CO-DESIGN RESULTS

Report

D1.2 – Co-Design Results

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Executive Summary

The objective of Deliverable 1.2 is to outline the methodological design of the co-creation from the FACEREHAB system, where these requirements are defined by stakeholders. Based on scientific literature and evidence-based practice, the features identified in the co-creation process will focus on three main areas: assessment, exercise plan and therapeutic guidance for facial paralysis. We will mainly use elements from three different understandings of co-creation: technology co-design and experienced-based co-design (EBD). The results will serve as an aid to understand and clarify the user's requirements and expectations of the system's functionality and to provide a basis for the definition of the different system functional features. For the conceptualization of requirements, we organize a design-thinking session to determine what is more important for all involved stakeholders in the process, not only technical partners but also health care professionals that represent themselves, informal caregivers and patients.

In the FACEREHAB project, different methods will be used to engage users, addressing different problem areas, from the technical to the social, because is believed that the co-creation process in health will be able to favor both the techno-scientific evolution and to enhance the quality of the provision of health services. Through the involvement of patients, informal caregivers, professionals, researchers and organizations in the processes of change, value in health will be created through the improvement and integration of the patient's social environment in the rehabilitation process.

1   Introduction

1.1 Background

In the contemporary social context, of active character and reflexiveness, resulting from globalization and access to information, patients, caregivers and health professionals are no longer passive recipients of products and/or services, starting to play a participatory role in the co-creation process so, the involvement of all parts in FACEREHAB project is crucial to build a system that is realistic from technician´s point of view as well as the expectation of the final users.

After anamnesis, medical evaluation and clinical diagnosis the rehabilitation process in facial paralysis (FP) presupposes three fundamental therapeutic moments: assessment, exercise plan and therapeutic guidance. Based on the results of Task 1.1 (D1.1) a set of features were elected so the solution can meet all the expected behaviors thus, a brief bibliographical review will be presented below about the assessment, exercise plan and guidance processes that support the subsequent description of all the features that need to integrate the system.

FP is characterized by the presence of signs of decreased unilateral facial muscle strength, decrease/absence of wrinkles in the frontal region, difficulty/inability to mobilize the eyebrow, lagophthalmos (the patient has difficulty/inability to close the eye), sign of Legendre (decreased contraction of the eyelid orbicularis muscle), Mingazzini's sign (with the eye closed it is easy to lift the upper eyelid), Bell's sign (eyeball upward rotation when closing the eye), no lifting of the nose wing with inspiration, asymmetry of the labial commissure (difficulty/inability to mobilize the labial commissure) (Barros et al., 2004).

The face is asymmetrical at rest and during movements, and incomplete movements and synkinesis in forehead, eye, nose and lip movements, as well as excessive tearing during activities such as chewing, can also be observed (Jesus et al., 2012).

The absence of movement of the muscles of the face results in disfigurement and compromise of facial expression, fundamental for the process of human communication (facial mimicry) (Salvador, Tessitore, Pfeilsticker, Paschoal & Nemr, 2013, pg.593). Speech is hampered by the deviation of the nasolabial filter and by the inadequate articulation of labiodental phonemes and bilabials, due to the flaccidity that occurred at the beginning of the FP, in the muscles of the face, both in buccinator muscle and in the orbicularis oris muscle, the which causes an articulatory impairment (Tessitore, Pfeilsticker & Paschoal cit in Salvador, Tessitore, Pfeilsticker, Paschoal & Nemr, 2013, pg.593; Dias, Silva & Barreto, 2021, pg. 2).

From a functional point of view, the facial and mastication muscles act synergically. During mastication, various muscle groups are coordinately contracted, with an obvious emphasis to the mastication muscles, followed by the tongue and facial muscles, specially the buccinator muscle and the orbicular muscle of the lips. In FP, the paralyzed hemiface leads to unilateral mastication, in the non-affected side. The containment of food between the dental arches is jeopardized by the inefficiency of the buccinator muscle and by the labial incompetence, which is a consequence of the flaccidity present in the affected hemiface. The lips, turned to the normal side and with little occlusion strength, determine the decrease of intra-oral pressure, altering the balance among the structures, lips, cheeks, palate and tongue. With the orofacial muscle tonus jeopardized, there will be extra-oral escape, difficulty in liquid ingestion and impairment of the masticatory function (Solomon, 2006; Queiroz, Testa, Tessitore & Paschoal, 2007; Rahal & Goffi-Gomez, 2007; Carvalho, 2008; Tessitore, Paschoal & Pfeilsticker, 2009; Bernardes, Gomez & Bento, 2010; Tessitore, 2010; cit in Mory et al., 2013, pg.403).

Although mastication is not the responsibility of the facial nerve, it plays an important role in the oral phase of swallowing, which can harm the masticatory system when FP occurs. In the oral or preparatory phase of swallowing, a bolus is formed, with lip closure and organization/coordination with chewing itself. The most described difficulty is the containment of food which can generate escape through the labial commissure on the affected side, due to the flaccidity of the Buccinator muscle and the orbicularis oculi of the lips (Magalhães, 2003) in short "with the orofacial muscle tonus jeopardized, there will be extra-oral escape, difficulty in liquid ingestion and impairment of the masticatory function" (Quintal, Tessitore, Pfeilsticker & Paschoal, 2004; Solomon, 2006; Queiroz, Testa, Tessitore & Paschoal, 2007; Rahal & Goffi-Gomez, 2007;Bernardes, Gomez & Bento, 2010; Tessitore, 2010; cit in Mory et al., 2013, pg.403).

Some patients choke and may have difficulty swallowing solid food due to decreased saliva production and paralysis in the stylohyoid muscles and digastric posterior belly, both innervated by the facial nerve (Tessitore, Pfelsticker & Paschoal, 2008).

In breathing, the greatest difficulty is related to nasal obstruction on the paralyzed side. Intact musculature on the contralateral side displaces the lower part of the nose to the affected side and the action of gravity causes the nasal base to fall, promoting asymmetry and collapse of the affected nostril, which causes difficulty in breathing, especially during sleep. Visually, there is no elevation of the nose wing with inspiration (Catarina et al., 2012).

1.2 Assessment of Facial Paralysis

Assessment and treatment in FP are especially complex due to the wide variability in regeneration potential and the lack of reliable prognostic data for spontaneous recovery. Depending on the location of the lesion, FP can manifest as central or peripheral paralysis (Wenceslau et al. 2016). The resulting symptoms depend not only on the cause, time and level of the injury, but also on the individual model of facial innervation (Wenceslau et al., 2016).

The search for evidence-based practice has become essential in the therapeutic process. The need to establish a prognosis regarding the evolution of FP and to assist in therapeutic planning has led to the development of methods to quantify it clinically. Traditional classification systems are based on objective and subjective clinical observations made by the treating therapist. To clinically quantify the impact of facial paralysis on facial mimicry, as well as the outcome of intervention processes, were developed subjective and objective methods, among which highlight: the graduation of House Brackmann, Index of facial function, Moiré topography, three-dimensional analysis of facial movements, electroneuromyography and anthropometric measurements (Salvador, Tessitore, Pfeilsticker, Paschoal & Nemr, 2013, pg.593).

The most common method used and accepted by the American Academy of Otorhinolaryngology - Head and Neck Surgery (AAOHNS) is the House-Brackmann Scale (HBS) (House & Brackmann, 1985), based on the therapist's clinical observation and is prone to inter and intra-observer variability and anthropometric measurements.

The House and Brackmann Scale, that will be used in the clinical pilot, is divided into six degrees, according to the severity of the motor dysfunction, mainly assessed according to the occurrence of asymmetries at rest or during movements, muscle tone and synkinesis (table 3).

Grade	Description	At rest	In movement
i	Normal	Symmetry	Normal facial function
ii	Mild dysfunction	Normal symmetry and tone	Forehead: moderate to good function
			Eye: complete closure with minimum effort
			Mouth: slight asymmetry
iii	Moderate dysfunction	Normal symmetry and tone	Forehead: slight to moderate movement
			Eye: complete closure with effort
			Mouth: slight weakness with maximum effort
iv	Moderately severe dysfunction	Normal symmetry and tone	Front: none
			Eye: incomplete closure
			Mouth: asymmetric with maximum effort
v	Severe dysfunction	Asymmetry	Front: none
			Eye: incomplete closure
vi	Total paralysis	Asymmetry	No movement
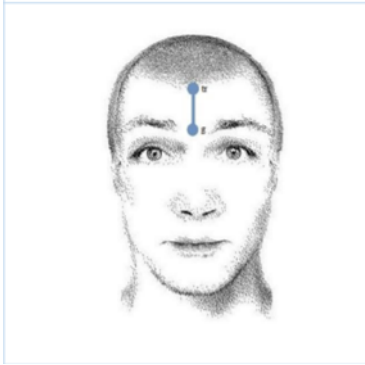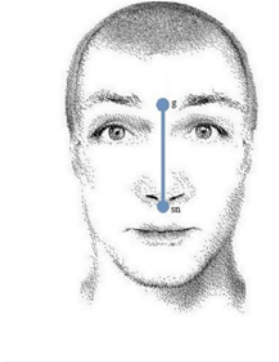
Anthropometry has been used in the diagnosis and monitoring of several clinical areas. In speech therapy, in the area of orofacial motricity, the use of facial anthropometric measurements is indicated during the assessment and reassessment process (Cattoni, 2006; Rodrigues, Monção, Moreira & Mota, 2008 cit in Ramires et al., 2011, pg. 248).

Direct anthropometry allows, through the use of a digital caliper, the measurement, that is, the obtaining quantitative data, as well as determining the differences between the measures collected (Cattoni, 2006).

Procedure for evaluating anthropometric orofacial measurements:

The anthropometric orofacial assessment must be performed using a digital caliper (which must be reused in all reassessments), the patient must remain seated with feet properly supported on the floor, facing the therapist, with the head kept in a natural position , lips closed and teeth in centric occlusion without pressure. Subsequently, craniofacial points must be touched for precise location, which must be marked on the skin with a demographic pencil. Anthropometric measurements should be taken without pressing the caliper tips against the skin surface, which could alter the results. All measurements must be performed twice, in order to obtain greater reliability. The result of each measurement must be obtained by the average in millimeters of the two collections and registered according to the following table.

