

Usability Evaluation of an Electrically-Powered Orthopedic Exerciser: A Focus Group Interview(FGI) and Satisfaction Survey Study

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Usability Evaluation of an Electrically-Powered Orthopedic Exerciser: A Focus Group Interview(FGI) and Satisfaction Survey Study

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Abstract

Background: Errors while using medical devices, owing to flaws in the user interface design and implementation, can be a risk for users. Accordingly, increasing emphasis is being placed on usability evaluations by actual users in the design and development stages of medical devices to minimize the risk factors that may cause usage errors. Moreover, a usability evaluation is a mandatory requirement for medical device regulations in countries that follow the IEC 60601-1 standard.

Objective: This study aimed to conduct a formative evaluation using focus group interviews (FGIs) and satisfaction surveys with healthcare professionals in the field of rehabilitation medicine to identify areas for improvement to enhance the safety and convenience of an electrically-powered orthopedic exerciser, a lower-extremity medical rehabilitation device, in the prototype stage.

Methods: Quantitative and qualitative data were collected through formative evaluation conducted using FGIs and satisfaction surveys with participants; participants consisted of rehabilitation doctors (n=5) and physical therapists (n=5) with experience in using similar medical devices.

Results: During the formative evaluation, the following three categories were derived to reduce exerciser usage errors: 1) product upgrades to ensure safety, 2) hardware and software improvements for convenience of use, and 3) improvement of the manual for better identifiability and understanding of the product and instructions.

Conclusions: Improvement areas to ensure safety, convenience of use, and clarity of instructions were identified through a formative evaluation based on FGIs and satisfaction surveys with healthcare professionals with experience in using similar medical devices. The factors derived from this formative evaluation are expected to contribute to the development of an improved electrically-powered orthopedic exerciser, and repeated formative and summative evaluations of the improved version will eventually lead to the development of a safe medical device.

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Original Manuscript

Original Paper

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Usability Evaluation of an Electrically-Powered Orthopedic Exerciser: A Focus Group Interview(FGI) and Satisfaction Survey Study

Abstract

Background: Musculoskeletal disorders significantly impair physical function and quality of life, necessitating systematic rehabilitation. Electrically-powered orthopedic exercisers, such as Continuous Passive Motion devices, are widely used to enhance joint mobility and muscle recovery. However, existing devices often lack advanced functionalities and user-specific adaptability, limiting their effectiveness. To address these shortcomings, the Rebless Pro was developed as a novel device supporting active and passive exercises with personalized treatment programs.

Objective: This study aimed to conduct a formative usability evaluation of the Rebless Pro prototype using focus group interview(FGI) and satisfaction surveys with healthcare professionals specializing in rehabilitation medicine. The goal was to identify areas for improvement to enhance the safety, usability, and information clarity of the device. **Methods:** Usability evaluation was performed at the National Rehabilitation Center with 10 participants (5 Physiatrists and 5 physical therapists) who had prior experience using similar devices. FGI were conducted to collect qualitative insights into user experiences, while satisfaction surveys provided quantitative data on ease of use of user interface and identifiability and understanding of information. Data collection focused on identifying risk factors, usability challenges.

Results: Three key areas for improvement were identified: (1) product upgrades to ensure patient safety, including adjustments to exercise speed and resistance; (2) hardware and software improvements to improve usability, including adjustments to the location of the emergency button and improvements to the graphical user interface elements; and (3) improvements to the user manual, including detailed contraindications, patient criteria, and clearer operating instructions. Although the mean score of physiatrists ($M = 4.463$) was higher than that of physical therapists ($M = 4.114$) in terms of the ease of use of the user interface, the difference was not statistically significant. Similarly, in the category of identifiability and understanding of information, physiatrists ($M = 4.467$) also reported higher mean scores than physical therapists ($M = 3.733$), but this difference was not statistically significant either.

Conclusions: Usability evaluation provided actionable insights into improving the Rebless Pro's safety, usability, and information clarity. To further refine the device, iterative usability evaluations involving both healthcare professionals and patients are recommended. These efforts are expected to contribute to the development of a safe, effective, and user-friendly Electrically-powered Orthopedic Exerciser suitable for commercialization.

