Junior LP Foot - Clinical Investigation Protocol

Exploratory testing of a pediatric prosthetic foot

ESAR

CONFIDENTIAL DOCUMENT

Document Sign-off Information			
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Sponsor's Statement: On behalf of the Sponsor, I have reviewed and approved this CIP in its entirety and agree to sponsor its implementation.

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Principal Investigator: [redacted]	Date and Signature:

Co-Investigators:	[redacted]		Össur hf	Product Designer - Lead Pro-Flex & TS
	[redacted]		Össur hf	Product Designer
Monitor:	[redacted]		Össur hf	Clinical Investigation Specialist

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Tables

1 How to Refer to This Document

[0] CIP2023101939, Clinical Investigation Protocol, [redacted]

2 Summary

Title of the investigation: Exploratory testing of a pediatric prosthetic foot

The purpose of the following study is of exploratory nature to provide design input for a prosthetic foot under development for children with lower limb loss, amputation or deficiency.

User testing is needed to get data points for the stiffness curve of the foot. These datapoints are extrapolated from user testing and reduces the risk to design a too stiff or soft device.

Machine tests cannot replace user feedback. The user´s perception helps to detect performance deficits and address these in early stages of the design.

Walking performance may change if the foot is too stiff or too soft. Some of these changes can be spotted by observation through legal guardians or experienced prosthetists. Product changes may be justified based on the observations made by the child, legal guardian, CPO or engineers specializing in foot design.

Device(s) being tested:	Pro-Flex LP Junior	
Instruments and equipment:	1. LASAR posture alignment tool or laser for plumb line 2. Video cameras	
Subjects recruited:	Inclusion criteria:	Exclusion criteria:
Up to 15	• Cognitive ability to understand all instructions and questionnaires in the study (adapted to kids). • Active prosthesis user • Transtibial or transfemoral amputation, limb loss or similar level congenital limb deficiency. • Age 5 or older. ○ Age 5-12 years preferred. • 15 kg < Body weight < 55 kg • 16 ≤ Foot size ≤ 24 • Clearance: Size 16 > 50mm, Sizes 17-19 > 60mm, Sizes 20-24 > 70mm • Willing and able to participate in the study and follow the protocol, including consent to participate from legal guardian if under 16 years old.	• Users with severe residual limb pain or socket problems, which have negative impact on testing and outcome.
Procedures:	• Potential subjects identified, fitting inclusion/exclusion criteria, by PI • Informed consent obtained from participant if applicable, legal guardian or both. • Subject (legal guardian) signs ICF, by PI	

	• Subject ambulates on their current prescribed foot for observation – Questions administered, by PI or delegated by PI • Subject fitted with investigational device, by PI • Subject ambulates in the investigational device for observation – Questions administered, by PI or delegated by PI • Subject is fitted back to their prescribed prosthesis, by PI

* The foot design is a downsized (size and stiffness) version of the Pro-Flex LP and therefore can be used for adults if a small foot size and

Tasks and responsibilities:

The **Principal Investigator** or delegates (provided by Shriners) will be in contact with the patients, has access to all patient and health information.
Responsibilities:

- Screen subjects
- Informed Consent
- Report possible vigilance cases/SAEs to sponsor
- Explain trial to legal guardian and subject
- Fit subject with device under investigation (and any other intervention; and back to their current device, as applicable)

The **Co-Investigators** (provided by the sponsor - Össur) will be in contact with the patients during the scheduled visit and collect data on the investigational devices. This direct contact to the patients is essential for the product designers to observe the product function and assess the next steps for development. They require limited patient information in advance (age, weight, height, side of amputation, foot size) to prepare the prosthetic feet in the right size and stiffness. The subject profile data will be noted and stored anonymously (subject ID).
The Co-Investigators will be on-site for testing within one work week to conduct the activities.
No patient health data apart from age, weight, height, side of amputation and foot size will be required.
Responsibilities:

- Conduct trial procedures at study site
- Collect Data
- Assist PI in explaining the trial to legal guardian and subject
- Analyze results (post trial)
- Write report (post trial)

The **Monitor** (provided by the sponsor - Össur) will be on-site during testing in the same week together with the Co-Investigators.

- Monitor trial
- Control data collection
- Investigate possible vigilance cases/SAEs (post trial)
- Analyze results (post trial)
- Write report (post trial)

3 Changes from Previous Revision

3.1 Changes for Revision 1.00

Initial release – October 2023.

4 Abbreviations

ADE	Adverse Device Effect
AE	Adverse Event
AR	Adverse Reaction
BL	Baseline
CA	Competent Authority
CEP	Clinical Evaluation Plan
CER	Clinical Evaluation Report
CI	Co-Investigator
COI	Coordinating Investigator
CIB	Clinical Investigator´s Brochure
CIP	Clinical Investigation Plan
CIR	Clinical Investigation Report
CRF	Case Report Form
CRO	Clinical Research Organisation
CT	Clinical Trial
CTA	Clinical Trial Authorisation
EC	Ethics Committee (see IEC, IRB, REB and REC)
EDS	Electronic Data capture Service
FU	Follow-Up
GCP	Good Clinical Practice
CIB	(Clinical) Investigator Brochure
ICF	Informed Consent Form
IDMF	Investigational Device Management Form
IEC	Independent Ethics Committee
IFU	Instructions For Use
IRB	Independent/Institutional Review Board
LCI	Local Co-Investigator
LPI	Local Principal Investigator
LRA	Local Research Assistant
PI	Principle Investigator
PIS	Participant Information Sheet
REB	Research Ethics Board
REC	Research Ethics Committee
SAE	Serious Adverse Event
SADE	Serious Adverse Device Event
SOP	Standard Operating Procedure
SOTA	State-Of-The-Art
SRA	Sponsor Research Assistant
USADE	Unanticipated Serious Adverse Device Effect

5 Investigational Device

The investigational device is not listed with FDA and will be labeled according to regulations concerning investigational devices.

See Table 2 for details on the investigational device.

Table 1 Identification and Description of the Investigational Device

<table>
<tr><td>Summary description of the investigational device and its intended purpose:</td><td>The device is a low-profile prosthetic ESAR foot. It is Class I, a low-risk product, and is a further development of a well-established technology (Pro-Flex LP, FDA listed). Exo-prosthetic devices are by their nature non-invasive. The investigational device is a non-sterile, reusable (i.e. non-disposable), single user device, which is used as part of prosthetic system.</td></tr>
<tr><td>Manufacturer of the investigational device:</td><td>Össur hf.
Grjothals 5
110 Reykjavik
Iceland</td></tr>
<tr><td>Name or number of the model/type, including software version and accessories, if any, to permit full identification:</td><td>Pro-Flex LP Junior (Össur product number: PN20688)</td></tr>
<tr><td>Traceability during and after the investigation:</td><td>Investigation Device Management Form (IDMF) will be used to track the use of each device within the clinical investigation using the device serial number/prototype number.</td></tr>
<tr><td>Intended purpose of the investigational device in the proposed clinical investigation:</td><td>Intended purpose of the investigational device in the proposed clinical investigation is within the intended purpose as described above.
See following chapters on the intended purpose of the investigational device in the proposed clinical investigation for details.</td></tr>
<tr><td>The populations and indications for which the investigational device is intended:</td><td>Lower limb loss, amputation or deficiency.
<table>
<tr><th>Device</th><th>Impact level</th><th>User weight limit</th><th>Foot size</th></tr>
<tr><td>Pro-Flex LP Junior</td><td>Low-High</td><td>55 kg</td><td>16-24 cm</td></tr>
</table></td></tr>
<tr><td>Description of the investigational device:</td><td>The Pro-Flex LP Junior is a downsized version of the existing Pro-Flex LP to suit for users with small foot size and low weight. Material has been changed from carbon to glass fiber. All other aspects of the foot will be the same as the existing Pro-Flex LP. The junior version is equivalent to the existing version.</td></tr>
</table>