Anatomical structure	Procedure

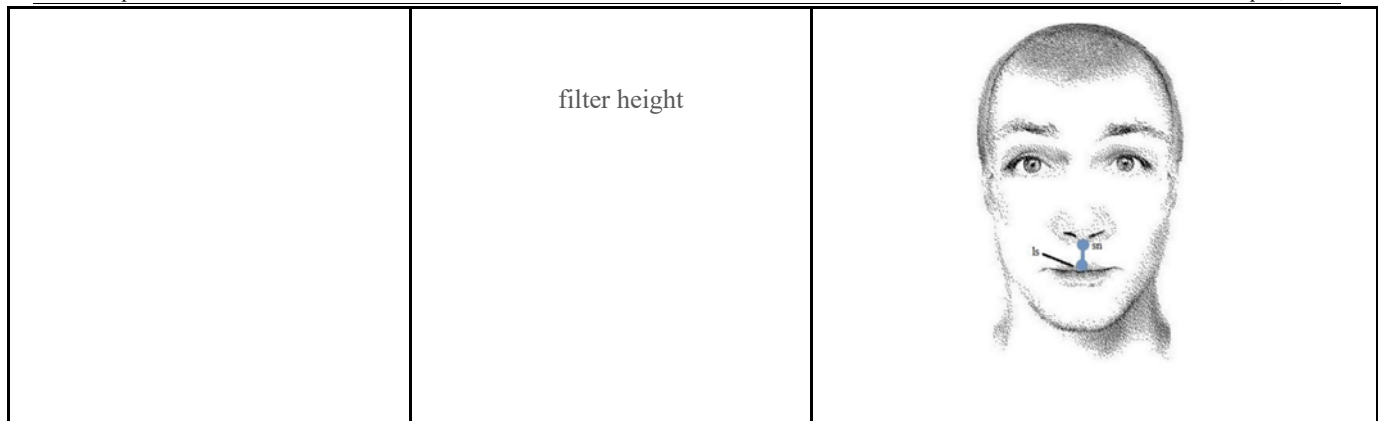|		
Face	Height of the upper third of the face	
	Height of the middle third of the face	
	Height of the lower third of the face	
	Distance between outer corner of the eye and the cheilion on the side right and left face	
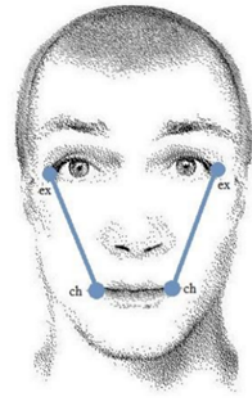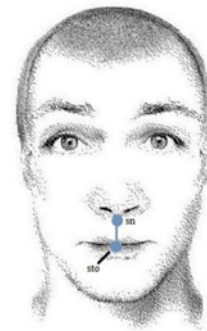
	Upper lip height	
	lower lip height	

As mentioned above, FP can trigger numerous changes in chewing ability. As it is a subjective assessment, it is important not only the informal assessment, the patient questionnaire as well as the use of image/video recording for further analysis.

Procedure for evaluating mastication function and the oral phase of deglutition

During the therapeutic assessment, the mastication function and the oral phase of deglutition must be recorded and evaluated by the speech therapist, using food with consistencies: solid, pasty and liquid. The patients must be instructed to chew normally, as they do at home. They should not be oriented nor should they receive suggestions during the assessment, thus avoiding changes in their normal behavior. The procedure must be repeated 2 times for each consistency of food. The recorded material must be evaluated, focusing on the difficulties encountered and compensatory behaviors. Questions should also be asked to the user regarding the difficulties they face in eating at home and at the time of assessment in a clinical context.

1.3 Exercise Plan

The rehabilitation program varies from subject to subject and the protocol used must contemplate the particularities of each patient.

In rehabilitation, it is necessary to check whether the exercises trigger correct responses, in order to identify as early as possible the probable innervation changes during nerve regeneration. Aiming at the total restoration of facial symmetry, Physiotherapy makes use of myofacial techniques in the affected hemiface, favoring the propagation of nervous excitation. Although there is controversy and lack of clear scientific proof of the benefit of known rehabilitation techniques, their intervention involves stratifying the degree of injury and establishing a functional prognosis, preventing complications (applying heat, ice, massage) and treating them (Machado et al., 2013). The Speech Therapist is responsible for rehabilitating oral functions such as speaking, chewing, swallowing, sucking and breathing (Romão et al, 2015).

The intervention advocates optimizing facial mimicry and chewing, swallowing, sucking, speaking, breathing and communication functions. Thus, the Physiotherapist together with Speech Therapy play a key role in guiding these patients, and their collaboration should be requested early (Mory, et al. 2013).

In the rehabilitation of facial expression, therapy with the therapists should be carried out every other day, however, it is extremely important that they continue to perform the exercises learned in the clinic in the home context, which will make their rehabilitation quicker and more effective.

The structural basis of the protocol proposed in this project is based on the use of manual manipulations in the muscles of the face, always following the direction of muscle fibers design, use of stimulation of the zones and motor points of the face, myofunctional exercises and oral and/or stomatognathic functions as facilitators of the recovery process.

1.4 Therapeutic Guidelines

FP sequelae cause important changes and difficulties in the life of those who are affected. Given the many FP causes and its functional and aesthetic impacts on the life of people with this condition, its treatment requires the work of a multidisciplinary team, which enables these patients' comprehensive care and potentializes the evolution of the cases (Dias, Silva & Barreto, 2021, pg. 2)

Facial paralysis may be accompanied by changes in salivary and tear secretions, as well as changes in facial and auditory sensitivities, so the initial guidelines of specific care in relation to the eye, feeding (functional use) and daily stimulation are fundamental to the process of rehabilitation.

One of the key aspects of treatment is the implementation of general measures aimed at preventing one of the most frequent complications – corneal ulcers. Eye lubrication with artificial tears applied every 60 minutes during the day and the use of sunglasses to protect against foreign bodies is recommended. At night, ocular occlusion with ophthalmic dressings is suggested (Machado et al., 2013).

If the patient has sequelae such as sinkinesias, contractures or muscle spasms, it is oriented to use heat on the face associated with intra and extraoral slips in the nasogenian groove, to promote muscle loosening (self-massage).

2   Features

2.1 Clinical – Therapeutic Guidelines on FaceRehab Context

2.2. Clinical – Static and Dynamic Evaluation on FaceRehab Context

Assessment	
Static	
Exercices	**Task**
Facial asymmetry	Actual projection of the patient's image
Depression of the end of the eyebrow on the paralyzed side	
Erasing the facial creases on the paralyzed side	
Deviation from the labial commissure to the contralateral side	
Cheek bag depression	
Functional Assessment of Swallowing/Chewing - oral phase	
Anthropometric orofacial measurements	
Breath Assessment	
Articulatory evaluation	
Dynamic	
Exercises	**Task**
Wink	Indicator that registers that movement is slower and incomplete on the paralyzed side.
Eyebrow	Indicator that registers more flaccidity compared to the contralateral side.
Nasolabial fold	Indicator that registers more flaccidity compared to the contralateral side.
Frown	Indicator that demonstrates the non-wrinkling of the paralyzed side or an evident asymmetry
Close the eyes	Indicator that registers the deviation of the eyeball upwards and outwards, while the eyelid does not completely cover the eye.
Look up at maximum effort	Indicator that registers the eyeball on the paralyzed side placing itself in a higher position in relation to the other side.
Show teeth and wrinkle the nose	Indicator that registers the lateral deviation of the mouth as well as the most pronounced protrusions on the contralateral side.
Opening the eyelids against patient resistance	Indicator that demonstrates a lower degree of muscle strength on the affected side.

Guidelines	
Exercice	**Task**
Self-Massage *If the patient presents sequelae such as synkinesis, contractures or muscle spasms, advise for the use of heat on the face associated with intra and extra-oral gliding maneuvers in the nasolabial fold, to promote the "release" of the muscles It should allow providing "reminder" type guidelines and triggering an avatar to exemplify the maneuver and self-massage.	Sliding the fingers on the forehead, up and down. Finger glide above the eyebrow, distal to medially. Sliding the fingers over the cheek, from the bottom to the top. Sliding of the fingers on the lips and cheek, in a horizontal direction, simulating a smile.
Eye hygiene Care of the affected eye: (a) Reinforce medical guidelines with the use of of the eye drops and the ointment. (b) Always sleep with an eye patch while being instructed to do so. it. (c) Ensure the eye is closed. (d) Drop eye drops whenever you feel the eye dry up or burn. (and use sunglasses when in the sun. (f) If necessary, use a cap. (g) No expose yourself to wind or areas with dust ./or fumes.	The patient must moisten the non-woven fabric compress sterilized with saline and then pass it on the eyelid in towards the eyelashes; Note: Change the compress before cleaning the other eye; With support: Put a few drops of serum physiologic directly in the eye and then with the tissue compress non-woven sterilized ironing Eyelid towards the eyelashes.
Nasal hygiene Promote nasal hygiene; Increase circulation blood and lymph for improve nasal aeration; Stimulate nasal breathing.	Nasal hydration and hygiene with saline - washing technique nose with adapted syringe; Digital massage (fingers) on the lateral nasal cartilage, keeping the two index fingers in the region of the nasal ala, with circular movements from top to bottom down and front to back. Inspiration followed by expiration in each nostril separately (ask the user to cover one of the nostrils).

Motor Exercise			
Exercise	**Task**	**Level**	**Duration**
Elevation of the upper eyelid.	Raise the eyebrows.	Easy Moderate Difficult	5 repetitions, 5 sec 8 repetitions, 10 sec 10 repetitions, 20 sec
Medial eyebrow traction with visualization of medial forehead wrinkles.	Frowning the eyebrows. Tip: make as many wrinkles as possible.		
Wrinkle the nose with support in the same position for 5s – simulate the "smelly" movement.	Elevation of the nose wing associated with inspiration.		
Simulate sniffing a rose,	Elevation of the nose wing		

covering one nostril at a time.	associated with sequential unilateral inspiration.		
Look at a fixed point and blink.	Orbital, eyelid and lacrimal occlusion.		
Abruptly close your eyes and then open them.	Orbital, eyelid and lacrimal occlusion.		
Push your lips together simulating a kiss.	Protrusion of the orbicularis oris.		
Push the lower and upper lip, showing the teeth.	Elevation and depression of the orbicularis without compression.		
Simulate lipstick placement.	Elevation followed by protrusion and compression of the orbicularis oris.		
Push the lips together simulating a kiss, followed by an open smile (showing teeth).	Protrusion followed by retraction of the orbicularis oris.		
Push the lips together simulating a kiss, followed by a closed smile (without showing teeth).	Protrusion of the orbicularis oris followed by retraction.		
Function Exercice			
Exercice	**Task**	**Level**	**Duration**
Say the sounds /i/-/u/, articulating with exaggeration. Protrusion and retraction of the orbicularis oris associated with the articulatory production of the sounds. It should be able to detect 5 open smile movements in the production of the phoneme /i/ followed by the Isotonic	Sound phonemes /i/-/u/ In Portuguese: /i/- high vowel, anterior or unrounded paleatal; /u/ - high vowel, posterior or veil, rounded. Very important: this exercise needs phonetic adaptation for other languages.	Easy Moderate Difficult	5 repetitions 8 repetitions 10 repetitions
Push the lips simulating a kiss and sideways them to the right side. Repeat the same movement to the left side.	Protrusion of the orbicularis oris followed by right lateralization. Protrusion of the orbicularis oris followed by left lateralization.		
Approaching and compressing the lips with force simulating a "pulled kiss".	Protrusion of the orbicularis oris followed by compression and plosion.		
Swallow liquids according to orientation:	Contraction of the orbicularis oris, enhancing the 1st active pressure point for swallowing, using sensory		

