SUPPLEMENTARY MATERIAL 3

Didactic methodology of the exercise application

The 3D multimedia animations have been designed in an attempt to reduce the cognitive load (the amount of information that working memory cand hold at one time).[1] To this end, the technical aspects, the content and the form of instruction have been taken into account:[2]

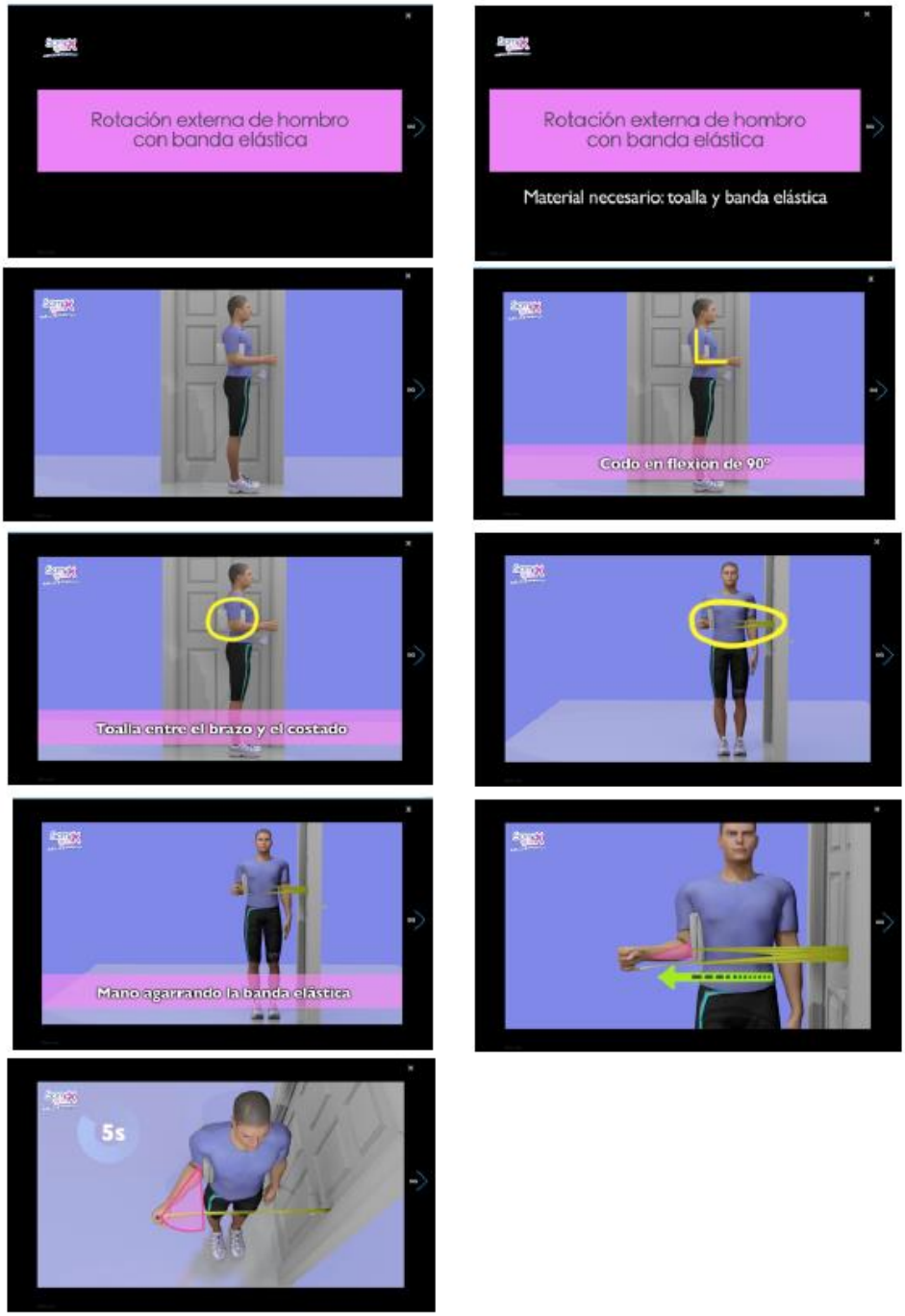
- **Technical aspects:** Visual quality, audio quality, coordination of audio and video, and use of graphic elements (arrows, position signs, time markers...) to highlight important information.
- **Content:** The instructional objective is explicit and clear. There is an explicit call to continued action teaching the way to progress.
- **Instructions:** The instructional techniques focus on patient engagement. The content is presented in an organized way. Short sequences of information are used to allow learners to engage. All extraneous information that doesn't contribute to the learning goal or help build relationships is eliminated.