	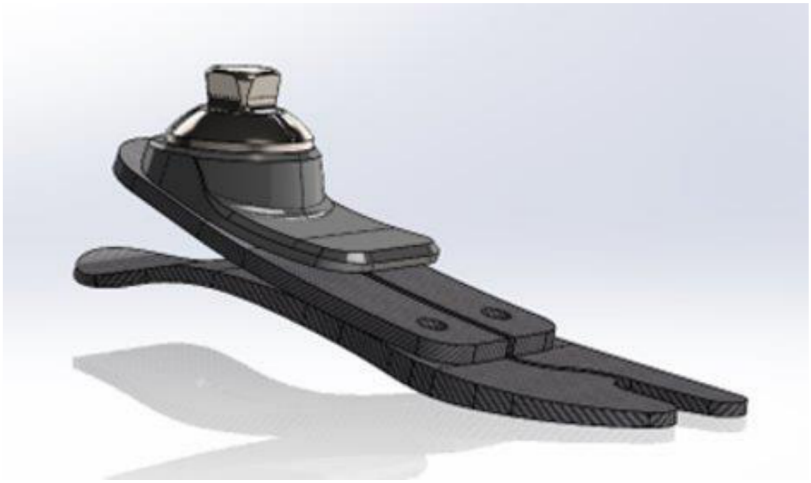 **Figure 1 Pro-Flex LP Junior** See **Table 2** Technical and functional features below for descriptions of device features and their relation to the investigation. The aspect of the prosthesis that is in direct physical contact is usually a liner that serves as an interface to the rest of the prosthesis. In other words, the device is usually not in direct physical contact with the user. The device does not incorporate, as an integral part, a substance or human blood derivative referred to in Section 7.4 of Annex I of 93/42/EEC, amended by 2005/50/EEC. The device is manufactured without utilizing tissues of animal origin as referred to in Directive 2003/32/EC. The device does not incorporate, as an integral part, a substance or human blood derivative and is manufactured without utilizing tissues of animal origin.
Summary of the necessary training and experience needed to use the investigational device:	Training requirements for subjects and procedures relating to fitting and use of a device will for all general purposes be equivalent to the training and procedures required for using a CE-marked/FDA listed device of a similar type. The device will be supplied and fitted by a certified CPO.
Specific medical or surgical procedures involved in the use of the investigational device:	N/A

Table 2 Technical and functional features

#	Feature	Description (if not obvious)	Covered by this investigation:
1	Pro-Flex Design	3-blade design, Pro-Flex Sole blade	Stiffness profile, overall performance
2	Split Toe	Pro-Flex Sole blade	N/A Technical Verification

3	Waterproof	The user shall be able to use the Pro-Flex LP Junior foot in water, include chlorine and salt water.	N/A Technical Verification
4	Low Build Height	The Pro-Flex LP Junior foot shall have a build height lower than 55mm for sizes 19 cat. 2	N/A Technical Verification
5	Improved range of motion (ROM)	The Pro-Flex LP Junior shall provide improved ankle motion when compared to Flex-Foot Junior	N/A Technical Verification

6 Justification for the Design of the Clinical Investigation

6.1 General background

The lack of a limb during childhood is rare but can be caused by amputation or due to congenital abnormalities.[4] Acquired amputations in children most commonly occur from trauma or disease.[2–4] The average age of amputation of children presenting to emergency rooms in the US was found in one study to be around 6.18 years old with finger amputations comprising the majority (91.6%).[3] In 2005 there were an estimated number of 10.000 persons under the age of 18 with a transtibial amputation in the US.[5] Congenital limb deficiencies (CLDs) occur in 5-7.9/10.000 births with the incidence of an upper limb CLD two to three times greater than that of the lower limb.[1,2] In the US there are approximately 2/10.000 live births each year affected with congenital lower limb deficiencies.[3] The cause of CLD is still to large extent unknown but a recent literature review identified causes to four themes: genetics, environment, drugs, and vascular with the biggest underlying factor for most causes believed to originate from a vascular disruption.[1]

6.1.1 Treatment of pediatric amputations and congenital limb deficiencies

Amputation techniques used for adults are generally also suitable for pediatric patients but attention should be given to the growth and development of children and hence changes of the residual limb.[4] Children with lower limb loss and CLD require prosthetic care and face both gait and balance limitations. Prosthetic rehabilitation is thus aimed at improving functional capacity and mobility throughout the developmental phases of the child.[6,7] For acquired amputations, the child is fitted once the limb heals enough to tolerate prosthesis fitting.[2] Children with limb deficiencies require ongoing lifelong prosthetic care.[7] The timing of prosthetic fitting should consider the accomplishment of developmental milestones. The ideal time to start fitting a child with a lower limb prosthesis is when they begin to pull to a stand (between 10-14 months). The next milestone is around the age of 2 years when development of a normal walking patterns occurs. For children who are managing their prostheses well and demonstrate the ability to jog or run, it is possible to start fitting them with dynamic response feet including various running “blades” at a very early age.[2]

Children will generally require a new prosthesis about every 12 to 24 months until they are skeletally mature.[2] Children fitted with prosthesis before two years old are less likely to abandon the prosthesis, with preschool children having a lower drop-out prevalence compared to adults and school-age children.[8]

A prosthesis generally consists of a socket, interface, suspension, structure, and level-specific components. Additional components (e.g., feet, knees, terminal devices, elbows) are included based on the level of amputation and the purpose of the prosthesis.[2] For lower limb prostheses, feet are chosen based on a variety of patient characteristics, such as activity level, weight, shoe size, and limb clearance.[2] Importantly children with amputation or CLD are likely to have comorbid physiologic, cognitive, and/or behavioral challenges. Despite these challenges, the physical demands of a child are generally higher than those of an adult.[7]

6.1.2 Prosthetic feet in general

Prosthetic feet generally consist of foot and ankle prosthetic units that are designed to substitute for some of the functions of a normal human foot and ankle, both from a biomechanical and aesthetic perspective.[11,12] There is limited evidence in literature to recommend for or against any specific prosthetic foot category.[13] Energy Storing and Return (ESAR) feet are generally recommended for trauma-related trans-tibial amputees as these feet seem to result in higher walking speed. ESAR feet are also recommended for other trans-tibial amputees as longer step length is achieved with an ESAR foot compared to conventional fixed prosthetic foot, and gait efficiency at high activity levels is better when using an ESAR foot.[14] It is expected that dynamic, energy storing prosthetic feet can be effective in children, particularly at higher locomotion speeds.[6]

Two recent literature reviews have been conducted at Össur. One is on ESAR feet generally **[8]** and the other on the more recent Pro-Flex feet family **[7]**. The first review included 57 articles on the topic and for the general population there is literature support for functional improvements of the ESAR feet in comparison to standard SACH feet, including reduced impact on the residual and intact limb, improved walking symmetry, reduced walking effort and difficulty, and increased energy return **[8]**. Similar evidence was found for the Pro-Flex family review that included 13 publications, mostly on the use of the Pro-Flex Pivot **[7]**.