Keywords: Usability Evaluation; Usability; Electrically-powered Orthopedic Exerciser; Focus Group Interview; Satisfaction Survey

Introduction

Background

Musculoskeletal (MSK) disorders, resulting from diseases or injuries affecting muscles, tendons, ligaments, and bones, are a major cause of reduced physical function and quality of life [1]. Patients with MSK disorders often experience difficulties in performing independent daily activities due to reduced joint mobility, weakened muscle strength, and chronic pain, necessitating systematic and continuous rehabilitation therapy [2]. In clinical rehabilitation, electrically-powered orthopedic exercisers play a crucial role in facilitating joint tissue regeneration and muscle strength recovery [3].

A representative example of such devices is the Continuous Passive Motion (CPM) device, which is widely used to prevent joint stiffness and promote tissue healing, particularly after orthopedic surgeries [4, 5]. However, despite their therapeutic benefits, conventional CPM devices exhibit several limitations that hinder optimal rehabilitation outcomes. First, they typically provide only passive range of motion exercises, without accommodating more dynamic modes such as active-assisted or resisted exercises, which are essential for patients requiring progressive muscle strengthening or functional restoration [6, 7]. Second, these devices lack user-specific customization features. Most CPM units operate on fixed protocols that do not account for individual differences in pain tolerance, range of motion progression, or rehabilitation goals [8, 9]. As a result, patients may experience discomfort or disengagement due to inappropriate exercise intensity or duration. Third, many CPM devices are ergonomically unsuitable for certain populations, such as obese patients, individuals with severe joint deformities, or those unable to maintain a supine position. Since most CPMs are designed for supine use, they may also limit usability and patient compliance in non-hospital settings [10, 11].

To address these issues, alternative models such as sitting-type CPM devices have been developed. These devices allow patients to perform rehabilitation exercises in a seated position, which can enhance comfort, accessibility, and safety. Some studies have reported that sitting-type CPMs offer comparable efficacy to conventional models while improving patient satisfaction [9]. Nevertheless, these alternatives are still relatively underutilized in clinical practice, partly due to limited availability and familiarity among clinicians.

In response to the need for more adaptive and patient-centered solutions, the Reblless Pro was developed as a next-generation orthopedic exerciser supporting both passive and active-assisted exercises. The device was designed to allow personalized treatment protocols and improve usability in various clinical settings.

Electrically-powered orthopedic exerciser

The Reblless Pro (H Robotics Inc., Incheon, Republic of Korea), an electrically powered orthopedic exerciser developed to support full range of motion (ROM) exercises and facilitate active and passive rehabilitation of the knee and ankle in individuals with neurological or MSK disorders (Figure 1). During the initial design phase, user requirements were collected from clinicians to inform the development of device functionalities and interface elements. Currently in its prototype stage, the Reblless Pro comprises a main unit and a tablet-based controller operated via the Reblless Pro application.

The application features an intuitive graphical user interface and is structured around five core

functional modules: (1) Passive ROM, which enables therapist-initiated joint mobilization; (2) Active-Assisted ROM, providing adjustable support for patient-initiated movement; (3) Evaluation ROM Measurements, allowing objective tracking of joint range; (4) Resisted ROM, designed to improve muscular strength and motor control through applied resistance; and (5) Interactive Custom Setup, which enables therapists to personalize treatment protocols according to patient-specific needs.

The device operation workflow begins with patient registration and profile setup. Therapists select exercise modes and set individualized parameters—such as ROM range, resistance, and assistance levels—based on therapeutic goals. During sessions, the app provides real-time feedback on joint movement, resistance, and exercise performance. Upon completion, session data is automatically stored, supporting longitudinal progress monitoring and outcome evaluation.

The Rebliss Pro is intended for use by physical therapists and physiatrists, with the primary patient population being individuals with neurological or MSK impairments, including lower-extremity muscle paralysis, joint contractures, or those undergoing post-surgical rehabilitation. These users often require guided motor recovery and muscle strengthening to improve functional outcomes.

Figure 1. Electrically-powered orthopedic exerciser



Usability Evaluation

Usability issues in medical devices can directly affect patient safety and treatment outcomes, often arising from deficiencies in user interface (UI) design [12]. To mitigate such risks, IEC 62366 emphasizes the integration of usability engineering throughout the device development process, distinguishing between formative and summative evaluations [13–15]. Formative evaluations, conducted during the early stages of design, aim to identify UI-related strengths, weaknesses, and potential use errors. These evaluations are iterative and typically involve direct input from intended users to guide design refinement [16]. Focus group interview (FGI), in particular, are widely used during the formative phase to collect user feedback on prototype usability [17, 18].