The videos are 3D animations that allow to visualize an exercise from different perspectives, and are accompanied by audio, text, and animated graphic elements such as arrows, position signs, and time markers that facilitate the understanding and correct completion of the exercise. In addition, each exercise indicates the material necessary to perform it, the starting position, the correct way to do it, and the different parameters to consider (intensity, frequency and duration) and how to progress. Several aspects have been taken into account in the teaching methodology:

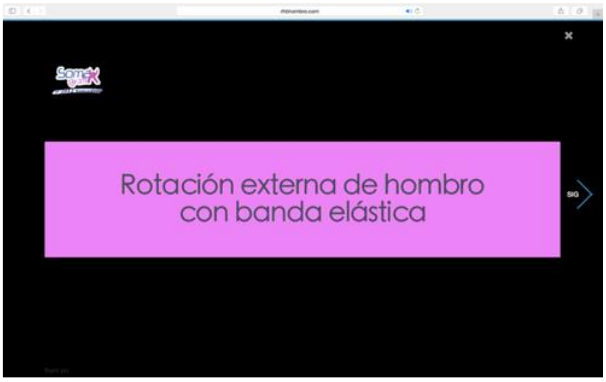
1. **Nomenclature of the exercise:** A short name is used to quickly identify the exercise to be performed.
2. **Necessary material:** Description, in the audio and in the text, of the material required to perform each exercise.
3. **Starting position:** Description and visualization from various perspectives of the initial position, which is considered adequate to begin the exercise. Position marks are used to facilitate this.
4. **Execution of the exercise:** Description of the correct way to perform the exercise. Arrows are introduced to mark the direction in which the movement should be performed, signs indicating the final position to be reached and a marker of the time to maintain this position.

Example of didactic methodology with one of the included exercises

The whole video sequence of the shoulder external rotation exercise with elastic band is presented below.



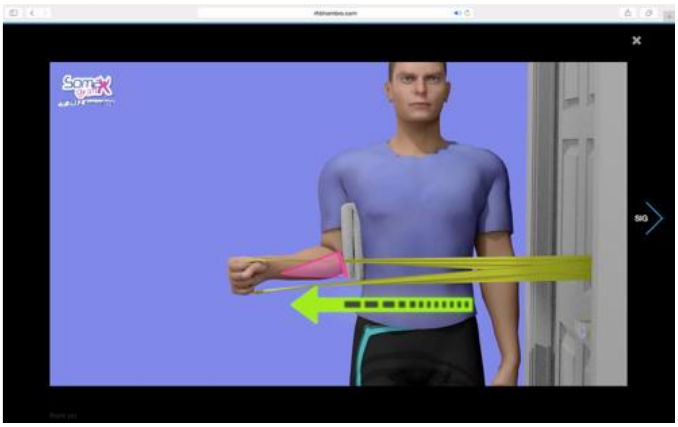
The video begins by naming the exercise to be performed: external rotation of the shoulder with an elastic band. This allows the exercise to be easily identified, both by the professional who is going to teach it and by the patient who is going to do it.



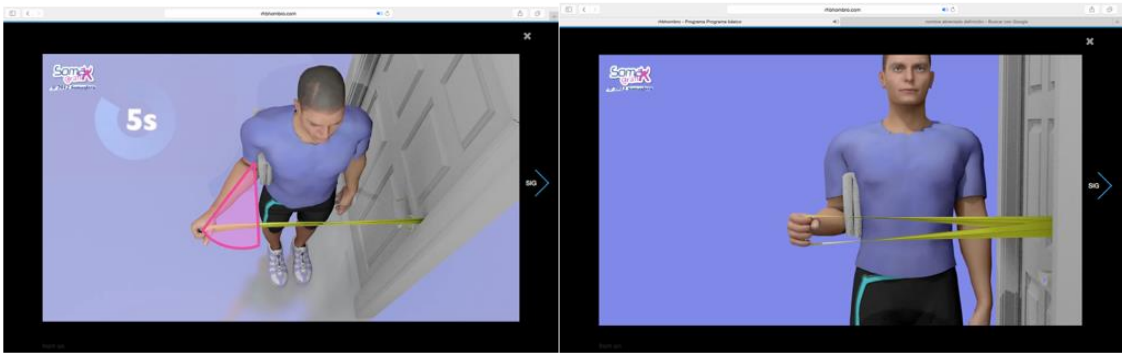
Next, the starting position is described, standing next to a door, with the elbow of the arm with which the exercise is to be performed in a 90° flexed position and placement of the folded towel between the elbow and the side. Several position and text marks are introduced to focus the patient's attention on those aspects that are a frequent source of error.

After this, a change of perspective is made so that the patient can visualize the starting position from another angle and the position of the elastic band with respect to the door (caught with the door or hooked to the door handle) and the hand holding the elastic band, which should be in slight tension, is specified.

The video goes on to specify the execution of the exercise, pulling the elastic band, making it taut to form an arc of about 45º and emphasizing not to move the rest of the body or allow the towel to fall to the floor. It is common to make the mistake of helping with the rest of the body to make the movement or separating the elbow from the body, so with these explanations we intend to reduce the possibility of such errors. An arrow marker is introduced for the direction of the movement and another for the magnitude of the arc of the movement to be performed.



Finally, the time to hold that final position is specified, 5 seconds and slowly return to the starting position.



REFERENCES

1 Castro-Alonso JC, de Koning BB, Fiorella L, *et al.* Five Strategies for Optimizing Instructional Materials: Instructor- and Learner-Managed Cognitive Load. *Educ Psychol Rev* 2021;**33**:1379–407. doi:10.1007/S10648-021-09606-9

2 Beemer LR, Tackett W, Schwartz A, *et al.* Use of a Novel Theory-Based Pragmatic Tool to Evaluate the Quality of Instructor-Led Exercise Videos to Promote Youth Physical Activity at Home: Preliminary Findings. *Int J Environ Res Public Health* 2023;**20**. doi:10.3390/IJERPH20166561