6.1.3 Pediatric prosthetic feet

The selection of available prosthetic components is still limited in the pediatric population compared to adults and there are only a limited number of studies on pediatric feet. Consequently, clinicians mostly make choices based on personal experience and intuition.[6]

Clinical observations indicate that pediatric prostheses that are too stiff and/or too long may result in excessive hip external rotation on the affected side of children and toddlers with an amputation during walking. The actual stiffness values of commercially available pediatric prosthetic feet are unknown to pediatricians or prosthetists and there are no objective science-based measures for prosthetic prescription. The prescription process is mainly the responsibility of a prosthetist. Prosthetic foot size, which may or may not indicate foot stiffness, is usually selected to match the unaffected foot size or, in order to take into account limb growth, the largest available foot size.[5] Taboga and Gabrowski measured axial and torsional stiffness of three different prosthetic feet in a testing machine and they found that for feet tested, axial stiffness values were comparable and independent of foot size. They also found that prosthetic foot size was correlated with both plantarflexion and dorsiflexion torsional stiffness, such that larger sizes were more torsionally stiff than smaller sizes.[5]

A few studies have evaluated the effect of different prosthetic feet on gait and balance of children with LLA, primarily for TT amputation. Much of the early studies were examining the Solid Ankle, Cushioned Heel (SACH) foot. The SACH foot simulates only plantar flexion through compression of a rubber heel, while the single axis foot allows both dorsiflexion and plantar flexion about a hinged joint. Before the advent of energy-storing feet, most of the studies attributed asymmetries between the limbs to the shortfalls of foot types.[6]

The Seattle foot was one of the first energy-absorbing and releasing (ESAR) foot types, and it produced a small increase in stride length and walking speed compared to the SACH among children with TT amputation. Furthermore, it was less resistant to passive dorsiflexion in mid-stance. The Seattle allowed a normal knee extensor moment during stance, while a knee flexor moment dominated the stance phase with the SACH. The energy cost of walking was slightly lower with the Seattle foot. Another energy-storing foot, the Flex-foot, returned more energy (over 65%) than the SACH. Also, during fast walking, the SACH required greater joint powers and moments from the intact limb, while in self-selected walking speeds, greater powers and moments were generated by the intact limb with the Flex foot.[6] Jeans et al. included 64 patients (age range, 4.7 to 19.2 years) with unilateral below-the-knee prosthesis use and they underwent gait analysis and review of data for the involved limb. Component prescription was not controlled for in this study; patients were tested while using their current prosthesis. The feet were classified as low (SACH), medium (Dynamic response foot) and high performance (Flex-foot Cheetah) feet and the findings showed that ankle motion was greater in children with TT and Syme amputations using high-performance feet compared with low performance and medium-performance feet. However, peak power of the prosthetic ankle, which is important for push-off, did not show significant difference among the feet.[9] McMulkin et al. compared different common ESAR or multiaxial feet for children and adolescents (mean age of the subjects was 11.8 years (range, 7.2–20 years). Each subject tested all three prosthetic feet. As no significant differences were found comparing the three prosthetic feet the authors suggest that the subjective preference may be the determining factor in pediatric foot selection and that the users should be given the opportunity to test different feet.[10]

6.1.4 Important prosthetic needs of pediatric and adolescent populations

While many prosthetic principles apply similarly to adults and children, prosthetists face a unique range of practical and theoretical considerations for pediatric clients. Considering the many years that a child is expected to live and thrive in the community, setting them off on the right foot and prosthesis early in life is an important consideration of rehabilitation professionals.[6] Children who require a prostheses are generally highly active and interested in a wide array of activities. These activities often require the provision of a separate (secondary) prosthesis with activity-specific components that meet a child's needs when he or she cannot otherwise perform that activity.[2] There are important differences between children and adults that lack a limb. The most obvious differences relate to a child's physiology: a still-growing skeleton with rapid variations in size and ongoing motor and cognitive development. While children with amputation or CLD are more likely to have comorbid physiologic, cognitive, and/or behavioral challenges because of associated conditions, their physical demands and activity is generally higher than those of adults.[7]

The population of children with amputations and CLD is small and only limited data has been published on the needs and prosthetic treatment of pediatric and adolescent populations. There is a need to involve children as well as their parents/legal guardians and prosthetists to provide feedback on the unique needs of pediatric populations requiring a prosthesis.

6.2 Clinical Investigation to support pediatric foot development

The device under investigation is a downsized version of the already marketed and FDA listed prosthetic foot device (Pro-Flex LP). The Pro-Flex LP Junior will be classified as an energy storing and returning foot (ESAR). The design of ESAR prosthetic feet is well known design and the Flex-Foot (two blade design) is one of the earliest designed ESAR feet on the market. It has been on the market for many years.

The Pro-Flex LP Junior is a pediatric foot product under development. The clinical development stage will be pilot, and the investigation will be exploratory, first in human-, early feasibility clinical investigation. Burden to subjects will be interventional, their prescribed prosthetic foot will be replaced by the investigational device. The investigational device is developed to replace state of the art ESAR feet available on the market. The subject is expected to have a similar or better experience with the investigational device compared to the comparator for the duration of testing.

6.2.1 Clinical experience with similar pediatric prosthetic feet

There is no clinical experience with the investigational device itself as it is a novel device under development, but there is ample clinical experience with equivalent and/or similar devices within the ESAR feet family. Pro-Flex Feet are a subcategory of ESAR feet. There real-world experience from the use of similar junior ESAR feet marketed by Össur, i.e. the Vari-Flex Junior. Complaint rate has been documented as [redacted] in the most recent post market surveillance report, [redacted]

6.2.2 Justification for the need to design a new pediatric prosthetic foot

There is a need to design a new junior foot since a better design, Pro-Flex (https://www.ossur.com/en-au/prosthetics/pro-flex-family), has been available to adults for a number of years. A recent literature reviews has been conducted at Össur to evaluate the Pro-Flex family of feet for adults **[7]**. The review included 13 publications and supported clinical claims that the Pro-Flex design can support increased ankle range of motion, greater push-off power, reduced sound side impact, improved center of pressure progression, reduced external knee adduction moment, normalized whole body mechanics, increased energy return and improved walking symmetry. Furthermore increased function and satisfaction in the form of perceived smooth roll over.

The complaint rate of current Junior devices on the market is also high compared to adult devices, indicating that design changes can be made improve device performance for children.