1. Put a sip of water in your mouth; 2. Close lips tightly; 3. Swallowing; Sensory adaptations to exercise: 1st room temperature water; 2nd ice water; 3rd warm water; 4th room temperature water with lemon drops; 5º room temperature water with orange drops	techniques.		
Fill your cheeks with air and blow it out completely. Attention: When filing cheeks, try to control the swallowing of saliva, trying to ensure that there is no escape.	Inflate the cheeks and produce a continuous expiratory breath, no previous saliva escape.		
Fill only the right cheek with air and blow it all the way out.	Inflate the cheeks unilaterally.		
Puff your cheeks and then blow with: 1st language of mother-in-law; 2nd straw; 3rd balloon. (Increasing degree of complexity).	Inflate the cheeks bilaterally associated with the lip protrusion, producing a continuous and strong expiratory murmur to expand the object (mother-in-law-tongue or balloon).		
Fill the cheek on the right side and hold for 10s before blowing. Puff left cheek and hold for 10 sec before blowing.	Inflate the cheeks unilaterally, holding the air for 10s and producing a continuous expiratory murmur.		
Bilaterally fill the cheeks as much as possible and hold in this position for 10sec.	Inflate the cheeks bilaterally, approach and bilaterally protrude the orbicularis oris, sustaining the air for 10s.		
Inflate the cheeks unilaterally, keeping the lips closed and applying opposing hand force (try to deflate the cheek).	Inflate the cheeks bilaterally, with uniform and bilateral approximation and protrusion of the orbicularis oris of the mouth, while applying a continuous and opposing force to the		

	movement.		
Put water in the mouth without swallowing and without letting it escape or swallow it for 10s.	Protrude the cheeks with water, not swallowing and applying continuous compression on the orbicularis oris for 10 sec.		
With water in the mouth, inflate the cheeks and then pass the water from one cheek to the other without letting the waterfall, for 10sec.	Protrusion and lateralization of the water inside the cheeks, applying continuous and uniform compression to the orbicularis oris without any previous leakage of fluid.		
Suck water through a straw; 1st - Start with straws of larger diameter and gradually decrease (increasing degree of complexity); 2º - Suck nectar through a straw (start with liquid consistency and then add thickness to peach nectar).	It should be able to detect the movements of the cheeks and lips during the exercise, as well as recognize the type of object used (straw and its size).		
Copy the various facial expressions displayed on the screen	Mimic therapy		
Naming and repeating words	Articulation production considering the position and movement of the articulators: - Appointment; - Use of the plosive sounds technique: - Articulation of plosive sounds associated with vowels; - Monosyllabic, disyllabic and trisyllabic production of plosive sounds associated with vowels; - Use of the over-articulation technique.		
Simulate the chewing movement; - Simulate the chewing movement producing the phoneme /m/ continuously.	- Simulation of bilateral cyclic chewing movement, with minimal approximation and compression of the orbicularis oris; - Simulation of bilateral cyclic chewing movement, with minimal approximation and compression of the orbicularis oris while producing the phoneme /m/. Very important: this exercise needs phonetic adaptation for other		

	languages		
- Using solid food, chew bilaterally, 2x on the healthy side and 2x on the affected side; 3x healthy and 3x affected side; 4x healthy and 4x affected side. - Each time you pass the food	- Bilateral functional cyclic chewing using solid foods and tongue support for lateralization. - Cleaning the oral vestibules with tongue support. It must be able to detect the chewing movement (Action of the cheeks and lips) and give guidance to lateralize the food. If it is necessary to use the external hand support, the application must recognize it. Isotonic Isometric from one side to the other, use your tongue to sweep the vestibule and lateralize the food. Note: If necessary, use the external hand support to remove the accumulation of food, but then remove. Complexification: 1. Use typical bread; 2. Use loaf bread or biscuits (+ soft but sticks more).		

FaceRehab Domain	Exercise	Task	Level	Duration
Assessment				
Static	Facial asymmetry	Actual projection of the patient's image		
	Depression of the end of the eyebrow on the paralyzed side			
	Erasing the facial creases on the paralyzed side			
	Deviation from the labial commissure to the contralateral side			
	Cheek bag depression			
	Functional Assessment of Swallowing/Chewing - oral phase			
	Anthropometric orofacial measurements			
	Breath Assessment			
	Articulatory evaluation			
Dynamic				

	Wink	Indicator that registers that movement is slower and incomplete on the paralyzed side;		
	Eyebrow	Indicator that registers more flaccidity compared to the contralateral side;		
	Nasolabial fold	Indicator that registers more flaccidity compared to the contralateral side;		
	Frown	Indicator that demonstrates the non-wrinkling of the paralyzed side or an evident asymmetry		
	Close the eyes	Indicator that registers the deviation of the eyeball upwards and outwards, while the eyelid does not completely cover the eye;		
	Look up at maximum effort	Indicator that registers the eyeball on the paralyzed side placing itself in a higher position in relation to the other side;		
	Show teeth and wrinkle the nose	Indicator that registers the lateral deviation of the mouth as well as the most pronounced protrusions on the contralateral side;		
	Opening the eyelids against patient resistance	Indicator that demonstrates a lower degree of muscle strength on the affected side.		
Guidelines	Self-Massage *If the patient presents sequelae such as synkinesis, contractures or muscle spasms, advise for the use of heat on the face associated with intra and extra-oral gliding maneuvers in the nasolabial fold,	Sliding the fingers on the forehead, up and down. Finger glide above the eyebrow, distal to medially. Sliding the fingers over the cheek, from the bottom to		8 m

	to promote the "release" of the muscles It should allow providing "reminder" type guidelines and triggering an avatar to exemplify the maneuver and self-massage;	the top. Sliding of the fingers on the lips and cheek, in a horizontal direction, simulating a smile.		
	Nasal and eye hygiene			
Motor Exercise	Elevation of the upper eyelid.	Raise the Eyebrows.	Easy Modera te Difficu lt	5 5 repetitions, 5 seg 8 repetitions, 10 seg 10 repetitions, 20 seg
	Medial eyebrow traction with visualization of medial forehead wrinkles.	Frowning the Eyebrows; Tip: make as many wrinkles as possible.		
	Wrinkle the nose with support in the same position for 5s – simulate the "smelly" movement.	Elevation of the nose wing associated with inspiration		
	Simulate sniffing a rose, covering one nostril at a time.	Elevation of the nose wing associated with sequential unilateral inspiration.		
	Look at a fixed point and blink	Orbital, eyelid and lacrimal occlusion.		
	Abruptly close your eyes and then open them.	Orbital, eyelid and lacrimal occlusion.		
	Push your lips together simulating a kiss.	Protrusion of the orbicularis oris.		
	Push the lower and upper lip, showing the teeth.	Elevation and depression of the orbicularis without compression		
	Simulate lipstick placement.	Elevation followed by protrusion and compression of the orbicularis oris.		
	Push the lips together simulating a kiss, followed by an open smile (showing teeth)	Protrusion followed by retraction of the orbicularis oris.		

	Push the lips together simulating a kiss, followed by a closed smile (without showing teeth).	Protrusion of the orbicularis oculi followed by retraction.		
Function Exercise	Say the sounds /i/-/u/, articulating with exaggeration. Protrusion and retraction of the orbicularis oculi associated with the articulatory production of It should be able to detect 5 open smile movements in the production of the phoneme /i/ followed by the Isotonic	sound phonemes /i/-/u/ In Portuguese: /i/- high vowel, anterior or unrounded paleatal; /u/ - high vowel, posterior or veil, rounded. Very important: this exercise needs phonetic adaptation for other languages.	Easy Modera te Difficu lt	5 repetitions, 8 repetitions, 10 repetitions,
	Push the lips simulating a kiss and sideways them to the right side; Repeat the same movement to the left side.	Protrusion of the orbicularis oculi followed by right lateralization; Protrusion of the orbicularis oculi followed by left lateralization.		
	Approaching and Compressing the Lips with force simulating a "pulled kiss".	Protrusion of the orbicularis oris followed by compression and plosion.		
	Swallow liquids according to orientation: 1. Put a sip of water in your mouth; 2. Close lips tightly; 3. Swallowing; Sensory adaptations to exercise: 1st room temperature water; 2nd ice water; 3rd warm water; 4th room temperature water with lemon drops; 5º room temperature water with orange drops	Contraction of the orbicularis oris, enhancing the 1st active pressure point for swallowing, using sensory techniques.		
	Fill your cheeks with air and blow it out completely; Attention: When filing cheeks, try to control the swallowing of saliva, trying to ensure that there is no escape.	Inflate the cheeks and produce a continuous expiratory breath, no previous saliva escape.		
	Fill only the right cheek with air and blow it all the way out;	Inflate the cheeks unilaterally		
	Puff your cheeks and then blow with: 1st language of mother-in-	Inflate the cheeks bilaterally associated with the		

	law; 2nd straw; 3rd balloon. (Increasing degree of complexity).	lip protrusion, producing a continuous and strong expiratory murmur to expand the object (mother-in-law's tongue or balloon).		
	Fill the cheek on the right side and hold for 10s before blowing; Puff left cheek and hold for 10 s before blowing.	Inflate the cheeks unilaterally, holding the air for 10s and producing a continuous expiratory murmur.		
	Bilaterally fill the cheeks as much as possible and hold in this position for 10s.	Inflate the cheeks bilaterally, approach and bilaterally protrude the orbicularis oculi, sustaining the air for 10s.		
	Inflate the cheeks unilaterally, keeping the lips closed and applying opposing hand force (try to deflate the cheek);	Inflate the cheeks bilaterally, with uniform and bilateral approximation and protrusion of the orbicularis oris of the mouth, while applying a continuous and opposing force to the movement.		
	Put water in the mouth without swallowing and without letting it escape or swallow it for 10s.	Protrude the cheeks with water, not swallowing and applying continuous compression on the orbicularis oculi for 10 seg		
	With water in the mouth, inflate the cheeks and then pass the water from one cheek to the other without letting the water fall, for 10s.	Protrusion and lateralization of the water inside the cheeks, applying continuous and uniform compression to the orbicularis oculi without any previous leakage of fluid.		
	Suck water through a straw;	It should be able to		

	1st - Start with straws of larger diameter and gradually decrease (increasing degree of complexity); 2º - Suck nectar through a straw (start with liquid consistency and then add thickness to peach nectar).	detect the movements of the cheeks and lips during the exercise, as well as recognize the type of object used (straw and its size).		
	Copy the various facial expressions displayed on the screen	Mimic therapy		
	Naming and repeating words	Articulation production taking into account the position and movement of the articulators: - Appointment; - Use of the plosive sounds technique: - Articulation of plosive sounds associated with vowels; - Monosyllabic, disyllabic and trisyllabic production of plosive sounds associated with vowels; - Use of the over-articulation technique.		
	Simulate the chewing movement; - Simulate the chewing movement producing the phoneme /m/ continuously; - Using solid food, chew bilaterally, 2x on the healthy side and 2x on the affected side; 3x healthy and 3x affected side; 4x healthy and 4x affected side. - Each time you pass the food	- Simulation of bilateral cyclic chewing movement, with minimal approximation and compression of the orbicularis oris; - Simulation of bilateral cyclic chewing movement, with minimal approximation and compression of the orbicularis oculi while producing the phoneme /m/; Very important: this exercise needs phonetic adaptation for other languages		

		- Bilateral functional cyclic chewing using solid foods and tongue support for lateralization; - Cleaning the oral vestibules with tongue support. It must be able to detect the chewing movement (Action of the cheeks and lips) and give guidance to lateralize the food; If it is necessary to use the external hand support, the application must recognize it; Isotonic Isometric from one side to the other, use your tongue to sweep the vestibule and lateralize the food. note: If necessary, use the external hand support to remove the accumulation of food, but then remove. Complexification: 1. Use typical bread; 2. Use loaf bread or biscuits (+ soft but sticks more).		

