A redesign of the Wilmer Carrying Orthosis shoulder bandage

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The Wilmer Carrying Orthosis (WCO) is designed for people with a totally or partially dislocated shoulder, which is called (sub)luxation. Because of this condition the arm cannot or can hardly be used, and the full weight of the arm needs to be carried by the ligaments and capsule of the shoulder joint. (Sub)luxation leads to pain and discomfort, and the inactivity of muscles in the arm usually leads to oedema formation in the hand, fingers, and forearm. If a shoulder (sub)luxation is not treated, the shoulder keeps hanging from its capsule and ligaments and will dislocate further and further in time (see Figure 1), which is usually a very painful occurrence. Because of the pain and loss of control over the shoulder movements, the arm can hardly be used as it should, which makes the condition very limiting. The condition is often permanent. With a smart balancing construction (see Figure 2), the WCO can neutralize a shoulder (sub)luxation. This relieves pain for patients and so supports them to live with their disability. [1] [2]

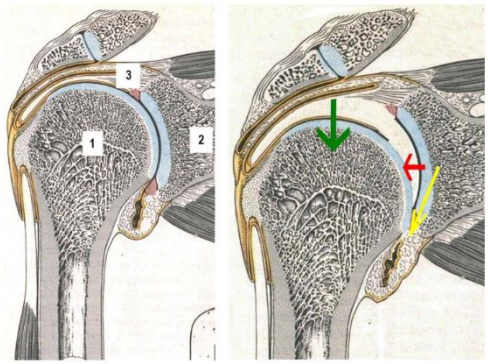

Figure 1: A normal shoulder joint (left) vs subluxation of the shoulder joint (right) [2]

Figure 2: Smart balancing construction of the WCO [1]

Ambroise is a company that helps many clients by developing lightweight dynamic orthoses, of which one is the WCO. However, Ambroise has found some problems with the WCO. Users have experienced that the chest strap, which is part of the shoulder bandage (see Figure 3), painfully cuts below the armpit of the uninjured arm. Also, women with large breasts have experienced the chest strap of the shoulder orthosis to be extra annoying, because they are forced to put the chest strap closer to the armpit to prevent the band from crossing the breast. Next to that, the shoulder pad slips down, leading to a malfunctioning orthosis. Ambroise has therefore asked for a redesign of the part of the WCO that is around the body, called the shoulder bandage. Because the chest strap is causing two problems, it is required that the chest strap was eliminated in the redesign. However, it was found that without this part, the orthosis would not remain in its position and malfunction. The challenge in this bachelor final assignment was therefore to find a workable solution for the redesign of the WCO. The research question to answer was:

> *How can the constraining forces on the Wilmer Carrying Orthosis shoulder cap be redirected such that the chest strap can be eliminated?*

As a start towards a solution to this problem, inspiration was gathered from existing shoulder orthosis on the market. Next, ideas for the shoulder bandage were drawn (see Figure 4). While doing this, no idea was excluded, all constructions that could possibly keep the orthosis in its position were considered. After extensive brainstorming, conceptualizing, and component-testing, a construction for the shoulder bandage that did not cause an uncomfortable cutting feeling below the armpit and kept the orthosis in its position seemed to be feasible*. This idea was developed with the goal to create the most feasible and finished redesign for the WCO, that was more comfortable than the current design.

In the end, a functional redesign direction of the WCO was created. But more investigation and elaboration are necessary to find out whether the redesign direction can be elaborated into a more comfortable solution than the old design.

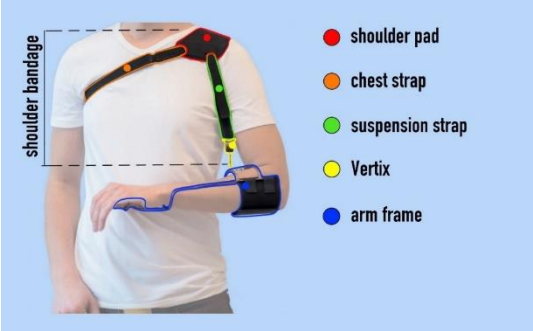

Figure 3: naming of elements of the WCO

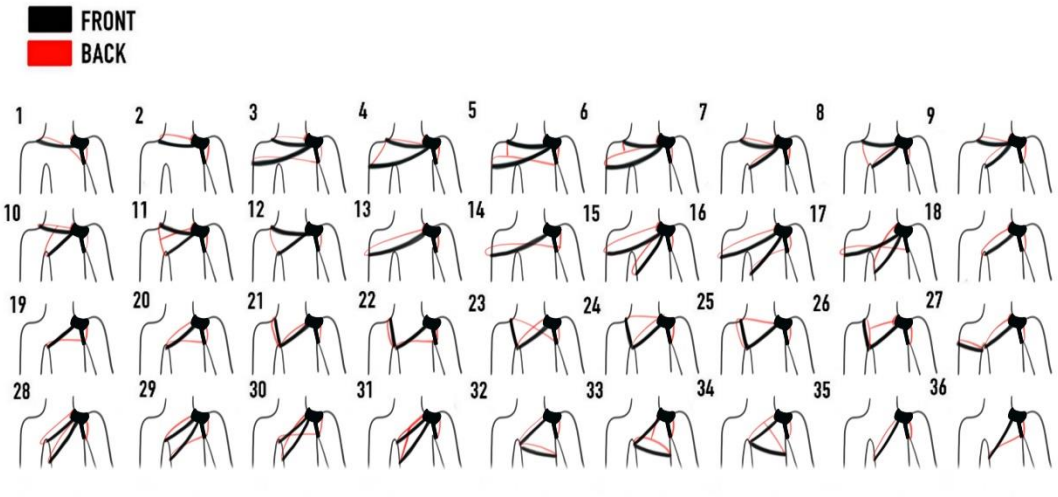

Figure 4: Possibilities for the redirected strap(s) that could possibly replace the chest strap.

**Due to confidentiality agreement, details of the chosen solution direction could not be given.*

References

[1] "Wilmer Draagorthese," Ambroise, [Online]. Available: https://www.ambroise.nl/armorthesen/schouderorthesen/wilmer-draagorthese/. [Accessed 11 April 2022].

[2] N. G. A. v. Leerdam, "De WILMER ® Draag Orthese," 2004.