6.2.3 The need to involve prosthetic users in device development

Based on prior experience both user feedback on the actual device and observation of device use has been pivotal in designing successful foot devices such as the Pro-Flex. Benchtop / machine testing is performed on devices prior to any human testing but is not adequate to evaluate subjective user experiences. It is important to understand that while the junior version looks like a sized down version of the original Pro-Flex, design changes including changes in materials are required to achieve the desired functionality. To achieve adequate device

function user feedback from the intended users of the device, children, is considered necessary. This should improve functionality of the device for children. Given answers and observations will be compared to prescribed prosthesis. Rating the prescribed prosthesis enables the subject to have a better direct comparison between devices as he/she is already customized to the prescribed prosthesis when they arrive for the test.

6.2.4 Testing will take the needs of pediatric populations in consideration

Testing will be executed in the Shriners Hospital for Children. Legal guardian will be present during the whole test, staff will be reduced to the minimum number necessary (PI, co-investigators, study monitor). The test will be designed to take a maximum time of 2 hours including a refreshment break and enough time for the children to get accustomed to the situation. Test might be repeated at another day, if more testing is required and all participants (legal guardian and children) agree. The investigational devices will be mechanically tested according to EN ISO 10328:2016 prior to use. These structural tests are the same as standardized testing performed on prosthetic feet available on the market.

6.2.5 Summary and conclusion

The device under development needs to be tested by children since it is intended for children of various age, weight and size. Children with amputation and congenital deficiency are fortunately very few but that sets limitations on the possibility to test and develop junior devices. Due to the small population size a convenience sample will be chosen. Based on the above it is considered justifiable to use the device in human subjects including children within the age ranges specified in the inclusion criteria.

7 Objectives and Hypotheses

The primary objective of this study is to evaluate the overall performance and overall stiffness of the investigational device compared to state-of-the-art devices.

The secondary objective is to assess the suitability and patient perception for different activities by feedback from the user.

The primary endpoints are Hypotheses A-B.

No risks or anticipated adverse device effects (ADE) are to be assessed.

The hypothesis and endpoints are specified in Table 3.

Table 3 Endpoints, test methods and hypotheses

	Hypothesis	**Test Method**	**Endpoint**	**Acceptance Criteria**
A	Perceived overall stiffness of the Pro-Flex LP Junior is better or as good as prescribed prosthesis.	Collect subjective user feedback with Questionnaires. Observation of device behavior and effects by experts.	Testing prototypes with different stiffness characteristics.	80% observer confidence.
B	Perceived overall Functional Performance of the Pro-Flex LP Junior is better or as good as prescribed prosthesis.	Collect subjective user feedback with Questionnaires. Observation of device behavior and effects by experts.	Perform various gait related tasks.	80% observer confidence.

8 Design of the Clinical Investigation

8.1 General

The test will be a single group, prospective design. Individuals with amputation, limb loss or deficiency are a small proportion of the general population. The population group specified in the inclusion/exclusion criteria is a further subsample of individuals with amputation, limb loss or deficiency. For practical reasons, it is more feasible to use within-subject comparison rather than creating study arms to compare. Furthermore, as mobile prosthesis users will be recruited, within-comparison is feasible comparing to the subject's previous device.

All investigational activities will be conducted in a controlled environment at Shriners Hospital for Children; Pediatric Orthotic and Prosthetic Services Northeast, LLC; 516 Carew Street; Springfield, Ma 01104; US

As stated above the primary objective is to evaluate the stiffness configurations of the device.

Drop-outs and withdrawals will be replaced if the test schedule allows for timely replacement.

See chapter 10.2 Sample size calculation and Table 3 for analysis of variables.

Equipment required for each subject:

- Pen/pencil
- User feedback questionnaires
- Investigational device: Pro-Flex LP Junior
- Video Camera
- LASAR 3D alignment device or laser for plumb line
- Various gait related tasks
    - Ramp
    - Stairs
    - Uneven Surface
    - Ball
    - Chair

The equipment used does not require specific monitoring, maintenance or calibration procedures.

8.2 Investigational Device(s) and Comparator(s)

The subjects will be asked to use the investigational device during measurements at the study site. Individual exposure will differ between subjects. Subjects will evaluate and provide feedback on their prescribed foot prior to them being fitted to the investigational device.

Their prescribed foot has the same intended use as the investigational device. Furthermore, it is indicated for the same condition and population group.

The subject will be using the remaining part of their current prosthetic system with the investigational device, as it was used with their prescribed foot.

No other device, medication or intervention will be used.

Up to 15 subjects are to be enrolled and therefore up to 15 investigational devices will be used, varying in size, side and stiffness category.

The same investigational device might be tested by multiple patients. Before reuse of an investigational device, it will be cleaned as applicable but are generally not patient contacting devices. This temporary use is considered justifiable according to ISO 10328 **[3]** mechanical testing, which exceeds the limited use time during this study.

8.3 Subjects

All subjects will be dispositioned as follows:

- Screen Failure: Subject did not pass screening procedures, not called in for clinical visit.
- Candidate for enrollment: Passed screening procedures, accepts to come in for clinical visit.
- Enrolled: Informed consent signed
- Fitted: Subject uses the investigational device.
- Discontinued: Candidate for enrollment or enrolled subject whose participation ended because they withdrew consent, were withdrawn by the Investigator.

Table 4 Inclusion/Exclusion criteria

Inclusion: Only patients with the following characteristics **are eligible** for study entry**:**	**Exclusion**: Patients with the following characteristics **are not eligible** for study entry:
• Cognitive ability to understand all instructions and questionnaires in the study (adapted to kids). • Active prosthesis user • Transtibial or transfemoral amputation, limb loss or similar level congenital limb deficiency. • Age 5 or older. ○ Age 5-12 years preferred. • 15 kg < Body weight < 55 kg • 16 ≤ Foot size ≤ 24 • Clearance: Size 16 > 50mm, Sizes 17-19 > 60mm, Sizes 20-24 > 70mm • Willing and able to participate in the study and follow the protocol, including consent to participate from legal guardian if under 16 years old.	• Users with severe residual limb pain or socket problems, which have negative impact on testing and outcome.

* The foot design is a downsized (size and stiffness) version of the Pro-Flex LP and therefore can be used for adults if a small foot size and low stiffness category is required.

A subject and/or the legal guardian can withdraw the participation at any time, at his/her discretion, and this will not have any consequences for the participant's treatment. In such cases a report stating reasons for discontinuation of the participant shall be prepared by principal investigator (PI). No further investigational procedures concerning the subject will be conducted, except for a statement explaining the reason for withdrawal, including but not limited to interacting or interviewing the subject in order to obtain data on him/her; obtaining additional private information on the subject by either observing the subject or collecting or receiving such information from any source.

The relevant PI can withdraw the participant from the trial at any time. The reasons shall be documented. There are no pre-specified criteria for discontinuation of participants from the trial. The discontinuation of participants in the trial may result in replacement with new participants if the required sample is too small.

Subjects will be enrolled at Shriners Hospital for Children.

The total time period required to implement the clinical investigation is expected to be 6 months. Each individual subject is expected to participate in the clinical investigation for 2 hours.