The present study conducted a formative usability evaluation of the Rebliss Pro, which is currently in its implementation phase. Using FGI and user satisfaction surveys with rehabilitation medicine professionals—the device’s intended users—this study aimed to identify areas for improvement to enhance the safety and convenience of the device, in accordance with IEC 62366.

Methods

Overview

In this study, FGI and satisfaction surveys were conducted to collect quantitative and qualitative data on an electrically-powered orthopedic exerciser. This study was approved by the institutional review board of the National Rehabilitation Center (NRC; NRC-2023-03-020).

Participants

The evaluation participants comprised NRC-affiliated five physiatrists and five physical therapists, were recruited through peer referral and a bulletin board announcement at NRC Usability Testbed. The inclusion criteria were licensed Physical Medicine and Rehabilitation or physical therapists with experience using medical devices for electrically-powered orthopedic exerciser and sufficient proficiency in Korean and English to comprehend SW terminology. Individuals lacking experience in electrically-powered orthopedic exerciser were excluded from the study. The participants provided voluntary consent after receiving a comprehensive explanation of the study objectives, methods, and procedures. All participants had at least 1 year of clinical experience using electrically-powered orthopedic exerciser such as the CPM. The full formative assessment process, including FGI, was conducted separately for physiatrist group and physical therapist group.

Usability evaluation procedure

A usability evaluation was conducted at the NRC Usability Testbed. The evaluation was carried out in two separate sessions, categorized into a physiatrist group and a physical therapist group, with each session lasting 90 minutes. The evaluator provided an introduction to the assessment to familiarize participants who may have been unfamiliar with usability evaluations, explaining the objectives, methods, and procedures of the product evaluation. Following this, participants were required to confirm their understanding of the evaluation details, after which informed consent was obtained for voluntary participation as well as for video and audio recordings. FGI commenced with questions regarding the general characteristics of the participants. Subsequently, the evaluator confirmed that participants had reviewed the relevant information on the Rebliss Pro and inquired about their prior experiences with similar devices, including the specific names of those devices. A demonstration of the use scenarios (Appendix 1) was then conducted in conjunction with FGI using the Rebliss Pro. Upon completion of the interview, a satisfaction survey was administered to gather participants' feedback.

Usability evaluations conducted in environments that closely resemble real-world usage scenarios have been reported to accurately capture user experience and satisfaction, thereby playing a pivotal role in enhancing the commercial viability of medical devices [19]. In alignment with such findings, this study implemented formative evaluations within a simulated environment designed to replicate actual usage conditions. For the usability evaluation, the physical therapy environment in which Rebliss Pro was used was simulated, and the device was set up on a Bobath table (Figure 2). The luminous intensity, temperature, and relative humidity of the evaluation sites were measured before usability evaluation. The luminous intensity was 550 ± 100 lux, temperature was 24 ± 2 °C, relative humidity was $50 \pm 10\%$, and noise was 50 ± 5 dBA. The actual scenes of the evaluation are shown in Figure 3.

Figure 2. Evaluation environment



Figure 3. Scenes of the evaluation



FGI

FGI were employed as a qualitative data collection method to evaluate the usability of the Rebless Pro prototype. Each FGI session was conducted once per group, with one moderator, one observer for recording, and five participants present in the evaluation space. The moderator posed identical questions to each participant sequentially, ensuring that all participants—from the first to the fifth—had an opportunity to respond. FGI questionnaire was structured following Krueger and Casey's (2009) guidelines[17], incorporating introductory, transitional, key, and end questions(Appendix 2). To gather feedback on Rebless Pro, product demonstrations were conducted according to predefined use scenarios. Scenarios for eight tasks were designed based on the user manual. Participants observed the device during these demonstrations and provided insights into predictable or identified risk factors and areas for UI improvement. The core questions focused on collecting participants' opinions regarding the UI of Rebless Pro after observing its functionality and use. Additionally, participants offered suggestions for mitigating risks and improving usability based on their observations during the product demonstrations. Content analysis was conducted on the data obtained from FGI [20, 21]. Microsoft Excel was employed throughout the processes of data transcription, coding, and thematic derivation

Satisfaction surveys

After FGI, satisfaction surveys of the Rebless Pro were conducted to collect the quantitative data. The satisfaction survey consisted of 51 items on the ease of use of UI(Cronbach's $\alpha = 0.987$) and 3 items on identifiability and understanding of information(Cronbach's $\alpha = 0.617$). The survey items were rated on a 5-point Likert scale ranging from 1 (very difficult) to 5 (very easy). The difference in satisfaction between the physiatrist group and the physical therapist group was analyzed using the Mann-Whitney U test in SPSS 25(IBM Corp.). The satisfaction survey results are presented as means and standard deviations for each item by group(Appendix 3,4).