3   Use Cases

Package in package 'Engineering View'

3.1   Use Cases x Requirement Traceability diagram

Use Case diagram in package 'Use Cases'

Figure 1: Use Cases x Requirement Traceability

3.2   Actors

Package in package 'Use Cases'

3.3   Use Cases

Package in package 'Use Cases'

<div align="right">

Use Cases
Version 1.0 Phase 1.0 Proposed
mmestre created on 11/29/2021. Last modified 1/5/2022

</div>

3.3.1 Authentication

UseCase in package 'Use Cases'

<div align="right">

Authentication
Version 1.0 Phase 1.0 Proposed
mmestre created on 12/17/2021. Last modified 1/26/2022

</div>

EXTERNAL REQUIREMENTS

Requirement. US_001 - Authentication

As a: User
I want to be able to: Access to FaceRehab System
So that: I can complement the rehabilitation carried out in a clinical context.

[Stereotype is «user story».]

CONNECTORS

Satisfy «satisfy»   Source -> Destination
From: Authentication : UseCase, Public
To: US_001 - Authentication : User Story, Public

Association   Unspecified
From: Informal Caregiver : Actor, Public
To: Authentication : UseCase, Public

Association   Unspecified
From: Patient : Actor, Public
To: Authentication : UseCase, Public

Association   Unspecified
From: Therapist : Actor, Public
To: Authentication : UseCase, Public

3.3.1.1   Authentication diagram

Use Case diagram in package 'Use Cases'

<div align="right">

Authentication
Version 1.0
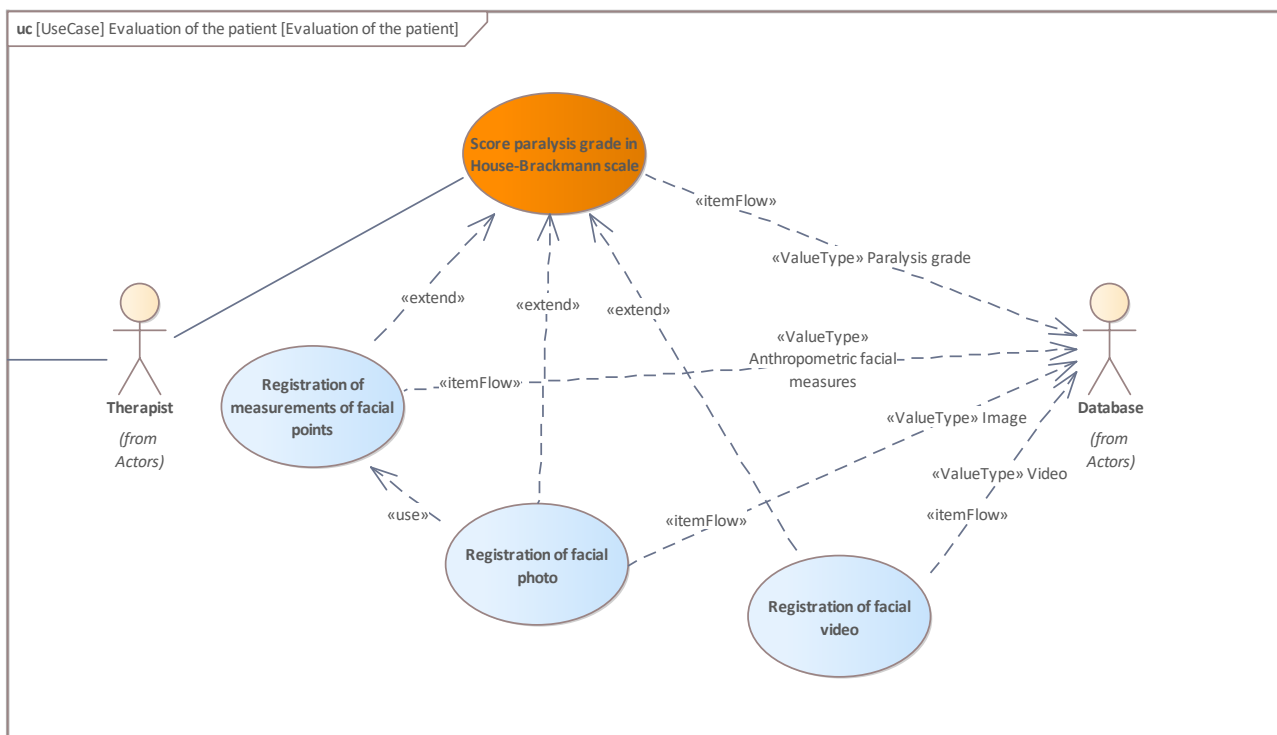João Quintas created on 1/10/2022. Last modified 4/11/2022

</div>
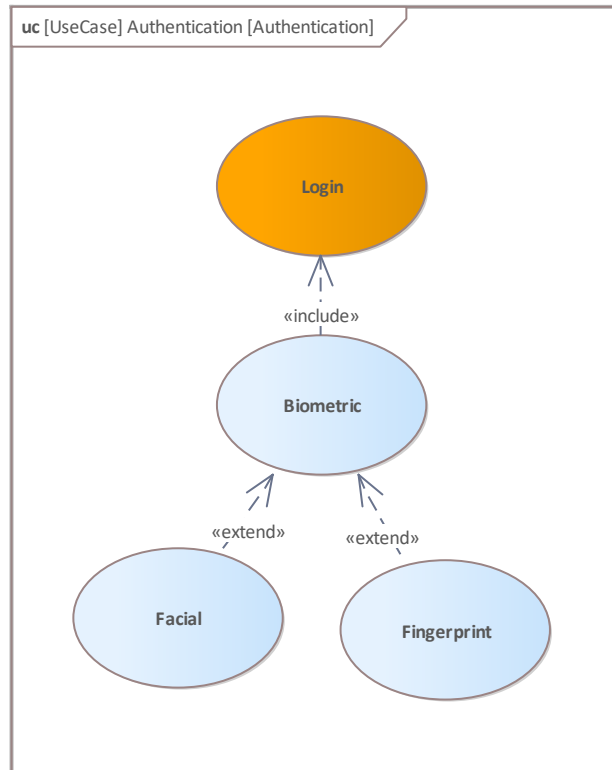
Figure 2: Authentication

3.3.1.2   Biometric

UseCase owned by 'Authentication', in package 'Use Cases'

<div align="right">

Biometric
Version 1.0 Phase 1.0 Proposed
João Quintas created on 1/10/2022. Last modified 1/10/2022

</div>

CONNECTORS
↗ **Include** «include»   Source -> Destination From: Biometric : UseCase, Public To: Login : UseCase, Public
↗ **Extend** «extend»   Source -> Destination From: Facial : UseCase, Public To: Biometric : UseCase, Public
↗ **Extend** «extend»   Source -> Destination From: Fingerprint : UseCase, Public To: Biometric : UseCase, Public

3.3.1.3   Facial

UseCase owned by 'Authentication', in package 'Use Cases'

<div align="right">

Facial
Version 1.0 Phase 1.0 Proposed
João Quintas created on 1/10/2022. Last modified 1/10/2022

</div>

CONNECTORS

CONNECTORS
↗ **Extend** «extend»   Source -> Destination From: Facial : UseCase, Public To: Biometric : UseCase, Public

3.3.1.4   Fingerprint

UseCase owned by 'Authentication', in package 'Use Cases'

<div align="right">

Fingerprint
Version 1.0 Phase 1.0 Proposed
João Quintas created on 1/10/2022. Last modified 1/10/2022
</div>

CONNECTORS
↗ **Extend** «extend»   Source -> Destination From: Fingerprint : UseCase, Public To: Biometric : UseCase, Public

3.3.1.5   Login

UseCase owned by 'Authentication', in package 'Use Cases'

<div align="right">

Login
Version 1.0 Phase 1.0 Implemented
João Quintas created on 1/10/2022. Last modified 4/13/2022
</div>

EXTERNAL REQUIREMENTS
☑ Requirement. Login window The authentication window must show two input field, one for username and other for password and a button to submit the provided information [Stereotype is «Functional».]
☑ Requirement. Password field The login window must include an input text field for the user to insert his/her password using alphanumeric characters up to 20 chars. [Stereotype is «Functional».]
☑ Requirement. Submit button The login window must include a submit button for the user to confirm the login action with no less than 100px wide and 50px height, in color grey. [Stereotype is «Functional».]
☑ Requirement. Username field The login window must include an input text field for the user to insert his/her username using alphanumeric characters up to 20 chars. [Stereotype is «Functional».]

CONNECTORS

CONNECTORS

↗ **Realization**   Source -> Destination
   From: Login : UseCase, Public
   To: Login window : Requirement, Public

↗ **Realization**   Source -> Destination
   From: Login : UseCase, Public
   To: Submit button : Requirement, Public

↗ **Realization**   Source -> Destination
   From: Login : UseCase, Public
   To: Username field : Requirement, Public

↗ **Realization**   Source -> Destination
   From: Login : UseCase, Public
   To: Password field : Requirement, Public

↗ **Include** «include»   Source -> Destination
   From: Biometric : UseCase, Public
   To: Login : UseCase, Public

SCENARIOS

▦ Basic Path. Basic Path

1. The user accesses the main screen of Facerehab
2. Introduce a username
3. Introduce a password
4. Click the login button

CONSTRAINTS

▦ Invariant. FaceRehab connected to local area network and with internet connection

FaceRehab connected to local area network and with internet connection

                                                [Approved, weight is 0.]

3.3.2 Caregiver Guidance

UseCase in package 'Use Cases'

                                                  Caregiver Guidance
                     Version 1.0 Phase 1.0 Proposed
      Miguel Mestre created on 1/12/2022. Last modified 1/26/2022

EXTERNAL REQUIREMENTS

☑ Requirement. US_004 - Caregiver Guidance

As a: Caregiver
I want to be able to: Have access to detailed information and dedicated guidelines
So that: I can help the patient in the rehabilitation carried out at home

                                          [Stereotype is «user story».]

CONNECTORS

➚ **Association**   Unspecified
   From: Caregiver Guidance : UseCase, Public
   To: Informal Caregiver : Actor, Public

➚ **Satisfy** «satisfy»   Source -> Destination
   From: Caregiver Guidance : UseCase, Public
   To: US_004 - Caregiver Guidance : User Story, Public

3.3.3 Evaluation of the patient

UseCase in package 'Use Cases'

Measure patient level of facial paralysis

Evaluation of the patient
Version 1.0 Phase 1.0 Proposed
mmestre created on 12/16/2021. Last modified 1/26/2022

EXTERNAL REQUIREMENTS

☑ Requirement. US_002 - Therapeutic Evaluation

As a: Therapist
I want to be able to: get a facial analysis
So that: I can perform a static and dynamic evaluation to the patient in the first use, revaluation and final evaluation.

[Stereotype is «user story».]