8.4 Procedures

i) Recruitment

Potential subjects will be identified from Shriners Hospital for Children. Clinic personnel evaluates, based on previous experience of interaction with and servicing of patients, if a potential participant is fit for the study. If a potential participant fits the inclusion and exclusion criteria the clinic personnel will contact them or registered contact person (i.e. legal guardian) via telephone. During the telephone call the clinic personnel will verify if they are interested in participating in a study. If interest is expressed and if the eligibility criteria are met an appointment will be made for the clinical visit. Questions relating to the duration of the study, number of clinical visits required, and the investigational device will be answered.

The clinic personnel will communicate to the study monitor the number of users he has identified that meet the inclusion criteria and are willing to participate.

ii) Test procedure

There is one scheduled study event. At the initial visit, the study event, for each subject a researcher qualified to obtain informed consent.

Test will be executed in the respective study site. Legal guardian will be present during the whole test, staff will be reduced to the minimum number necessary (CPO, Engineer, Monitor). The test will be designed to take a maximum time of 2 hours including a refreshment break and enough time for the user to get accustomed to the situation. Test might be repeated at another day, if more testing is required and all participants (legal guardian and children) agree.

Termination:

1. Inform the legal guardian (and children) – get a written informed consent.
2. Explain the procedure – show them what is expected (go through the procedure).
3. Give them permission to explore the surroundings.
4. Walk on their current prescribed foot for observation – go through a procedure and ask questions.
5. Change to the first version prototype, version expected to be best suited for the participant.
6. BREAK - refreshments.
7. Change to a softer or stiffer version of the prototype.
8. Iterate from results from 7 (softer or stiffer).

The activities will be tailored towards the ability of participants. Observation of activities in these different activities can yield information on new design considerations and may lead to design improvements. Feedback will be sought from subjects, legal guardians, PI and Co-Investigators.

Gait related tasks may include:

- Incline/decline
- Side steps
- Walking backwards
- Kick a ball
- Running
- Zig-zag run
- Twist and turn
- Uneven surface
- Sit to stand / standing up from the ground
- Stairs

iii) Measurements and data collection

For each user a baseline data form and user feedback questionnaire will be filled out. Furthermore, videos of each activity may be taken. For each subject there is one scheduled visit to the test site. No follow-up is performed as the investigational device is only used at the investigation site. There are no long-term effects anticipated after testing the investigational device.

Table 5: Visit schedule and procedures

Procedure/Activity	Recruitment phase:	Initial visit:
Potential subjects identified, fitting inclusion/exclusion criteria, by PI from customer database.	x	
Potential Subject and/or legal guardian agreed to take part in the study	x	
Subject and/or legal guardian signs ICF		x
Subject walks on their current prescribed foot for observation – go through the test procedure and ask questions		x
Subject fitted with investigational device for observation – go through the test procedure and ask questions		x
Subject is fitted back to their prescribed prosthesis		x

A data collection form will be used to track all data collected from the visit. This form will keep track on:

- Questionnaires
- Observations

Questionnaires and Observation forms can be found in Annex I.

For each subject there is one scheduled visit to the study site and questionnaires/tasks/measurements administrated during the course of the study.

8.5 Subject Compensation

A set rate will determine the payment made for participation.

The subjects will be compensated for their spent time in the clinic with a [redacted] voucher at the end of the visit. Travel and daily allowance that covers accommodation will be provided if longer distance travel is required (within US). A small gift for children (no significant monetary value) can be provided.

8.6 Responsibilities

The **Principal Investigator** or delegates (provided by Shriners) will be in contact with the patients, has access to all patient and health information.
Responsibilities:

- Screen subjects
- Informed Consent
- Report possible vigilance cases/SAEs to sponsor
- Explain trial to legal guardian and subject
- Fit subject with device under investigation (and any other intervention; and back to their current device, as applicable)

The **Co-Investigators** (provided by the sponsor - Össur) will be in contact with the patients during the scheduled visit and collect data on the investigational devices. This direct contact to the patients is essential for the product designers to observe the product function and assess the next steps for development. They require limited patient information in advance (age, weight, height, side of amputation, foot size) to prepare the prosthetic feet in the right size and stiffness. The subject profile data will be noted and stored anonymously (subject ID).
The Co-Investigators will be on-site for testing within one work week to conduct the activities.
No patient health data apart from age, weight, height, side of amputation and foot size will be required.
Responsibilities:

- Conduct trial procedures at study site
- Collect Data
- Assist PI in explaining the trial to legal guardian and subject
- Analyze results (post trial)
- Write report (post trial)

The **Monitor** (provided by the sponsor - Össur) will be on-site during testing in the same week together with the Co-Investigators.

- Monitor trial
- Control data collection
- Investigate possible vigilance cases/SAEs (post trial)
- Analyze results (post trial)
- Write report (post trial)

8.7 Study monitoring and Oversight

The Study Monitor will monitor the study to ensure all procedures are followed correctly and according to the study protocol.

Monitoring activities will be done with investigators where monitors will verify that 1) the Investigator(s) are conducting the study in accordance with the protocol, applicable SOPs, Good Clinical Practice (GCP) and applicable regulatory requirements; 2) participants' safety, rights and well-being are being protected; and 3) data recorded on the case report forms are accurate, complete and verifiable from source documentation.

Unexpected issues or adverse events will trigger specific meetings outside of regular monitoring meetings with investigators and will be conducted to address any unanticipated issues that arise which require training, remediation or other situations in which the investigators require assistance.

The monitor will gather and review all study data and follow up on missing data and non-conformities.

An electronic/paper-based folder, which will be defined as the Study Master File Index (SMFI), will be maintained at the study site and serve as the central source for essential documents (ED) maintenance at the site. Documents with original signatures must also be maintained in a secure location on site. This includes study-level and participant-level documents (i.e. ICFs).

The following documents represent a complete essential document packet and are to be maintained in the SMFI:

- Original REC approved protocol, all communication with REC as appropriate, amendments, deviations, violations
- All versions of the informed consent and study documents provided to subjects
- Principal Investigator's (PI) and Co-Investigator(s) (CIs) Curriculum Vitae (CV)
- Delegation of Responsibilities and Signature Log(s); up to date, all tasks appropriately delegated
- Investigational Device(s) Shipping and Accountability log; up to date, all investigational devices accounted for
- Subject Screening/Enrollment Log; filled in and filed for each subject
- Compensation log; filled in and signed by each subject after reception of each compensation payment.
- Insurance statement
- Case Report forms, study logs and visit checklists; filled out and signed.
- File Notes; Documented evidence (e.g. Note to File) and reporting of non-compliance to GCP, SOPs, protocol to Sponsor (if applicable)
- Monitoring visit Reports
- Adverse Event Reports; To be filled out by PI, and filed to the sponsor in the event of an AE

9 Investigational Device Accountability

The investigational device will be provided as needed for the study population. Devices will not be packaged but will be labeled according to US regulatory requirements. Subjects will not be blinded.