Results

Participant characteristics

In physiatrist group, clinical experience ranged from 1 year and 3 months to 2 years and 3 months. Experience in using similar medical devices ranged from 3 months to >1 year. In the physical therapist group, the clinical experience ranged from 7 to 28 years, and experience using similar medical devices was >1 year for all members (Table 2). All members of both groups had experience using electrically-powered orthopedic exercisers, such as MOTomed and CPM, but all were using the Rebless Pro for the first time.

Table 2. General participant characteristics

No.	Sex	Age	Experience	Occupation	Experience using similar medical devices	Name of similar medical device
1	Female	29	2 yr 3 mo	physiatrist	1 yr, > once a day	MOTOmed
2	Female	27	2 yr 3 mo	physiatrist	1 mo, once a day	CPM
3	Male	26	2 yr 3 mo	physiatrist	6 mo, once a day	MOTOmed
4	Female	28	1 yr 3 mo	physiatrist	4 mo, once a day	MOTOmed
5	Male	25	1 yr 3 mo	physiatrist	3 mo, twice a day	MOTOmed
6	Female	51	28 yr 10 mo	Physical therapist	1 yr, 3 times a day	MOTOmed
7	Male	40	14 yr	Physical therapist	1 yr, once a day	MOTOmed
8	Female	36	9 yr 10 mo	Physical therapist	1 yr, once a day	MOTOmed
9	Female	32	9 yr 6 mo	Physical therapist	1 yr, once a day	MOTOmed
10	Female	29	7 yr 3 mo	Physical therapist	1 yr, 3 times a day	MOTOmed, CPM

No.: Number

FGI results

From FGI, three key factors and seven sub-factors were derived as possible improvements to the Rebless Pro. The three key factors were as follows: 1) product upgrades to ensure safety, 2) hardware and software improvements for convenience of use, and 3) improvement of the manual for better identifiability and understanding of the information (Table 3).

Table 3. Outcome of content analysis

Subject	Suggested Solution
(1) Product upgrade to ensure safety	Improve the exterior Fasten the device Adjust the motor for exercise speed and resistance
(2) Improvements for convenience of use	Improve the hardware UI Improve the software UI
(3) Improvement of the manual for better identifiability and understanding of the information	Input details about the intended patient group and medical indications Input details about device use and operation

UI: User Interface

Product upgrade to ensure safety

The participants prioritized patient safety and suggested the following potential risks and improvements to the Rebless Pro:

The exterior requires improvement as the device has a complex structure and accidents may be caused through items getting caught on its exterior.

The device should be fastened to the table, but force applied by the therapist should allow it to slide or move. The device should be secured using an anti-slip pad.

Patients may complain of pain because the speed of the basic exercise may be too fast. The initial position angle should be adjusted while the device is being fitted.

Movement speed needs to be more finely adjusted.

The operating exercise speed should be shown on the controller display.

The basic resistance intensity of the device may be too high for the patient to counteract.

There is a high likelihood of errors occurring during ROM measurement, and measurement range errors may occur.

Hardware and software improvements for convenience of use

For user convenience and ease of use, the following hardware and software improvements to the Rebless Pro were suggested:

The power (ON, OFF) button should be repositioned.

The emergency stop button should be repositioned, and separate buttons should be provided for the patient and therapist.

The material of the fastening strap where the device is secured to the patient should be changed.

Noise from the motor may interfere with the treatment of other patients. The motor noise should be adjusted.

As this device is provided to the patient by medical staff, the wording of the instructions should be improved to make it easier for patients to understand (instead of using medical terminology).

The information about intensity and stiffness sensitivity is provided only in the manual. It is cumbersome to have to refer to the manual while using the device. A pop-up window with a summary of each function should be added to the controller display.

Control icons, such as up and down arrows, should be presented more clearly on the display.