CONNECTORS

➚ **Dependency**   Source -> Destination
   From: Evaluation of the patient : UseCase, Public
   To: Rehabilitation Program : UseCase, Public

➚ **Association**   Unspecified
   From: Evaluation of the patient : UseCase, Public
   To: Patient : Actor, Public

➚ **Satisfy** «satisfy»   Source -> Destination
   From: Evaluation of the patient : UseCase, Public
   To: US_002 - Therapeutic Evaluation : User Story, Public

➚ **Association**   Unspecified
   From: Therapist : Actor, Public
   To: Evaluation of the patient : UseCase, Public

➚ **Realization**   Source -> Destination
   From: Therapist Side Patient Profile View : Webpage, Public
   To: Evaluation of the patient : UseCase, Public

PRE-CONDITION CONSTRAINT

⚙ User must be authenticated

[Approved, weight is 0]

SCENARIOS

⊞ Basic Path. Basic Path

1.   Therapist selects assessment option in graphical user interface
2.   Therapist score the patient's grade according the House-Brackmann scale
3.   Therapist performs anthropometric measurements of the face (i.e. measuring key point of the face using a caliper tool) and register measurements in patient's profile
4.   Therapist takes photo for the static evaluation of the patient's face and adds it to patient's profile
5.   Therapist record a video for the dynamic evaluation of the patient's face and adds it to patient's profile
6.   Validate information inserted in patient's profile by clicking button to save data
7.   Register saved information in database for patient's profile

POST CONDITION CONSTRAINT

⚙ Patient assessment graded in House-Brackman Scale

[Approved, weight is 1]

3.3.3.1   Evaluation of the patient diagram

Use Case diagram in package 'Use Cases'

Evaluation of the patient
Version 1.0
João Quintas created on 1/17/2022. Last modified 3/21/2022

Figure 3: Evaluation of the patient

3.3.3.2   Registration of facial photo

UseCase owned by 'Evaluation of the patient', in package 'Use Cases'

Registration of facial photo
Version 1.0 Phase 1.0 Proposed
João Quintas created on 1/17/2022. Last modified 3/14/2022

EXTERNAL REQUIREMENTS

☑ Requirement. Take Photo button

Button to take the photo (present in the interface of the interactive device) during the Therapy Assessment.
View button size should be no less than 100px wide and 50px height, in color grey.

[Stereotype is «Functional».]

☑ Requirement. View Photo button

Button to view the photo taken during the Therapy Assessment.
View button size should be no less than 100px wide and 50px height, in color grey.

[Stereotype is «Functional».]

CONNECTORS

↗ **Extend** «extend»   Source -> Destination
   From: Registration of facial photo : UseCase, Public
   To: Score paralysis grade in House-Brackmann scale : UseCase, Public

↗ **Usage**   Source -> Destination
   From: Registration of facial photo : UseCase, Public
   To: Registration of measurements of facial points : UseCase, Public

↗ **Realization**   Source -> Destination
   From: Registration of facial photo : UseCase, Public
   To: Take Photo button : Requirement, Public

↗ **Realization**   Source -> Destination
   From: Registration of facial photo : UseCase, Public
   To: View Photo button : Requirement, Public

↗ **ItemFlow** «itemFlow»   Source -> Destination
   From: Registration of facial photo : UseCase, Public
   To: Database : Actor, Public

3.3.3.3   Registration of facial video

UseCase owned by 'Evaluation of the patient', in package 'Use Cases'

Registration of facial video
Version 1.0 Phase 1.0 Approved
João Quintas created on 1/18/2022. Last modified 3/14/2022

EXTERNAL REQUIREMENTS

EXTERNAL REQUIREMENTS

☑ Requirement. Record Video button

Button to record a video (present in the interface of the interactive device) during the Therapy Assessment.
View button size should be no less than 100px wide and 50px height, in color grey.

[Stereotype is «Functional».]

☑ Requirement. View Video button

Button to view the video recorded during the Therapy Assessment.
View button size should be no less than 100px wide and 50px height, in color grey.

[Stereotype is «Functional».]

CONNECTORS

↗ **Realization**   Source -> Destination
From: Registration of facial video : UseCase, Public
To: View Video button : Requirement, Public

↗ **Extend** «extend»   Source -> Destination
From: Registration of facial video : UseCase, Public
To: Score paralysis grade in House-Brackmann scale : UseCase, Public

↗ **ItemFlow** «itemFlow»   Source -> Destination
From: Registration of facial video : UseCase, Public
To: Database : Actor, Public

↗ **Realization**   Source -> Destination
From: Registration of facial video : UseCase, Public
To: Record Video button : Requirement, Public

3.3.3.4   Registration of measurements of facial points

UseCase owned by 'Evaluation of the patient', in package 'Use Cases'

Registration of measurements of facial points
Version 1.0 Phase 1.0 Proposed
João Quintas created on 1/17/2022. Last modified 3/17/2022

EXTERNAL REQUIREMENTS

☑ Requirement. Adjustable landmarks

Show landmarks superimposed with photo. Functionality of point and click the landmark of interest, drag and drop for new desired position.

[Stereotype is «Functional».]

☑ Requirement. Date form field

Form field to insert the Date of the Therapeutic Assessment

[Stereotype is «Functional».]

EXTERNAL REQUIREMENTS

☑ Requirement. Edit button

Button to edit information collected during the therapeutic assessment.
Save button size should be no less than 100px wide and 50px height, in color grey.

[Stereotype is «Functional».]

☑ Requirement. Fill form fields for each antropometric measurement

Show registered measurements in mm for each facial Anatomical Structure

[Stereotype is «Functional».]

☑ Requirement. Save button

Button to save information collected during the therapeutic assessment.
Save button size should be no less than 100px wide and 50px height, in color grey.

[Stereotype is «Functional».]

☑ Requirement. Validate button

Validate the antropometric measurements that appear in forms.
Validate button size should be no less than 100px wide and 50px height, in color grey.

[Stereotype is «Functional».]

CONNECTORS

↗ **Realization**   Source -> Destination
   From: Registration of measurements of facial points : UseCase, Public
   To: Edit button : Requirement, Public

↗ **Realization**   Source -> Destination
   From: Registration of measurements of facial points : UseCase, Public
   To: Validate button : Requirement, Public

↗ **Extend** «extend»   Source -> Destination
   From: Registration of measurements of facial points : UseCase, Public
   To: Score paralysis grade in House-Brackmann scale : UseCase, Public

↗ **ItemFlow** «itemFlow»   Source -> Destination
   From: Registration of measurements of facial points : UseCase, Public
   To: Database : Actor, Public

↗ **Realization**   Source -> Destination
   From: Registration of measurements of facial points : UseCase, Public
   To: Date form field : Requirement, Public

↗ **Realization**   Source -> Destination
   From: Registration of measurements of facial points : UseCase, Public
   To: Save button : Requirement, Public

↗ **Realization**   Source -> Destination
   From: Registration of measurements of facial points : UseCase, Public
   To: Adjustable landmarks : Requirement, Public

CONNECTORS

↗ **Realization**   Source -> Destination
From: Registration of measurements of facial points : UseCase, Public
To: Fill form fields for each antropometric measurement : Requirement, Public

↗ **Usage**   Source -> Destination
From: Registration of facial photo : UseCase, Public
To: Registration of measurements of facial points : UseCase, Public

SCENARIOS

⊞ Basic Path. Basic Path - Manual registration

1. Fill the form with metrics
2. Click save

⊞ Alternate. Automatic registration from photo

1. Take photo
2. Calculate measurements with FaceMotrics
3. Validate values that appear in form
4. Click Save

⊞ Alternate. Automatic registration with visual manual adjustment

1. Take photo
2. Show landmarks superimposed with photo
3. Therapist point and click the landmark of interest
4. Drag and drop for new correct position
5. Calculate measurements with FaceMotrics
6. Validate values that appear in form
7. Click Save

CONSTRAINTS

⊞ Invariant. Units

The result of each measurement must be obtained in millimeters.

[Approved, weight is 0.]

⊞ Invariant. Facial posture at rest

The Patient need to be seated with feet properly supported on the floor, with the head kept in a natural position, lips closed and teeth in centric occlusion without pressure.

[Approved, weight is 0.]

3.3.3.5   Score paralysis grade in House-Brackmann scale

UseCase owned by 'Evaluation of the patient', in package 'Use Cases'

Score paralysis grade in House-Brackmann scale
Version 1.0 Phase 1.0 Mandatory
João Quintas created on 1/17/2022. Last modified 3/21/2022

EXTERNAL REQUIREMENTS

☑ Requirement. Current Evaluation Score Output

Form, for exatmple a text field, to show the patient current evaluation score in House Brackmann Scale

[Stereotype is «Functional».]

☑ Requirement. Fill form field to select the grade in House-Brackmann scale

Drop-down option with the different grades/scores in the scale to select one

[Stereotype is «Functional».]

CONNECTORS

↗ **Realization**   Source -> Destination
   From: Score paralysis grade in House-Brackmann scale : UseCase, Public
   To: Fill form field to select the grade in House-Brackmann scale : Requirement, Public

---

↗ **ItemFlow** «itemFlow»   Source -> Destination
   From: Score paralysis grade in House-Brackmann scale : UseCase, Public
   To: Database : Actor, Public

↗ **Realization**   Source -> Destination
   From: Score paralysis grade in House-Brackmann scale : UseCase, Public
   To: Current Evaluation Score Output : Requirement, Public

↗ **Extend** «extend»   Source -> Destination
   From: Registration of facial photo : UseCase, Public
   To: Score paralysis grade in House-Brackmann scale : UseCase, Public

---

↗ **Extend** «extend»   Source -> Destination
   From: Registration of facial video : UseCase, Public
   To: Score paralysis grade in House-Brackmann scale : UseCase, Public

---

↗ **Extend** «extend»   Source -> Destination
   From: Registration of measurements of facial points : UseCase, Public
   To: Score paralysis grade in House-Brackmann scale : UseCase, Public

---

↗ **Association**   Unspecified
   From: Therapist : Actor, Public
   To: Score paralysis grade in House-Brackmann scale : UseCase, Public

---

SCENARIOS

⊞ Basic Path. Basic Path

1. Therapist selects the Evaluation screen/ option
2. A form with the parameters of the House-Brackmann scale is displayed
3. Therapist inserts the measurement in the corresponding field
4. Saves the form

3.3.4 Guidelines

UseCase in package 'Use Cases'

Guidelines for patient, therapist and caregiver

Guidelines
Version 1.0 Phase 1.0 Proposed
mmestre created on 12/16/2021. Last modified 1/26/2022

EXTERNAL REQUIREMENTS

☑ Requirement. US_003 - Therapeutic Guidelines

As a: Patient
I want to be able to: Have access to FaceRehab guidelines
So that: I can learn how to properly execute the various recommended exercises and have access to specific care tips and recommendations related to my clinical situation

[Stereotype is «user story».]

☑ Requirement. US_004 - Caregiver Guidance

As a: Caregiver
I want to be able to: Have access to detailed information and dedicated guidelines
So that: I can help the patient in the rehabilitation carried out at home

[Stereotype is «user story».]

☑ Requirement. US_009 - Professional Guidelines

As a: Therapist
I want to be able to: Have access to FP rehabilitation newest best practices and guidelines
So that: I can stay updated with state of the art clinical practice and prescribe better treatment

[Stereotype is «user story».]