The CI will keep records documenting the receipt, use and return of the investigational device in the Investigational Device Management Form, including:

- Date of receipt
- ID of each investigational device
- Date of use
- Subject ID
- Date of device return
- Date of return of unused, expired or malfunctioning investigational devices, as applicable

10 Statistical Considerations

10.1 Statistical design and procedures

The investigation is of exploratory nature to generate subject feedback to support product design and development. Based on the results the design of the investigational device might be adapted in another iteration, therefore a statistical analysis of results is not required at this stage. Acceptance criteria for the data, as

applicable, is defined in Table 3 Endpoints, test methods and hypotheses. Subgroup analysis will not be performed as no subgroups are defined.

10.2 Sample size calculation

As this investigation is conducted as an exploratory and feasibility test, no sample size calculation and power analysis has been conducted. The focus group for the investigation are children with a lower limb loss, amputation or deficiency. In addition, adults which fit within the size and weight ranges planned for the junior solutions can be enrolled if available. There is only a small number of this group available in Iceland, therefore a convenience sample of up to 15 subjects are expected to be enrolled.

11 Amendments and Deviations from the Protocol (CIP)

11.1 Amendments

Any amendments to this protocol must be first approved by the sponsor and PI and then be evaluated by the REC and, where appropriate regulatory authorities, before being implemented.

For non-substantial changes (e.g. minor logistical or administrative changes, change of monitor(s), telephone numbers, renewal of insurance) not affecting the rights, safety and well-being of human subjects or not related to the clinical investigation objectives or endpoints, a simple notification to the REC and, where appropriate, regulatory authorities can be sufficient.

11.2 Deviations

Investigators are not allowed to deviate from this protocol without a formal approval from the REC, if the deviation affects subject's rights, safety and wellbeing, or the scientific integrity of the clinical investigation. Any such deviation from the protocol is to be documented in detail and the report sent to the REC.

Under emergency circumstances, deviations from the protocol to protect the rights, safety and well-being of human subjects may proceed without prior approval of the sponsor and the REC. Such deviations shall be documented and reported to the sponsor and the REC as soon as possible.

Investigators can request for an approval from the sponsor for a deviation if the deviation does not affect subject's rights, safety and wellbeing, or the scientific integrity of the clinical investigation.

In case of a deviation from this protocol taking place without prior approval from the sponsor, and REC as applicable, it shall be reported to the sponsor within 24 hours of PI knowledge of the deviation. The PI responsible for the deviation is to send a report to the PI no later than five days after the deviation was reported. The report shall include:

- Reason for deviation
- When deviation took place
- Circumstances of the event
- Identification of all subjects affected by the deviation, if any
    - Details how each subject is affected, e.g. rights, safety or wellbeing
- Details how this deviation might affect the scientific integrity of the clinical investigation

The sponsor and the REC will evaluate any deviations that take place without prior approval on a case-by-case basis. If the deviation affects subject's rights, safety and wellbeing, and the scientific integrity of the clinical investigation the PI shall be disqualified from further participation in the clinical investigation.

12 Statement of Compliance

The clinical investigation shall be conducted:

- in accordance with the ethical principles that have their origin in the Declaration of Helsinki
- in compliance with the ISO 14155 International Standard **[5]**.
- in compliance with any regional or national legislations, as applicable

The clinical investigation shall not commence until the required approval from the REC, and regulatory authority as applicable, has been obtained. Any additional requirements imposed by the REC or CA shall be followed, if appropriate.

Subjects are provided with health insurance relating to any adverse health outcomes in relation to the clinical investigation.

13 Ethical Considerations

13.1 Anticipated clinical benefits

A subject testing the investigational device may benefit clinically from using the device compared to their prior prosthesis although only temporarily since the testing is short term. The results from the testing will however be used to improve the design of a new prosthetic foot that is intended specifically for children with limb loss, amputation or limb deficiencies. Participants thus benefit indirectly by developing a new prosthetic foot for children. Participation in testing will also allow the subject to test a new prosthetic foot, which adds experience with new components.

The attention to the setup of the current prosthesis used by the participant may lead to a study CPO identifying factors that can be improved through standard clinical care. If this occurs, a referral for clinical care with recommendations to the participant's prosthetists may be provided. Specific attention is directed to prosthetic alignment, socket fit and gait functions instrumental to the treatment and affecting the quality of care.

13.2 Device related risk

Each device designed and manufactured by Össur is subjected to thorough risk assessment, analysis and control, with failure mode effect analysis and hazard analysis, according to PR-00032 Risk Management process, based on ISO 14971 **[4]** (Risk Management for Medical Devices). All changes performed to the functions of a device are submitted to multi-level verification and, as applicable, validation processes before being authorized for use in a clinical investigation. The device technology will be mechanically tested according to EN ISO 10328:2016 prior to use. The device related risks are mitigated and minimized by both verification testing, including structural testing and the temporary supervised nature of the testing.

The design criteria are an important input in the risk analysis but also the experience of existing products of similar function and/or type. Similar junior foot devices are currently marketed by Össur, i.e. Vari-Flex Junior and post-market surveillance data provides data on device related risks as experienced in the real-world application of the device. Vari-Flex Junior is two-blade carbon fiber foot design (ESAR), based on their adult counter-devices and made for active children with limb loss, amputation or deficiency.

Outcome from PMS data did not give reason to update risk management documents. No new harm was identified from PMS data.

Foreseeable adverse events and anticipated adverse device effects, together with their likely incidence are expected to be in line with the PMS data. Mitigation beyond standard clinical practice and the information provided in the IFU for the device is not required. This also applies to potential treatment of harms stemming from these events or effects; standard clinical practice will be followed.

The FMEA and hazard analysis are tools for identifying harms, the sequence of events, their probability, and the potential failures that can cause these harms. Anticipated adverse device effects and residual risks associated with the investigational device, are identified in the Hazard Analysis Documentation **[1]** and the Risk Management Report **[6]**.

13.3 Risk of Study (To Patient)

At each visit a CI, a certified CPO, will be present to ensure the safety of the participants. The study adds no additional risk other than the risks identified above. Subjects will use the trial device as their primary prosthesis in the same manner as they would normally do on their current prosthesis since the testing procedures have been set up to mimic situations in the real life of children, including gait course. Thus, they are not required to do anything different from their routine clinical visit for acquiring a new prosthetic foot and their daily living activities.

After completion of the test the investigational device is returned to the sponsor. If the subjects wish to continue using the investigational device in everyday life, they can ask their CPO to apply for prescription as soon as it is available on the market.

13.4 Risk Mitigation

For each device designed by Össur risk mitigation is part of the design process according to ISO 14971 **[4]**. Furthermore, each participant fitted with a new prosthetic foot for the first time will be trained by a fully qualified professional until the user can demonstrate sufficient understanding of the product operation and demonstrate minimum ability level in its operation. This process is the same as the usual training process deployed for normal fitting of a prosthetic foot device.

As part of the training process, the participant and/or the participants legal guardian(s), will be informed on the risks inherent in using a Pro-Flex LP Junior.

13.5 Risk-to-Benefit Rationale

The residual risks of the investigation and the investigational device are minimal and are significantly out weighted by the benefits of participating in the investigation.