Improvement of the manual for better identifiability and understanding of the information

Participants suggested the following improvements to the Rebless Pro manual to allow better identifiability and understanding of information by users:

Detailed information about the contraindications for intended patient groups, stages of life and age groups, specific criteria for applicable patients, and the patient's position when fitting the device should be provided.

With respect to use of the device, calf/thigh measurement criteria, exercise intensity criteria based on Manual Muscle Test or Modified Ashworth Scale standards, and clear exercise speed criteria should be provided.

Satisfaction survey results

To identify the difference in satisfaction between physiatrists and physical therapists, a Mann-Whitney test was conducted. When comparing the overall mean of ease of use of UI, the satisfaction of physiatrist ($M=4.463\pm0.298$) was higher than that of physical therapists ($M=4.114\pm0.829$), but there was no statistically significant difference ($U = 10.000$, $p = 0.690$). In addition, when comparing the overall mean of information identifiability, the satisfaction of physiatrist ($M=4.467\pm0.506$) was higher than that of physical therapists ($M=3.733\pm0.894$), but there was no statistically significant

difference ($U = 6.000$, $p = 0.222$).

Table 4. Comparison of satisfaction surveys between physiatrist and physical therapists

	physiatrist (n=5)		physical therapists (n=5)		U	Z	P
	M	Sd	M	Sd			
ease of use of UI	4.463	0.298	4.114	0.829	10.000	-0.522	0.690
identifiability and understanding of information	4.467	0.506	3.733	0.894	6.000	-1.375	0.222

Discussion

Principal Results

A formative evaluation is a usability evaluation performed to improve the design of a medical device under development. To gain qualitative and quantitative insights into the course of the development of the Reblless Pro, an electrically-powered orthopedic exerciser, a formative evaluation was conducted. This was achieved using FGI and satisfaction surveys with rehabilitation medicine professionals who had experience using other electrically-powered orthopedic exercisers.

FGI enable individuals to freely express their own experiences and engage in discussions using not only their own knowledge but that of others, thereby providing diverse perspectives and detailed information on a specific topic [17]. Moreover, FGI are used to identify and analyze expert responses as experts share information and experience in using a particular product or service. Therefore, FGI findings may be used to develop or improve products and services [22].

Motorized medical devices can cause unintended movements by the patient or user, potentially leading to discomfort or injury [23]. Because the operator of the Reblless Pro is a medical professional and the user is a patient, the participants in this study prioritized patient safety and presented opinions on improvement of the exterior structure of the device and upgrades to the device fastening, exercise speed, and resistance strength. These points suggest that patient and operator safety is crucial when designing a rehabilitation device and that the product should be upgraded to ensure safety.

A previous study mentioned that devices using robotic technology should be equipped with at least one emergency stop button that is easily accessible to the user [24], and another study reported that an emergency stop system should be installed to prioritize user and patient safety in the event of device malfunction or user error [12]. On the basis of their own experience using similar medical devices and the product demonstration, the participants in our study indicated the need for the emergency button to be redesigned and repositioned so that it would be more visible and easily accessible to medical staff or patients in the event of an emergency. Consequently, we determined that the emergency stop system of a medical device has a direct impact on the ability to prevent device malfunction and that it plays an important role in ensuring device safety and efficacy.

The Reblless Pro is a novel device currently under research, meaning that all users, including medical staff and patients, can be considered novices to its operation. As the device is primarily operated by medical staff but worn by patients, it is crucial that the UI design and user manual prioritize intuitiveness and accessibility. This ensures that both medical staff and patients can easily learn and operate the device. Consistent with previous findings, simple terms should be used in the manual to facilitate quick and accurate operation, allowing users to interact with the device intuitively and

consistently [25].

From an ergonomic perspective, the medical device design should consider not only convenient usability but also possible injuries due to repeated strain and physical defects of individuals [26]. The key to the CPM is its ability to deliver the same movement as the actual human body through human lower-extremity ROM and accurate alignment [27]. As in previous studies, the need to mark the joint ROM and axes on the surface of the medical device was suggested in this study as an area of improvement for electrically-powered orthopedic exercisers, considering the individual physical factors of each patient.

The user manual of a medical device is important not only for usability but also for identifying and understanding information [28]. The user manual explains device operation, maintenance, and troubleshooting, which can potentially affect patient safety [29]. The participants in this study also requested specific information regarding specific operating standards and clear information about the intended patient groups, including contraindications and applicable age. Based on previous and the present studies, the construction of a high-quality user manual is essential for the effective use of the device.