CONNECTORS

↗ **Satisfy** «satisfy»   Source -> Destination
From: Guidelines : UseCase, Public
To: US_004 - Caregiver Guidance : User Story, Public

↗ **Association**   Unspecified
From: Guidelines : UseCase, Public
To: Informal Caregiver : Actor, Public

↗ **Satisfy** «satisfy»   Source -> Destination
From: Guidelines : UseCase, Public
To: US_003 - Therapeutic Guidelines : User Story, Public

↗ **Satisfy** «satisfy»   Source -> Destination
From: Guidelines : UseCase, Public
To: US_009 - Professional Guidelines : User Story, Public

↗ **Association**   Unspecified
From: Patient : Actor, Public
To: Guidelines : UseCase, Public

↗ **Association**   Unspecified
From: Therapist : Actor, Public
To: Guidelines : UseCase, Public

3.3.4.1   Guidelines diagram

Use Case diagram in package 'Use Cases'

<div align="right">

Guidelines
Version 1.0
João Quintas created on 1/18/2022. Last modified 2/3/2022

</div>
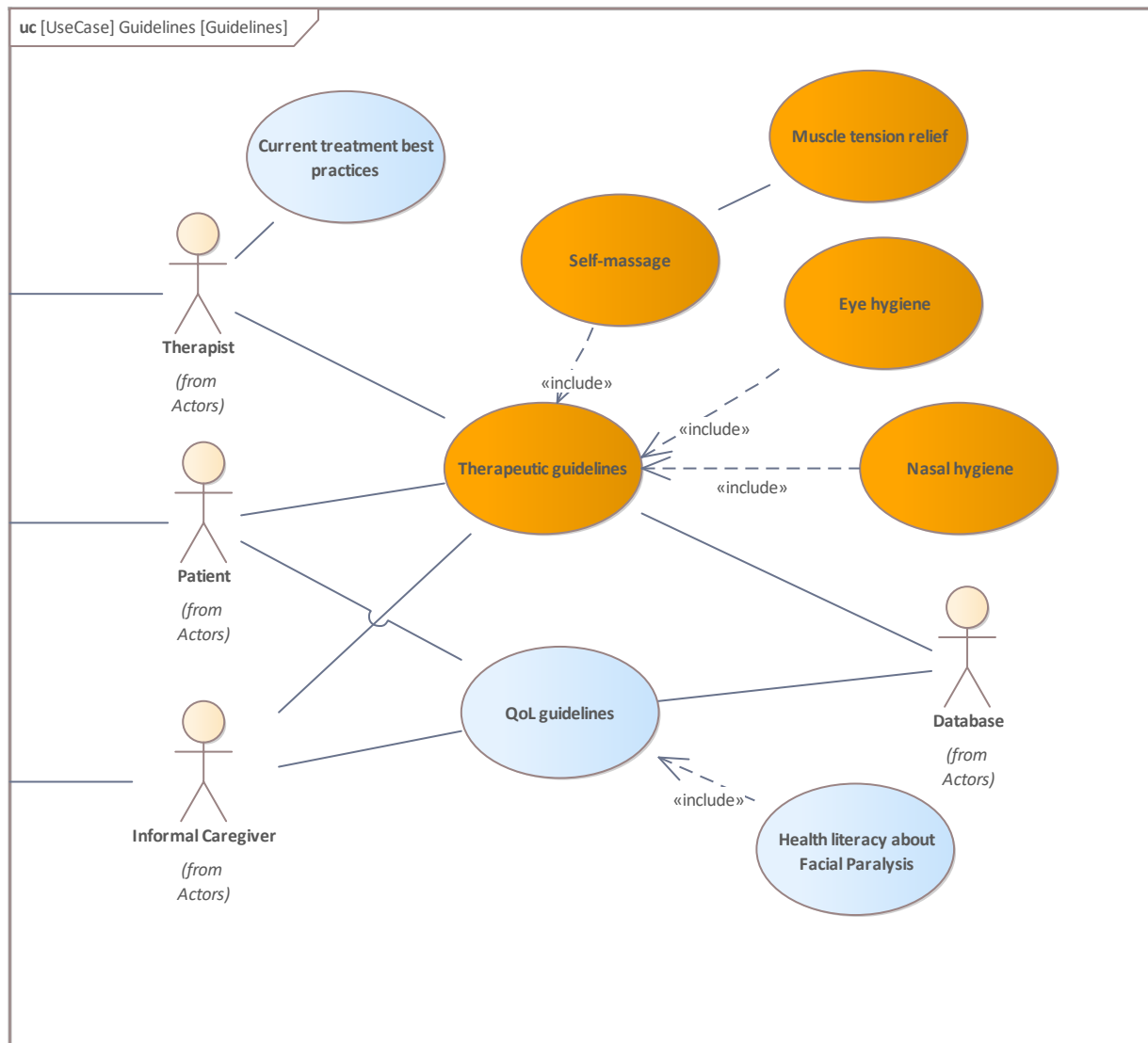
Figure 4: Guidelines

3.3.4.2   Current treatment best practices

UseCase owned by 'Guidelines', in package 'Use Cases'

Accessing to articles and scientific and technical best practices

<div align="right">

Current treatment best practices
Version 1.0 Phase 1.0 Proposed
Miguel Mestre created on 1/25/2022. Last modified 2/1/2022

</div>

CONNECTORS
↗ **Association**   Unspecified From: Therapist : Actor, Public To: Current treatment best practices : UseCase, Public

3.3.4.3   Eye hygiene

UseCase owned by 'Guidelines', in package 'Use Cases'

Care of the affected eye:
(a) Reinforce medical guidelines with the use of of the eye drops and the ointment;
(b) Always sleep with an eye patch while being instructed to do so. it.;
(c) Ensure the eye is closed;
(d) Drop eye drops whenever you feel the eye dry up or burn. (and use sunglasses when in the sun;
(f) If necessary, use a cap;
(g) No expose yourself to wind or areas with dust/or fumes.

The patient must moisten the non-woven fabric compress sterilized with saline and then pass it on the eyelid in towards the eyelashes;
Note: Change the compress before cleaning the other eye;
With support: Put a few drops of serum physiologic directly in the eye and then with the tissue compress non-woven sterilized ironing Eyelid towards the eyelashes.

<div align="right">

Eye hygiene
Version 1.0 Phase 1.0 Proposed
Miguel Mestre created on 1/25/2022. Last modified 1/26/2022

</div>

CONNECTORS
Include «include»   Source -> Destination From: Eye hygiene : UseCase, Public To: Therapeutic guidelines : UseCase, Public

3.3.4.4   Health literacy about Facial Paralysis

UseCase owned by 'Guidelines', in package 'Use Cases'

<div align="right">

Health literacy about Facial Paralysis
Version 1.0 Phase 1.0 Proposed
João Quintas created on 1/18/2022. Last modified 1/18/2022

</div>

CONNECTORS
Include «include»   Source -> Destination From: Health literacy about Facial Paralysis : UseCase, Public To: QoL guidelines : UseCase, Public

3.3.4.5   Muscle tension relief

UseCase owned by 'Guidelines', in package 'Use Cases'

If the patient presents sequelae such as synkinesis, contractures or muscle spasms, advise for the use of heat on the face associated with intra and extra-oral gliding maneuvers in the nasolabial fold, to promote the "release" of the muscles

<div align="right">

Muscle tension relief
Version 1.0 Phase 1.0 Proposed
Miguel Mestre created on 1/25/2022. Last modified 1/25/2022

</div>

CONNECTORS

CONNECTORS

↗ **Association**   Unspecified
    From: Muscle tension relief : UseCase, Public
    To: Self-massage : UseCase, Public

3.3.4.6   Nasal hygiene

UseCase owned by 'Guidelines', in package 'Use Cases'

Promote nasal hygiene; Increase circulation blood and lymph for improve nasal aeration; Stimulate nasal breathing.

Nasal hydration and hygiene with saline - washing technique nose with adapted syringe; Digital massage (fingers) on the lateral nasal cartilage, keeping the two index fingers in the region of the nasal ala, with circular movements from top to bottom down and front to back. Inspiration followed by expiration in each nostril separately (ask the user to cover one of the nostrils).

<div align="right">

Nasal hygiene

Version 1.0 Phase 1.0 Proposed

Miguel Mestre created on 1/25/2022. Last modified 1/25/2022

</div>

CONNECTORS

↗ **Include** «include»   Source -> Destination
    From: Nasal hygiene : UseCase, Public
    To: Therapeutic guidelines : UseCase, Public

3.3.4.7   QoL guidelines

UseCase owned by 'Guidelines', in package 'Use Cases'

<div align="right">

QoL guidelines

Version 1.0 Phase 1.0 Proposed

João Quintas created on 1/18/2022. Last modified 1/18/2022

</div>

CONNECTORS

↗ **Association**   Unspecified
    From: QoL guidelines : UseCase, Public
    To: Database : Actor, Public

↗ **Association**   Unspecified
    From: Patient : Actor, Public
    To: QoL guidelines : UseCase, Public

↗ **Include** «include»   Source -> Destination
    From: Health literacy about Facial Paralysis : UseCase, Public
    To: QoL guidelines : UseCase, Public

↗ **Association**   Unspecified
    From: Informal Caregiver : Actor, Public
    To: QoL guidelines : UseCase, Public

3.3.4.8   Self-massage

UseCase owned by 'Guidelines', in package 'Use Cases'

It should allow providing "reminder" type guidelines and triggering an avatar to exemplify the maneuver and self-massage.
Procedure:
(1) Sliding the fingers on the forehead, up and down;
(2) Finger glide above the eyebrow, distal to medially;
(3) Sliding the fingers over the cheek, from the bottom to the top;
(4) Sliding of the fingers on the lips and cheek, in a horizontal direction, simulating a smile.

Self-massage
Version 1.0 Phase 1.0 Proposed
João Quintas created on 1/18/2022. Last modified 1/25/2022

CONNECTORS
⬀ **Include** «include»   Source -> Destination From: Self-massage : UseCase, Public To: Therapeutic guidelines : UseCase, Public
⬀ **Association**   Unspecified From: Muscle tension relief : UseCase, Public To: Self-massage : UseCase, Public

3.3.4.9   Therapeutic guidelines

UseCase owned by 'Guidelines', in package 'Use Cases'

Therapeutic guidelines
Version 1.0 Phase 1.0 Proposed
João Quintas created on 1/18/2022. Last modified 1/18/2022

CONNECTORS
⬀ **Association**   Unspecified From: Therapeutic guidelines : UseCase, Public To: Database : Actor, Public
⬀ **Association**   Unspecified From: Patient : Actor, Public To: Therapeutic guidelines : UseCase, Public
⬀ **Include** «include»   Source -> Destination From: Self-massage : UseCase, Public To: Therapeutic guidelines : UseCase, Public
⬀ **Include** «include»   Source -> Destination From: Nasal hygiene : UseCase, Public To: Therapeutic guidelines : UseCase, Public
⬀ **Association**   Unspecified From: Informal Caregiver : Actor, Public To: Therapeutic guidelines : UseCase, Public

CONNECTORS

↗ **Association**   Unspecified
From: Therapist : Actor, Public
To: Therapeutic guidelines : UseCase, Public

↗ **Include** «include»   Source -> Destination
From: Eye hygiene : UseCase, Public
To: Therapeutic guidelines : UseCase, Public

3.3.5 Rehabilitation Program

UseCase in package 'Use Cases'