13.6 REC Review and Communications

The study protocol (CIP), information letter, informed consent form, and other study documentation forms require REC review and approval. In case required, communication to and from the REC shall be directed from or to the primary Össur contact, the Study Monitor:

[redacted]

Continuous communication will be maintained between the lead clinical research coordinator [redacted] at Shriners hospital and Össur and the REC, as required.

13.7 Vulnerable populations

The focus group of this investigation are children from the age of 5 years. The investigational device is a downgraded version of an adult prosthetic foot (Pro-Flex LP) already marketed.

During the whole process the legal guardian(s) will be involved and present. The informed consent will be explained to all and signed by the legal guardian(s). Agreement of the child participating will be sought before any study procedures are performed.

All procedures are planned to be children friendly in a manner that is perceived more as an adventure than a burdensome study procedure. A kind of a gait parkour might be built up in the Shriners Hospital for Children and

the children will have time to explore all tasks they want to perform. There will be enough time to accommodate and refreshment brakes as necessary. All questionnaires are in a children friendly design, rating in a 1-4 scale using stars/smileys as applicable. The duration of the whole test procedure should not exceed two hours.

13.8 Informed Consent

The Principal Investigator, or any researcher qualified, will obtain from the legal guardian(s), written signed informed consent form to his/her inclusion in the study, after explaining the rationale for and the details of the study, the risks and benefits of alternative treatments, and the extent of the subject's involvement. The legal guardian will receive a copy of the informed consent. Subject interest and willingness to participate in testing will be confirmed. If the child is able, then written confirmation will be requested in addition to the written consent from a legal guardian. The subject's prosthetist (CPO) will also be involved during Informed Consent as applicable.

The subjects/legal guardian will be informed that their participation is voluntary and that they can withdraw from participation at any time, at his/her discretion and this will not have any consequences for the participant's treatment.

In case the information on the ICF changes, and subjects need to be provided with new information, the PI will contact each subject/legal guardian by phone and explain the new information as required.

13.9 Participant confidentiality – Data management

Subjects will be assigned a random study identification (ID) number.

This ID will be used in all relevant documentation. Confidentiality of all relevant subject feedback and information will be maintained through use of the identifying number only, in all documentation. The study sponsor, Össur, will remain the sole owner of the study data. A list connecting the ID to the subject´s name will be stored in a locked fire-proof closet. Only investigators involved in the trial will have access to this information.

Frames in video recordings will only contain the lower extremities of subjects and any ambulatory assistance provided with their hands. Frames containing the face or other identifiable features of subjects will be deleted or blurred/crop from video recordings, if accidentally captured.

The data of subjects that withdrawn from participation will be deleted unless a specific agreement with these subjects to evaluate their data can be obtained.

The screening form will be in paper format and will be stored by the PI at Shriners hospital. All documents will be collected by the PI.

A declaration of confidentiality will be signed by sponsor staff involved in the testing to ensure necessary data protection.

A Clinical Investigation Report (CIR) will be generated by Medical Office. The report will be stored with the device technical file within Össur Quality Management System, along with the unlinked data and all accompanying investigational documents, according to the R&D and Quality documentation procedures. Subjects participating in the study can have access to the results, on demand, when the CIR is internally published.

Study results, data, and documentation will be stored for a minimum of 5 years.

14 Evaluation of Adverse Events and Device Deficiencies

For a list of foreseeable adverse events and anticipated adverse device effects, together with their likely incidence, mitigation or treatment see chapter 13.2 above.

14.1 Definitions of adverse events, effects and deficiencies

When conducted on a device that is not legally marketed, or a legally marketed device that will be used outside of the intended purpose of the device, the following shall apply:

An adverse event (AE) is any untoward medical occurrence, unintended disease or injury or any untoward clinical signs in subjects, including an abnormal laboratory finding, users or other persons in the context of a clinical investigation, whether or not related to the investigational device.

An adverse device effect (ADE) is any adverse event related to the use of an investigational device, including device deficiencies.

A serious/severe adverse event (SAE) is any adverse event that led to any of the following:

a) death,
b) serious deterioration in health of the subject, that either resulted in any of the following:
- life-threatening illness or injury,
- permanent impairment of a body structure or a body function,
- hospitalization or prolongation of patient hospitalization,
- medical or surgical intervention to prevent life-threatening illness or injury or permanent impairment to a body structure or a body function,
- chronic disease,

c) foetal distress, foetal death or a congenital physical or mental impairment of birth defect.

A serious adverse device effect (SADE) is an adverse device effect that has resulted in any of the consequences characteristic of a SAE.

An anticipated serious adverse device effect (ASADE) is an effect which by its nature, incidence, severity or outcome has been identified in the risk analysis for the device.

An unanticipated serious adverse device effect (USADE) is a SADE which by its nature, incidence, severity or outcome has not been identified in the current version of the risk analysis report.

A device deficiency (DD) is any inadequacy in the identity, quality, durability, reliability, safety or performance of an investigational device, including malfunction, use errors or inadequacy in information supplied by the manufacturer.

A use error (UE) is an act or omission of an act that results in a different medical device response than intended by the manufacturer or expected by the user.

14.2 Reporting procedures

All device related adverse events will be investigated. Adverse events that are serious, unanticipated and (possibly) device related shall be reported to the sponsor by telephone as soon as possible. The complete adverse event investigation form shall be provided to the sponsor within 24 hrs via email. Within ten days the Sponsor will report to the IRB and FDA, as applicable. Any serious device related adverse event will lead to the immediate termination of the trial. In this case all participants will be contacted immediately and advised to stop using the investigational device. An appointment will be made for them to return the trial device.

Participants will be provided the contact information of the investigator and told to call them in the event of an adverse event. Furthermore, an investigator will contact them weekly to check up on any problems. The participants prescribed prosthesis will be kept at the study site while they use the investigational device. If they experience problems with the investigational device an appointment will be made with on site to investigate further.

The investigator shall supply a copy of the complete adverse event investigation form, together with a cover letter to the IRB when events are judged to be serious, unanticipated and (possibly) device related.

Contact in case of unexpected adverse event:

[redacted] o a medical occurrence

- if either suitable action had not been taken,
- if intervention had not been made, or
- if circumstances had been less fortunate,

shall be reported according to the same procedure as if an ADE had taken place, specified above.

14.3 Suspension or premature termination of the clinical investigation

The sponsor/principal investigator, the REC, and the competent authorities can decide about investigation continuation. The clinical investigation can be suspended or prematurely terminated if the serious adverse device effects are considered disproportionately large compared to the possible benefits of the intervention. If the trial is terminated or suspended all trial participants will be informed and appropriate follow-up will be assured. If sponsor/principal investigator terminates or suspends the trial the relevant REC and competent authorities will be provided with a detailed written explanation of the termination or suspension.

The sponsor/principal investigator can upon completion of the analysis of the reason(s) for a suspension decide to lift the suspension, when the necessary corrective actions have been implemented. The investigators, REC, and relevant competent authorities will be notified and provided with the relevant data supporting the decision.

15 Publication Policy

A Clinical Investigation Report (CIR) will be generated by Medical Office. The report will be stored with the device technical file on PDM database, according to the QMS documentation procedures in **Product Documentation Processing in PDM - WI-00849**. The CIR and other records from the clinical investigation may be shared with the ethics committee (IRB) and/or the national Competent Authority (CA), as required. Furthermore, the CIR will be shared with national regulatory authorities, as part of the technical documentation for a device, if applicable, when applicable.