The high average scores (≥ 4) on ease of use of ui are likely influenced by the fact that participants assessed the device during a controlled product demonstration rather than real clinical use. The findings also showed that mean of satisfaction with information identifiability and understanding of information were lower in the physical therapist group than in the physiatrist group. In rehabilitation medicine, physiatrists and physical therapists form a collaborative, multidisciplinary team; however, physiatrists are responsible for establishing the overall treatment plan, whereas physical therapists specialize in assessing motor problems and providing rehabilitation training [30–32]. The satisfaction scores may have been lower for physical therapists than for physiatrists because physical therapists assigned scores for identification and understanding of the Rebless Pro on the basis of their own experience. These findings confirm that when developing a medical device, the intended users should be clearly defined so that they can satisfy the information identifiability and understanding requirements.

Because continuous formative evaluations of improved medical devices are important to ensure their efficacy [33], repeated formative evaluations are required for the commercialization of our high-quality electrically-powered orthopedic exerciser. Improving the UI to reduce errors that may cause serious harm is recommended to enhance device efficacy and safety.

Limitations

Owing to the nature of rehabilitation devices, both medical staff who operate the device and patients who receive therapy are considered users. However, this study focused on evaluating the usability of the Rebless Pro prototype from the perspective of rehabilitation professionals, specifically examining tasks performed by medical staff, such as operating the tablet-based controller and assisting patients in wearing the device. Despite not including patients as direct participants, healthcare professionals specializing in rehabilitation medicine provided valuable insights, including perspectives from the patient's viewpoint during the evaluation process. Also, standardized tools such as the System Usability Scale (SUS) were not utilized for quantitative data collection in this study. To ensure further refinement of the device through iterative formative evaluations, future studies should incorporate standardized tools to collect quantitative data.

Conclusions

If improvements are made with respect to the safety of the electrically powered orthopedic exerciser, the identifiability and comprehension of information, and the ease of use based on identified risk factors and areas for UI enhancement, the device can be refined to better meet user needs. This study primarily identified physiatrists and physical therapists as key user groups for evaluating the

electrically powered orthopedic exerciser, given their expertise in device operation and patient safety. Future evaluations should further integrate patient feedback to ensure usability and safety from both clinical and end-user perspectives. Iterative formative evaluations involving these specific user groups, alongside the systematic implementation of necessary modifications, will facilitate a summative evaluation of the final product. These efforts are expected to contribute to the commercialization of an electrically powered orthopedic exerciser that prioritizes both safety and usability for its intended users.

Acknowledgements

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Conflicts of Interest

None declared.

Abbreviations

CPM: continuous passive motion

NRC: National Rehabilitation Center

ROM: range of motion

UI: user interface

FGI: focus group interview

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Appendix 1. Use scenarios for rehabilitation medical staff

Use scenarios	Task description
Task 1. Turn on the power	
Sub-task 1	Connect the power cable plug to the main unit connector and press the “ON” sign on the power switch to turn on the device
Sub-task 2	Check the controller power and select “Start exercise now”
Sub-task 3	Select the exercise area, direction, method, and type from the controller home screen
Task 2. Length and position setting	
Sub-task 4	Unlock the main unit and check the lock menu on the controller display
Sub-task 5	Use a tape measure to measure calf and thigh lengths
Sub-task 6	Input the calf and thigh measurements into the controller
Sub-task 7	Load the affected area of the imaginary patient on the main unit
Sub-task 8	Lock the main unit and check the lock menu on the controller display
Sub-task 9	Set the initial position angle
Task 3. Active exercise	
Sub-task 10	Set the angle range for exercise (flexion-30, extension-110), exercise intensity (flexion-15, extension-15), and duration of exercise (20 min)
Sub-task 11	Start the exercise and pause after 3 min
Sub-task 12	Restart the exercise and finish after 3 min
Sub-task 13	Check the exercise record screen and return to the initial angle
Task 4. Passive exercise	
Sub-task 14	Select the item area (knee), direction (right), method (passive), and type (exercise) from the tablet home screen
Sub-task 15	Reset the length and position
Sub-task 16	Set the angle range for the exercise (flexion-30, extension-110), wait time (10 s), exercise speed (5), and duration of exercise (20 min)
Sub-task 17	Start the exercise and pause after 3 min
Sub-task 18	Restart the exercise and finish after 3 min
Sub-task 19	Check the exercise record screen and return to the initial angle
Task 5. Active range of motion (ROM) measurement	
Sub-task 20	Select the item area (ankle), direction (left), method (active), and type (ROM measurement) from the tablet home screen
Sub-task 21	Reset the length and position
Sub-task 22	Start measuring the active ROM
Sub-task 23	Finish measuring the active ROM
Sub-task 24	Check the active ROM measurement results on the screen and return to the home screen
Task 6. Passive ROM measurement	
Sub-task 25	Select the area (ankle), direction (left), method (passive), and type (ROM measurement) from the tablet home screen
Sub-task 26	Reset the length and position
Sub-task 27	Set the angle range for the exercise (flexion-30, extension-110, and speed-5)
Sub-task 28	Start measuring the passive ROM
Sub-task 29	Finish measuring the passive ROM