Rehabilitation Program
Version 1.0 Phase 1.0 Proposed
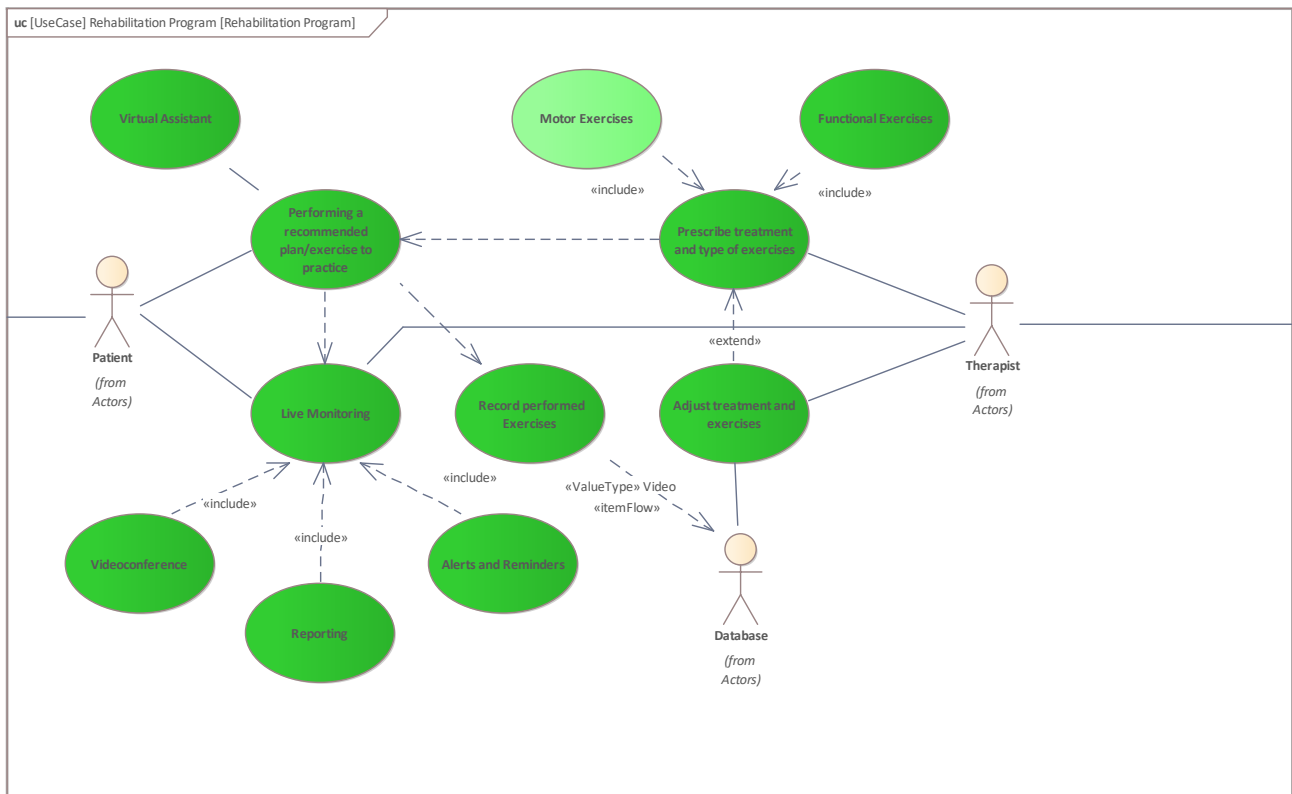Miguel Mestre created on 1/25/2022. Last modified 1/26/2022

EXTERNAL REQUIREMENTS

☑ Requirement. US_006 - Clinical Rehabilitation Program

As a: Patient
I want to be able to: Have access to specific exercises suitable for my needs
So that: I can improve my clinical condition over time

[Stereotype is «user story».]

☑ Requirement. US_008 - Home Rehabilitation Program

As a: Patient
I want to be able to: Have access to specific exercises suitable for my needs
So that: I can improve my clinical condition over time at home

[Stereotype is «user story».]

CONNECTORS

↗ **Satisfy** «satisfy»   Source -> Destination
From: Rehabilitation Program : UseCase, Public
To: US_006 - Clinical Rehabilitation Program : User Story, Public

↗ **Association**   Unspecified
From: Rehabilitation Program : UseCase, Public
To: Therapist : Actor, Public

↗ **Association**   Unspecified
From: Rehabilitation Program : UseCase, Public
To: Patient : Actor, Public

↗ **Satisfy** «satisfy»   Source -> Destination
From: Rehabilitation Program : UseCase, Public
To: US_008 - Home Rehabilitation Program : User Story, Public

↗ **Dependency**   Source -> Destination
From: Evaluation of the patient : UseCase, Public
To: Rehabilitation Program : UseCase, Public

3.3.5.1   Rehabilitation Program diagram

Use Case diagram in package 'Use Cases'

<div align="right">

Rehabilitation Program
Version 1.0
Miguel Mestre created on 1/25/2022. Last modified 3/21/2022
</div>

Figure 5: Rehabilitation Program

3.3.5.2   Alerts and Reminders

UseCase owned by 'Rehabilitation Program', in package 'Use Cases'

<div align="right">

Alerts and Reminders
Version 1.0 Phase 1.0 Proposed
Miguel Mestre created on 1/25/2022. Last modified 3/21/2022
</div>

EXTERNAL REQUIREMENTS

☑ Requirement. Wrong movement Alert

System should alert the patient in case of doing wrong the exercise

[Stereotype is «Functional».]

CONNECTORS

↗ **Include** «include»   Source -> Destination
   From: Alerts and Reminders : UseCase, Public
   To: Live Monitoring : UseCase, Public

CONNECTORS

⬈ **Realization**   Source -> Destination
From: Alerts and Reminders : UseCase, Public
To: Wrong movement Alert : Requirement, Public

SCENARIOS

⬛ Basic Path. Alerts for the therapist that the patient missed a session

1. An alert/notification is send to the therapist if a patient misses a planned session
2. A record about the missing session is added in the patient's profile
3. The event is added to the weekly report for the therapist

⬛ Basic Path. Reminder for the patient to perform session

1. An alarm is set for the day planned for the prescription to be performed
2. At the planned date the patient receives a notification that a session should be performed
2.1 The patient can snooze the notification if she/he is not available to perform the session
3. A new schedule is set with new date/time as selected by the patient
4. Save

3.3.5.3   Functional Exercises

UseCase owned by 'Rehabilitation Program', in package 'Use Cases'

Functional Exercises
Version 1.0 Phase 1.0 Proposed
Miguel Mestre created on 1/25/2022. Last modified 2/1/2022

CONNECTORS

⬈ **Include** «include»   Source -> Destination
From: Functional Exercises : UseCase, Public
To: Prescribe treatment and type of exercises : UseCase, Public

SCENARIOS

⬛ Basic Path. Basic Path

1. Select the Functional Exercise type
2. Create new exercise in FE pool
3. Describe the exercise
4. Create new level for the FE exercise
5. Describe the level
6. Save

⬛ Alternate. Removing exercises

1. Select Functional Exercises option
2. Select one of the available exercises in the pool
3. Select the Remove option
4. Confirm the remove action

3.3.5.4   Live Monitoring

UseCase owned by 'Rehabilitation Program', in package 'Use Cases'

Being capable of simultaneously follow the patient's execution of the planned session (i.e. commonly understood by real time)

<div align="right">

Live Monitoring
Version 1.0 Phase 1.0 Proposed
Miguel Mestre created on 1/25/2022. Last modified 2/3/2022

</div>

CONNECTORS

↗ **Dependency**   Source -> Destination
From: Performing a recommended plan/exercise to practice : UseCase, Public
To: Live Monitoring : UseCase, Public

↗ **Include** «include»   Source -> Destination
From: Alerts and Reminders : UseCase, Public
To: Live Monitoring : UseCase, Public

↗ **Include** «include»   Source -> Destination
From: Reporting : UseCase, Public
To: Live Monitoring : UseCase, Public

↗ **Include** «include»   Source -> Destination
From: Videoconference : UseCase, Public
To: Live Monitoring : UseCase, Public

↗ **Association**   Unspecified
From: Therapist : Actor, Public
To: Live Monitoring : UseCase, Public

↗ **Association**   Unspecified
From: Patient : Actor, Public
To: Live Monitoring : UseCase, Public

SCENARIOS

⊞ Basic Path. Manual intervention from therapist during exercises execution

1. Therapist receives notification that patient is having problem in performing exercises
2. Therapist manually triggers option for feedback to the patient during exercise execution
3. FaceRehab provides supervised feedback to the patient during exercise execution based on therapist indication

3.3.5.5   Motor Exercises

UseCase owned by 'Rehabilitation Program', in package 'Use Cases'

<div align="right">

Motor Exercises
Version 1.0 Phase 1.0 Proposed
Miguel Mestre created on 1/25/2022. Last modified 1/25/2022

</div>

CONNECTORS

CONNECTORS

↗ **Include** «include»   Source -> Destination
From: Motor Exercises : UseCase, Public
To: Prescribe treatment and type of exercises : UseCase, Public

3.3.5.6   Prescribe treatment and type of exercises

UseCase owned by 'Rehabilitation Program', in package 'Use Cases'

Prescribe treatment and type of exercises
Version 1.0 Phase 1.0 Proposed
Miguel Mestre created on 1/25/2022. Last modified 3/21/2022

EXTERNAL REQUIREMENTS

☑ Requirement. Add patient

The system must provide a Frame with fill forms to introduce patient information

[Stereotype is «Functional».]

☑ Requirement. End Date

Field form to insert end date of the therapy plan

[Stereotype is «Functional».]

☑ Requirement. Field to define Time repeating series

Field to insert a number relative to the number of the pretended repetitions of the current series sequence defined.

[Stereotype is «Functional».]

☑ Requirement. Field to select Functional exercise(s)

[Stereotype is «Functional».]

☑ Requirement. Field to select Motor exercise(s)

[Stereotype is «Functional».]

☑ Requirement. Form to create a new plan session

[Stereotype is «Functional».]

☑ Requirement. List of Rehabilitation Exercises

The system must provide a List of Rehabilitation exercises currently available for prescription

[Stereotype is «Functional».]

☑ Requirement. List patients

The system must provide a List of the Patients currently in rehabilitation

[Stereotype is «Functional».]

EXTERNAL REQUIREMENTS

☑ Requirement. Save button

Button to save the current defined plan.
Save button size should be no less than 100px wide and 50px height, in color grey.

[Stereotype is «Functional».]

☑ Requirement. Selected Exercises Customization Table

Table that shows selected exercises and allows the Therapist to select the level of each exercise (easy, moderate, difficult and custom). In case of the level selected is custom it is possible to define the repetition and the duration of the exercise.

[Stereotype is «Functional».]

☑ Requirement. Start Date

Field form to insert start date of the therapy plan

[Stereotype is «Functional».]

