geographical diversity,[2,8] lack of control groups,[2,8,9] recency bias,[8] and a failure to differentiate results between upper and lower limb prosthesis users.[2,9]

The studies explored child and parental perceived facilitators and barriers to sports participation,[2] perception of running specific prostheses,[8] and lived experiences.[9] Across studies, 77% to 100% of children utilized a sports prosthesis in a variety of activities.[2,8,9] Sports prostheses were perceived to improve participation quality by enabling better posture, increased strength, stability, balance, weight distribution, prevention of contralateral limb overuse,[2] faster running, higher jumping, and keeping up with peers.[8] Conversely, some participants felt any prosthesis could hinder participation.[2] Preferences varied by activity, with children identifying tasks best suited for sports versus everyday prostheses.[8] Notably, no study directly compared sports participation before and after receiving a sports specific prosthesis.

Clinical Message:
This medium-to-low-quality body of evidence indicates mixed results of the effect of sports prostheses on sports participation in children with lower limb differences. While some studies demonstrate improved participation quality,[2, 8] perceptions vary, and some children report that any prosthesis can be limiting during sports.[2] Clinically, these data can inform discussions with patients and families inquiring about sports prostheses, offering insight into lived experiences and potential benefits and challenges. Future research should include control groups of age- and condition- matched children who do not utilize a sports prosthesis to better assess comparative sports participation. With 11 U.S. states now mandating insurance coverage for activity specific prostheses,[10] there is growing opportunity for longitudinal studies comparing sports participation before and after receiving a sports prosthesis- offering valuable data to guide both clinical practice and policy.

References

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Evidence Table

	Sayed Ahmed, 2018[2]	**Hadj-Moussa, 2022**[8]	**Toovey, 2024**[9]
Population	Children ages 6-14 and/or their parent(s) Sample size: 19 total participants Gender of children: 6 females, 5 males Level of limb difference: partial hand (2), transradial (3), elbow disarticulation (1), transtibial (4), transfemoral (1)	Children ages 8-20 Sample size: 8 (4 accompanied by mother) Gender of children: 4 males, 4 females Level of limb difference: bilateral TT (2), unilateral TT (4), unilateral ankle disarticulation (1), bilateral KD (1)	Children between ages 9-16 and their parent Sample size: 9 pairs Gender of children: 3 female, 5 male, 1 gender queer Gender of parent: 9 females Level of limb difference: Bilateral upper limb (1), unilateral upper limb (2), bilateral lower limb (1), unilateral lower limb (5)
Inclusion/Exclusion Criteria	Inclusion: - Age 6-17 - Any form of limb absence - English speaking Exclusion: - None	Inclusion: - Age 8-20 - Any level/cause of lower limb amputation - Current running specific prosthesis (RSP) user - Able to communicate in English Exclusion: - None	Inclusion: - 8-17 years old - Any limb difference - Informed parental consent - Basic English proficiency of both parent and child Exclusion: - Parental or child intellectual disability impacting interview participation
Sampling Strategy	Convenience sampling through an outpatient clinic	Convenience sampling in a tertiary care pediatric rehabilitation hospital	Convenience sampling through the START Foundation, Royal Children's Hospital's Prosthetics and Orthotics Unit and social media
Study Design	Descriptive qualitative	Descriptive qualitative	Descriptive qualitative
Domain of Interest	Child and parental perceived facilitators and barriers to sports participation	Child and parental perception of running specific prostheses (RSP)	Participatory experience of young people with limb differences in sports/recreation

	Sayed Ahmed, 2018[2]	Hadj-Moussa, 2022[8]	Toovey, 2024[9]
Methodology	- Semi structured interviews conducted by two researchers (in person or via phone) - Option of just parent (3), just child (1), or child and parent (7) - Interviews continued until data saturation was reached - A total of 11 interviews were completed with a total of 19 participants	- Online study-specific activity survey completed by child before interview - Semi-structured interviews conducted over zoom with child as main interviewee and parent present as proxy - Transcription of interviews and coding to identify themes	- Semi structured interviews conducted via video conference - Parents and children interviewed separately - Audio recording of interviews and coding - Two rounds of member checking completed by 8 of 9 pairs
Data Analysis	- Interviews were recorded and transcribed by research team - Four individual researchers analyzed transcriptions using a thematic analysis approach and identified initial codebook independently - Codes were finalized through discussion with a total of seven research team members - Codebook used by researchers to identify themes	- Initial code book generated by two researchers independently coding three interviews using a data-driven content analysis approach - Codes reviewed by five researchers, then used to code remainer of interviews - Data analysis completed using NVivo 12.0	- Independent labelling of meaningful segments by two researchers to develop initial codes - Discussion and cross checking of themes and subthemes - Revision of themes and subthemes after member checking done by two researchers
Key Findings	- Several participants found specialized sports prosthesis/attachment to facilitate better posture, increased strength, stability, balance, weight distribution, prevent contralateral limb overuse, and improve quality of participation. - Reported hinderances of prosthesis use during sports included weight, range of motion limitations, and poor comfort and fit. - Some participants preferred to participate in sports without a prosthesis, having adapted before initially receiving a prosthesis.	- Participants felt their RSP allowed them to run faster, jump higher, and participate in physical activities with peers. - All participants expressed positive feelings when wearing the RSP and toward the cosmesis of the RSP. - Participants identified specific activities they preferred doing with either their daily use prosthesis or RSP. - Perception of capabilities of RSP greatly expanded after receiving an RSP. - The most reported RSP activity was running, with five other sports reported	- 7 of 9 children utilized a sport prosthesis. - All 9 children participated in sports or recreation with family or friends. - 8 of 9 children participated in structured sports or recreation. - 10 different sports reported

	Sayed Ahmed, 2018[2]	Hadj-Moussa, 2022[8]	Toovey, 2024[9]
	- Some sports leagues do not allow the use of a prosthesis or have heavy regulations on the types of prostheses allowed. - Some participants reported bullying as a barrier to wearing their prosthesis during sports. - All children reported involvement in inclusive programs. - 18 different sports reported		
Study Quality	Low	Low	Medium
Applicability to clinician question/ clinical takeaway	Medium Study findings indicate that some participants found sports specific prostheses to facilitate improved quality of participation in sports, while others found any prosthesis use in sports to be a hinderance	Medium Study findings indicate that running specific prosthesis users experience benefits in sports participation and have an increased perception of abilities after receiving an RSP	Low Study findings indicate that most participants utilize a sports specific prosthesis for sports participation
Study Limitations	- Small sample size - Lack of control group - No differentiation between results from upper and lower limb involvement - All participants from same outpatient clinic and geographical area - Lack of member checking - Inconsistencies between child vs parental involvement	- Small sample size - Lack of control group - All participants from same prosthetic clinic and geographic area - Lack of member checking - Recency bias-children had to recall experiences prior to Covid lockdown - Inclusion criteria of current RSP users could cause over representation of positive feelings towards RSP	- Small samples size - Lack of control group - No differentiation between results from upper and lower limb involvement - Specifically aimed at evaluating in Australian setting