Sub-task 30	Check the passive ROM measurement results on the screen and return to the home screen
Task 7. Recorded exercise	
Sub-task 31	Select the item (direction-left and type-recorded exercise) from the tablet home screen
Sub-task 32	After starting the recording, instruct the patient to move the device
Sub-task 33	After completing the recording, edit the exercise portion to set it
Sub-task 34	Start the recorded exercise
Sub-task 35	Finish 3 min after starting the recorded exercise
Sub-task 36	Check the exercise result screen
Task 8. Turn off the power	
Sub-task 37	Turn the power off on the controller, then turn the power off on the main unit

Appendix 2. Contents Questions of Focus Group Interview

Question process	Applications	Questions
Opening question	Beginning with the questions about general characteristics of the participants and questions related to interview topic - To give all participants a chance to speak out	- General characteristics (age, gender, career, experience with lower limb rehabilitation devices, etc.) - Are you currently providing treatment using lower limb rehabilitation devices such as electrically-powered orthopedic exerciser to your patients?
Transition question	From the start question to the main question, the question helps the conversation move smoothly in the interview	- Could you tell me about your experience using lower extremity rehabilitation devices such as electrically-powered orthopedic exerciser for treatment? - What types of treatment have you provided using electrically-powered orthopedic exerciser? (Treatment area/ROM angle/Passive, active, etc.) - What do you think are the advantages of providing treatment using passive and active lower extremity rehabilitation devices? - What should be considered when developing passive and active lower extremity rehabilitation devices that can be provided for treatment?
Key question	Through these questions, participants talked about their own opinions and experiences without a time limit It consisted of questions about rebless pro, and an interview was conducted after providing a product demonstration.	- Do you have any comments about the user manual? - Do you have any comments about the appearance and composition of the product? - Are there any expected errors or risk factors when using the product? Or are there any areas that need improvement? - Do you have any additional comments about rebless pro?
Ending question	Summarize the opinions collected in the discussion and see if there are anything missing or needed to be add	- Do you agree with this summary? - Please let us know if you have any additional thoughts on what should be considered when developing an electrically-powered orthopedic exerciser.

Appendix 3. Survey results on ease of use of UI

No	Survey item	Responses from physiatrists		Responses from physical therapists	
		M	SD	M	SD
1	Check the user manual	4.6	0.55	3.8	0.45
2	Check the exterior of the product	4.6	0.55	3.6	1.14

