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Complex made Simple...clinically relevant education by Judy C. Colditz, OT/L, CHT, FAOTA

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SHOULD ALL ORTHOSES BE 2/3 THE LENGTH OF THE FOREARM?

The origin of the statement "all orthoses should be two-thirds the length of the forearm" is unknown, but this principle continues to be taught and published in textbooks on orthotic construction. Is it true? Do all orthoses need to be two-thirds the length of the forearm? If so, why?

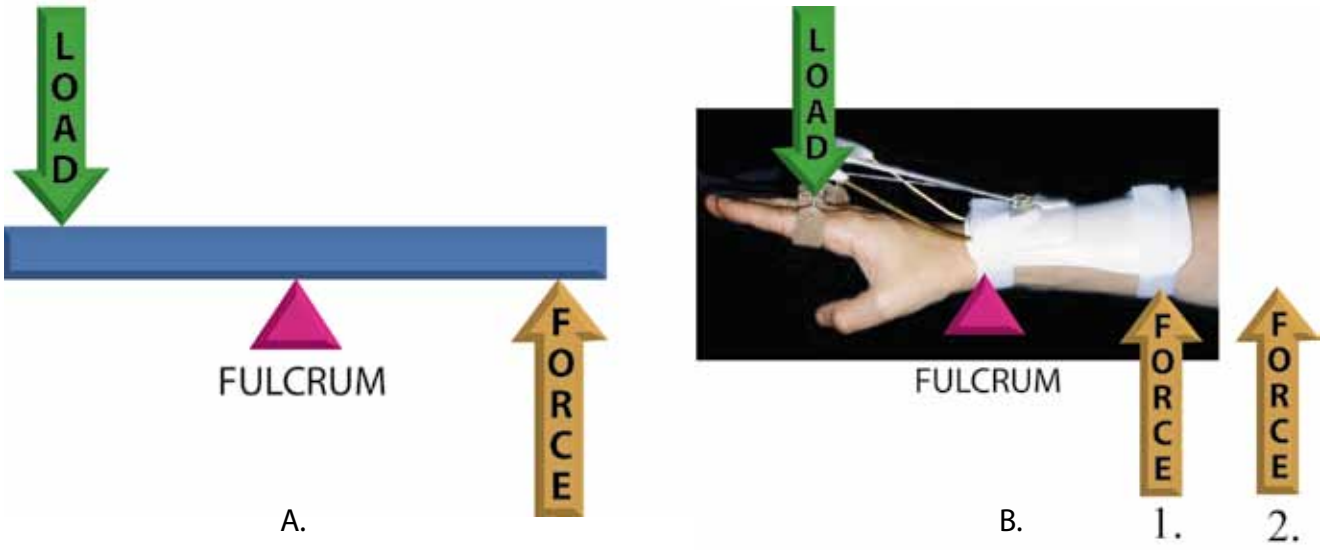
When is the 2/3 length unnecessary?

The purpose of most wrist orthoses is to restrict flexion/extension and radial/ulnar deviation of a wrist with normal innervation and muscle control. To accomplish this, the part proximal to the wrist only needs to be equal to the length of the part distal to the wrist.

Although it may be desirable to place the proximal edge of a volar orthosis at the musculo-tendinous junction in the forearm where there is more soft tissue mass, this musculo-tendinous junction is not in the proximal 2/3 of the forearm.

The ability of any orthosis to support the wrist is not solely dependent on the length of the molded material, but also its shape. If a narrow, flexible mold is applied volarly with a strap across the wrist dorsally, the stability of the wrist is compromised by two factors:

1. The flexible volar material – no matter how long – cannot provide stability.
2. The dorsal strap must be precisely placed



A. A first class lever is like a see-saw; the ability to move the load is dependent on the force applied. B. The radial palsy orthosis is a first class lever with the load being the weight of the hand, lifted by the force of the proximal strap. If the strap (force) moves from position (1.) to the more proximal position (2.), the force to lift the weight of the hand increases.

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SHOULD ALL ORTHOSES BE 2/3 THE LENGTH OF THE FOREARM?, continued

over the axis of the wrist and securely fastened to achieve reliable stabilization.
A narrow flexible forearm piece and an imprecise dorsal strap location or application are the primary causes of inadequate wrist stabilization rather than a shorter length of the proximal forearm piece.

When is the 2/3 length required/desirable?
When the orthotic design is a first class lever, the length of the forearm component becomes important. The longer proximal forearm length provides a longer lever arm to "lift" the wrist/hand. This lifting mechanism is relevant, for example, when the radial nerve is denervated and the weight of the hand must be lifted by the orthosis or when there is increased flexor tone against which the orthosis must support the wrist/hand. Again, an effective orthosis for these clinical presentations is a combination of the length and the design rather than the length only.
The default design commonly used by therapists for many orthoses is molded thermoplastic on one surface (usually volar) with strapping across the opposite (dorsal) surface. As discussed above, the strapping provides a variable that is often less than desirable. If, however, the design is circumferential, the "tube" shape created is an extremely rigid shape. This shape eliminates the strapping variable and also allows the proximal length and distal length to be equal without compromising wrist stability.
If restricting forearm rotation is also desired, Kim & Park (1) have recently demonstrated that limitation of active forearm rotation by a short arm cast is positively correlated with cast length. Therefore, a longer circumferential design is essential to limit forearm rotation.

Conclusion
As with many concepts handed down without scrutiny, the rule that all orthoses must be 2/3 the length of the forearm should be examined more closely. The forearm length of the orthosis is only one factor in designing a stable orthosis, is less relevant with a circumferential design, and is most relevant when the design is a first class lever lifting the wrist/hand against gravity or increased flexor tone.

1. Kim, JK and ES Park. "The effect of short arm cast length on forearm rotation." Jour hand surg [Am] 39.4 (2014): 629-33.