The results are mainly for internal consumption by Össur employees involved with research and development projects and for regulatory documentation purposes. Results may be published in appropriate journals and reported at scientific conferences. No reference will be made to any personal IDs and care will be taken that identifiable information has been removed.

16 References

Internal Document References:

[1]	HAD2022112234, Hazard Analysis Document [redacted]
[2]	ISO 13405-1:2015, Prosthetics and orthotics - Classification and description of prosthetic components. Part 1: Classification of prosthetic components
[3]	ISO 10328:2016, Prosthetics — Structural testing of lower-limb prostheses — Requirements and test methods
[4]	EN ISO 14971: 2019, Medical devices - Application of risk management to medical devices
[5]	EN ISO 14155: 2020, Clinical investigation of medical devices for human subjects - Good clinical practice
[6]	RMR2022112236, Risk Management Report, [redacted]
[7]	LDR2019083019, Literature Review Device Report – Pro-Flex family, [redacted] (internal document Ossur, published 21.10.2022)
[8]	LDR2019032151, Literature Review Device Report – ESAR Feet, [redacted] (internal document Ossur, published 07.09.2022)

External Literature References:

1. Shivers, E.; Day, S. A Literature Review of the Causes of Congenital Limb Deficiencies over the Last 20 Years. Journal of Prosthetics and Orthotics 2022, doi:10.1097/JPO.0000000000000444.

2. Hall, M.; Cummings, D.; Jr, R.W.; Kaleta, M.; Jr, K.K.; Laine, J.; Morgan, S. Essentials of Pediatric Prosthetics: Current Concept Review. Journal of the Pediatric Orthopaedic Society of North America 2020, 2, doi:10.55275/JPOSNA-2020-168.

3. Le, J.T.; Scott-Wyard, P.R. Pediatric Limb Differences and Amputations. Phys Med Rehabil Clin N Am 2015, 26, 95–108, doi:10.1016/j.pmr.2014.09.006.

4. Griffet, J. Amputation and Prosthesis Fitting in Paediatric Patients. Orthopaedics & Traumatology: Surgery & Research 2016, 102, S161–S175, doi:10.1016/j.otsr.2015.03.020.

5. Taboga, P.; Grabowski, A.M. Axial and Torsional Stiffness of Pediatric Prosthetic Feet. Clin Biomech (Bristol, Avon) 2017, 42, 47–54, doi:10.1016/j.clinbiomech.2017.01.005.

6. Eshraghi, A.; Safaeepour, Z.; Geil, M.D.; Andrysek, J. Walking and Balance in Children and Adolescents with Lower-Limb Amputation: A Review of Literature. Clinical Biomechanics 2018, 59, 181–198, doi:10.1016/j.clinbiomech.2018.09.017.

7. Louer, C.R.; Scott-Wyard, P.; Hernandez, R.; Vergun, A.D. Principles of Amputation Surgery, Prosthetics, and Rehabilitation in Children. J Am Acad Orthop Surg 2021, 29, e702–e713, doi:10.5435/JAAOS-D-20-01283.

8. Piscitelli, D.; Beghi, M.; Bigoni, M.; Diotti, S.; Perin, C.; Peroni, F.; Turati, M.; Zanchi, N.; Mazzucchelli, M.; Cornaggia, C.M. Prosthesis Rejection in Individuals with Limb Amputation: A Narrative Review with Respect to Rehabilitation. Riv Psichiatr 2021, 56, 175–181, doi:10.1708/3654.36344.

9. Jeans, K.A.; Karol, L.A.; Cummings, D.; Singhal, K. Comparison of Gait After Syme and Transtibial Amputation in Children: Factors That May Play a Role in Function. JBJS 2014, 96, 1641–1647, doi:10.2106/JBJS.N.00192.

10. McMulkin, M.L.; Osebold, W.R.; Mildes, R.D.; Rosenquist, R.S. Comparison of Three Pediatric Prosthetic Feet During Functional Activities. JPO: Journal of Prosthetics and Orthotics 2004, 16, 78.

11. Prosthetics and Orthotics — Classification and Description of Prosthetic Components — Part 2: Description of Lower-Limb Prosthetic Components; ISO/CD 13405-2, 2015;

12. Standards & Guidelines - BSRM.; BSRM;

13. VA/DoD Clinical Practice Guideline for Rehabilitation of Individuals with Lower Limb Amputation. 2017, 123.

14. Geertzen, J.; van der Linde, H.; Rosenbrand, K.; Conradi, M.; Deckers, J.; Koning, J.; Rietman, H.S.; van der Schaaf, D.; van der Ploeg, R.; Schapendonk, J.; et al. Dutch Evidence-Based Guidelines for Amputation and Prosthetics of the Lower Extremity: Amputation Surgery and Postoperative Management. Part 1. Prosthet Orthot Int 2015, 39, 351–360, doi:10.1177/0309364614541460.

17 Annex

17.1 Annex 1

17.1.1 Questionnaire

Date:		User ID:		Prototype Nr.	
Researcher:					

Current prosthesis:

1. What do you like about your current prosthetic leg?

_____

2. What would you like to be able to do with your current prosthetic leg?

_____

3. Why can't you do what you want with your current prosthetic leg?

_____

Pro-Flex LP Junior:

1. Now you have a new prosthetic leg, what is your first impression? (note down the first answers or reactions when the user takes the first steps)

_____

2. How do you like this new prosthetic leg?

1

Current prosthesis:

1. How do you feel about your own leg now, if you compare it to the new one you were trying on before?

2. Anything else you want to tell us?

_____

_____

_____

_____

_____

_____

2

17.1.2 Observational Forms

Date:		User ID:		Prototype Nr.	
Researcher:					

Please note your personal observations and expert opinion. In addition, note the kids rating while performing the gait related tasks. To help kids provide the rating, there will be a huge rating tool with large emoticons (smileys) and blocks with the shapes shown for roll-over. Please cross the rating as applicable based on the rating provided by the subject.

Task/Obstacle	Kids rating	Observation: Prescribed Foot
Level ground: Keel		
Level ground: Heel		
Level ground: Roll-Over		
Incline		
Decline		
Side Steps		
Walking backwards		
Kick a ball		
Running		
Jumping		
Zig Zag		
Twist and Turn		
Uneven Surface		
Standing up (from ground)		
Stairs		
Bend/duck during walking		

Task/Obstacle	Kids rating	Observation: Device ID_____
Level ground: Keel		
Level ground: Heel		
Level ground: Roll-Over		
Incline		
Decline		
Side Steps		
Walking backwards		
Kick a ball		
Running		
Jumping		
Zig Zag		
Twist and Turn		
Uneven Surface		
Standing up (from ground)		
Stairs		
Bend/duck during walking		

Date of test		Subject ID		Observer	

Rate your confidence that the device under development is better, same or worse in any tests compared to the prescribed device.			
Device ID	Performance	Overall stiffness	Overall function (obstacle course)