3	Connect the power cable plug to the main unit connector and press the "ON" sign on the power switch to turn on the device	4.6	0.55	4.6	0.55
4	Check the controller power and select "Start exercise now"	4.6	0.55	4.4	0.89
5	Select the exercise area, direction, method, and type from the controller home screen	4.8	0.45	4.4	0.89
6	Unlock the main unit and check the lock menu on the controller display	4	1.00	3.8	1.30
7	Use a tape measure to measure calf and thigh lengths	4	0.71	3.2	1.30
8	Input the calf and thigh measurements into the controller	4.6	0.55	3.4	1.34
9	Load the affected area of the imaginary patient on the main unit	4.2	0.84	3.8	1.30
10	Set the initial position angle	4	0.71	3.4	0.89
11	For active exercise, select "Start the test"	4.6	0.55	4.2	0.84
12	For active exercise, select "Start exercise on completion"	4.6	0.55	4.2	0.84
13	For active exercise, set the angle range for active exercise	4.4	0.89	4.0	1.22
14	For active exercise, set the pace for a single session	4.2	0.84	4.2	0.84
15	For active exercise, set the exercise intensity	4	0.71	4.4	0.55
16	For active exercise, set the duration of exercise	4.6	0.55	4.4	0.55
17	For active exercise, select "Start exercise"	4.8	0.45	4.4	0.55
18	For active exercise, select "Pause"	4.6	0.55	4.4	0.55
19	For active exercise, select "Finish exercise"	4.8	0.45	4.4	0.55
20	For active exercise, check the exercise result screen	4.8	0.45	4.4	0.89
21	For passive exercise, select the exercise area, direction, method, and type from the controller home screen	4.6	0.55	4.4	0.89
22	For passive exercise, set the length and position	4.6	0.55	3.8	1.30
23	For passive exercise, set the angle range for exercise	4.4	0.89	4.2	0.84
24	For passive exercise, set the wait time	4.8	0.45	4.2	0.84
25	For passive exercise, set the exercise speed	4.6	0.55	4.2	0.84
26	For passive exercise, set the duration of exercise	4.6	0.55	4.2	0.84

27	For passive exercise, select “Start exercise”	5	0.00	4.2	0.84
28	For passive exercise, select “Pause”	4.8	0.45	4.2	0.84
29	For passive exercise, select “Restart exercise”	4.8	0.45	4.2	0.84
30	For passive exercise, select “Finish exercise”	5	0.00	4.2	0.84
31	For passive exercise, check the exercise result screen	4.8	0.45	4.4	0.89
32	For active range of motion (ROM) measurement, select the exercise area, direction, method, and type from the controller home screen	4.2	0.45	4.4	0.89
33	For active ROM measurement, set the length and position	4	0.71	3.4	1.52
34	Start active ROM measurement	3.6	1.14	4.0	1.00
35	Finish active ROM measurement	3.8	0.84	4.0	1.00
36	For active ROM measurement, check the test result screen	4.4	0.55	4.4	0.89
37	For passive ROM measurement, select the exercise area, direction, method, and type from the controller home screen	4.4	0.55	4.4	0.89
38	For passive ROM measurement, set the length and position	4.4	0.55	3.4	1.52
39	For passive ROM measurement, set the angle range for exercise	4.4	0.55	3.8	1.30
40	Start passive ROM measurement	4.4	0.55	4.0	1.00
41	Finish passive ROM measurement	4.4	0.55	4.0	1.00
42	For passive ROM measurement, check the test result screen	4.4	0.55	4.4	0.89
43	For recorded exercise, select the exercise direction and type from the controller home screen	4.4	0.55	4.2	0.84
44	For recorded exercise, set the length and position	4.4	0.55	4.2	0.84
45	For recorded exercise, select “Start recording”	4.4	0.55	4.2	0.84
46	For recorded exercise, select “Finish recording”	4.4	0.55	4.2	0.84
47	For recorded exercise, edit the recorded exercise portion	4.4	0.55	3.8	1.30
48	For recorded exercise, set the duration of exercise	4.4	0.55	4.2	0.84
49	For recorded exercise, start and finish the exercise	4.4	0.55	4.2	0.84
50	Stop operating the main unit and controller	4.4	0.55	4.4	0.55
51	Press the “OFF” sign on the power	4.6	0.55	4.6	0.55

	switch to turn off the device				
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M: Mean, SD: Standard Deviation, No.: Number

Appendix 4. Survey results on identifiability and understanding of information

No .	Survey item	Responses from physiatrists		Responses from physical therapists	
		M	SD	M	SD
1	Were you able to clearly see the exterior markings on the product (e.g., label, button signs, etc.)?	4.4	0.55	3.0	2.00
2	When using the controller, were you able to check the operational status of the screen?	4.6	0.55	4.4	0.89
3	Was the user manual helpful?	4.4	0.55	3.8	0.45

M: Mean, SD: Standard Deviation, No., Number

Supplementary Files

Appendix 1. Use scenarios for rehabilitation medical staff.

URL: <http://asset.jmir.pub/assets/7432ce45bf1b72e7038e3271e280b554.docx>

Appendix 2. Contents Questions of Focus Group Interview.

URL: <http://asset.jmir.pub/assets/999db93ec4191ff88be1e39c3aa537e4.docx>

Untitled.

URL: <http://asset.jmir.pub/assets/22795936542c7c323ce33c63e5d8ce55.docx>