CONNECTORS

Realization   Source -> Destination
From: Prescribe treatment and type of exercises : UseCase, Public
To: List of Rehabilitation Exercises : Requirement, Public

Realization   Source -> Destination
From: Prescribe treatment and type of exercises : UseCase, Public
To: Selected Exercises Customization Table : Requirement, Public

Realization   Source -> Destination
From: Prescribe treatment and type of exercises : UseCase, Public
To: Field to select Motor exercise(s) : Requirement, Public

Realization   Source -> Destination
From: Prescribe treatment and type of exercises : UseCase, Public
To: Field to define Time repeating series : Requirement, Public

Realization   Source -> Destination
From: Prescribe treatment and type of exercises : UseCase, Public
To: Add patient : Requirement, Public

Realization   Source -> Destination
From: Prescribe treatment and type of exercises : UseCase, Public
To: Form to create a new plan session : Requirement, Public

Realization   Source -> Destination
From: Prescribe treatment and type of exercises : UseCase, Public
To: List patients : Requirement, Public

Realization   Source -> Destination
From: Prescribe treatment and type of exercises : UseCase, Public
To: Start Date : Requirement, Public

Dependency   Source -> Destination
From: Prescribe treatment and type of exercises : UseCase, Public
To: Performing a recommended plan/exercise to practice : UseCase, Public

CONNECTORS

⇗ Realization   Source -> Destination
From: Prescribe treatment and type of exercises : UseCase, Public
To: End Date : Requirement, Public

⇗ Realization   Source -> Destination
From: Prescribe treatment and type of exercises : UseCase, Public
To: Save button : Requirement, Public

⇗ Realization   Source -> Destination
From: Prescribe treatment and type of exercises : UseCase, Public
To: Field to select Functional exercise(s) : Requirement, Public

⇗ Association   Unspecified
From: Therapist : Actor, Public
To: Prescribe treatment and type of exercises : UseCase, Public

⇗ Extend «extend»   Source -> Destination
From: Adjust treatment and exercises : UseCase, Public
To: Prescribe treatment and type of exercises : UseCase, Public

⇗ Include «include»   Source -> Destination
From: Functional Exercises : UseCase, Public
To: Prescribe treatment and type of exercises : UseCase, Public

⇗ Include «include»   Source -> Destination
From: Motor Exercises : UseCase, Public
To: Prescribe treatment and type of exercises : UseCase, Public

SCENARIOS

⊞ Basic Path. Basic Path

1. Select the Prescription screen
2. Create new plan
3. Add new type of exercise from Motor Exercises list
   3.1 Select level for the type of Motor Exercises (Alternate path for Selecting the level)
4. Add new type of exercise from Functional Exercise list
   4.1 Select level for the type of Functional Exercises (Alternate path for Selecting the level)
5. Insert a list of dates when the planned prescription should be performed (like a calendar appointment)
6. Save

⊞ Alternate. Selecting the level

1. Selecting one level locks automatically all other levels

3.3.5.7   Reporting

UseCase owned by 'Rehabilitation Program', in package 'Use Cases'

<div align="right">

Reporting
Version 1.0 Phase 1.0 Proposed
João Quintas created on 2/3/2022. Last modified 3/21/2022

</div>

EXTERNAL REQUIREMENTS

☑ Requirement. Check Patient progression

Overview of the patient progression in a line chart, for example, representing measurements for each anatomical structure in a timeline

[Stereotype is «Functional».]

☑ Requirement. Check Patient Scores

Overview history of the patient scores in House Brackmann Scale since the beginning of treatment

[Stereotype is «Functional».]

CONNECTORS

↗ **Realization**   Source -> Destination
From: Reporting : UseCase, Public
To: Check Patient progression : Requirement, Public

↗ **Include** «include»   Source -> Destination
From: Reporting : UseCase, Public
To: Live Monitoring : UseCase, Public

↗ **Realization**   Source -> Destination
From: Reporting : UseCase, Public
To: Check Patient Scores : Requirement, Public

SCENARIOS

⚏ Basic Path. Weekly reporting for the therapist

1. Generate every Monday a report about patient's progress of the previous week
2. Include information which sessions were performed and missed according to the prescription plan
3. Include a progression indicator (e.g. amplitude of movements, results from exercises performed)

3.3.5.8   Virtual Assistant

UseCase owned by 'Rehabilitation Program', in package 'Use Cases'

Virtual Assistant
Version 1.0 Phase 1.0 Proposed
Miguel Mestre created on 1/25/2022. Last modified 2/3/2022

RESPONSIBILITIES (INTERNAL REQUIREMENTS)

☑ Functional. Visual aspect of virtual assistant represents an avatar of patient

The visual aspect of the virtual assistant should be a visual representation or model of the physical aspect of the patient

[Proposed, High difficulty.]

CONNECTORS

↗ **Association**   Unspecified
From: Virtual Assistant : UseCase, Public
To: Performing a recommended plan/exercise to practice : UseCase, Public

SCENARIOS

Basic Path. Guiding the patient throught the session exercises

1. FaceRehab greats the patient by vocally welcoming the patient with "[Username], welcome to your FaceRehab session for today. How are you feeling today?"
2. FaceRehab virtual assistant presents by explaining vocally and visually (i.e. facial expressions) the therapeutic guidelines for the patient to perform as a warm-up before the exercises for the current session
3. FaceRehab virtual assistant explains vocally and visually (i.e. facial expressions) the patient the next exercise to be performed in the current session

Alternate. Exemplifying guidelines with videos

1. FaceRehab will show a demonstration video in case the virtual assistant cannot perform an expected facial expression or demonstrate accurately a given exercise

Basic Path. Mimicking patient's facial expressions

1. While the patient is performing the therapeutic exercises the virtual assistant is mimicking his/her facial movements (e.g. like an example to follow, similar to what is happening in session with therapist)
2. The virtual assistant also provides motivational suggestions and feedback

3.3.5.9   Record performed Exercises

UseCase owned by 'Rehabilitation Program', in package 'Use Cases'

Record performed Exercises
Version 1.0 Phase 1.0 Proposed
mmestre created on 1/25/2022. Last modified 3/10/2022

CONNECTORS

ItemFlow «itemFlow»   Source -> Destination
     From: Record performed Exercises : UseCase, Public
     To: Database : Actor, Public

Dependency   Source -> Destination
     From: Performing a recommended plan/exercise to practice : UseCase, Public
     To: Record performed Exercises : UseCase, Public

SCENARIOS

Basic Path. Antropomorphic measurements of facial point

1. FaceRehab is capable to automatically track key point in the face
2. Register in the patient's dashboard the evolution in mm compared to previous session (i.e. evaluation or re-evaluation use case)

CONSTRAINTS

CONSTRAINTS

⚙ Invariant. Visual sensor is calibrated

[Approved, weight is 0.]

⚙ Invariant. Visual perception is callibrated

[Approved, weight is 0.]

3.3.5.10   Adjust treatment and exercises

UseCase owned by 'Rehabilitation Program', in package 'Use Cases'

Adjust treatment and exercises
Version 1.0 Phase 1.0 Proposed
mmestre created on 1/25/2022. Last modified 2/1/2022

EXTERNAL REQUIREMENTS

☑ Requirement. US_007 - Adjustment of Treatment

As a: Therapist
I want to be able to: Adjust exercises according to the patient clinical condition and progress
So that: I can improve the efficiency of the proposed rehabilitation plan, consequently, a faster recovery from patient

[Stereotype is «user story».]

CONNECTORS

↗ **Association**   Unspecified
   From: Adjust treatment and exercises : UseCase, Public
   To: Database : Actor, Public

↗ **Extend** «extend»   Source -> Destination
   From: Adjust treatment and exercises : UseCase, Public
   To: Prescribe treatment and type of exercises : UseCase, Public

↗ **Satisfy** «satisfy»   Source -> Destination
   From: Adjust treatment and exercises : UseCase, Public
   To: US_007 - Adjustment of Treatment : User Story, Public

↗ **Association**   Unspecified
   From: Therapist : Actor, Public
   To: Adjust treatment and exercises : UseCase, Public

SCENARIOS

⚕ Basic Path. Update prescription

1. Access the Exercises selection screen
2. Select existing prescription
3. Add new type of Exercises from Motor Exercises/ Functional Exercises
  3.1 Select level for the new exercise
4. Update the previous types of exercises from Motor Exercises or Functional Exercises
  4.1 Unlock the next level of exercises in that category

SCENARIOS

> 4.2 Automatically lock previous level of exercises in that category
> 5. Remove existing exercises from Motor Exercises or Functional Exercises

3.3.5.11   Performing a recommended plan/exercise to practice

UseCase owned by 'Rehabilitation Program', in package 'Use Cases'

Performing a recommended plan/exercise to practice
Version 1.0 Phase 1.0 Proposed
mmestre created on 1/25/2022. Last modified 3/21/2022

CONNECTORS

Dependency   Source -> Destination
From: Performing a recommended plan/exercise to practice : UseCase, Public
To: Live Monitoring : UseCase, Public

Dependency   Source -> Destination
From: Performing a recommended plan/exercise to practice : UseCase, Public
To: Record performed Exercises : UseCase, Public

Association   Unspecified
From: Virtual Assistant : UseCase, Public
To: Performing a recommended plan/exercise to practice : UseCase, Public

Dependency   Source -> Destination
From: Prescribe treatment and type of exercises : UseCase, Public
To: Performing a recommended plan/exercise to practice : UseCase, Public

Association   Unspecified
From: Patient : Actor, Public
To: Performing a recommended plan/exercise to practice : UseCase, Public

SCENARIOS

Basic Path. Performing session with virtual assistant

1. Patient access the planned session
2. The patient will see an option to select the FaceRehab virtual assistant for guiding, motivation
3. FaceRehab starts visual acquisition of the patient
4. FaceRehab tracks key point in the face and compare to expected exercise pattern
5. FaceRehab follows execution of exercises during the session mimicking patient's facial expressions in the virtual assistant face

Alternate. Performing session with visual bio-feedback

1. The patient will see an option to select the video of him/herself performing the exercise (i.e. video stream mirroring the facial expressions)
2. The virtual assistant is showed in overlay in a smaller format to still guide and motivate the patient at the bottom corner of the screen

3.3.5.12   Videoconference

UseCase owned by 'Rehabilitation Program', in package 'Use Cases'

Videoconference
Version 1.0 Phase 1.0 Proposed
mmestre created on 12/16/2021. Last modified 2/3/2022

EXTERNAL REQUIREMENTS

☑ Requirement. Video conferecing

The system must provide 1:1 video conferencing

[Stereotype is «Functional».]

CONNECTORS

Realization   Source -> Destination
From: Videoconference : UseCase, Public
To: Video conferecing : Requirement, Public

Include «include»   Source -> Destination
From: Videoconference : UseCase, Public
To: Live Monitoring : UseCase, Public

SCENARIOS

Basic Path. Set a date for a videoconference

1. The user selects the video conference option
2. Set the date for the video conference call
3. Set the time for the video conference call
4. Save
5. The appointment is added to the prescription plan available for the proposed date

Basic Path. Performing the video conference

1. The user access the video conference option
2. A video stream of the remote side is shown
3. A video stream of him/herself is shown
4. The control buttons for the video conference are displayed for mic on/off, camera on/off
5. If available, show a option for share screen
6. If available, show a option for chat window

UseCase owned by 'Rehabilitation Program', in package 'Use Cases'

4   Conclusions

The Co-design process allows to identify precisely what is more important for all different users. It helps to achieve the defined objectives more efficiently and precisely. Cooperating the users in developing a system also helps the system to be acceptable and more user-friendly. Co-design is not only allowed to utilize the knowledge, experience and technical issues of users in a system but also the chance of system's acceptance by its users could rise up. Therefore, such system could gain more success and achievement as it is being developed in a collaborative way.