Technical Note The Journal of Hand Surgery (Asian-Pacific Volume) 2022;27(2):413-416 • DOI: 10.1142/S2424835522710023

Wrist Extensor Deficit Detection Test – A Simple Test to Determine Wrist Extension Caused by Digital Extensors in Patients with Extended Upper Brachial Plexus Palsy

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Motor deficit in patients with extended upper brachial plexus palsy is variable. A patient with only thumb and finger extensors may seem to have active wrist extension because of them secondarily acting at wrist and causing wrist extension. To determine the presence of wrist extensors, it is important to block the wrist extension caused by the finger and thumb extensors. Conventional muscle testing is often ineffective in these patients as they learn a variety of trick movements over the time. We describe a simple clinical test to reveal the strength of the wrist extensors only by negating the effect of digital extensors on the wrist. If wrist extensors are absent, a nerve or tendon transfer can be done to address this deficit and improve the functional outcome.

Level of Evidence: Level V (Diagnostic)

Keywords: *Brachial plexus palsy, Extended upper brachial plexus, Wrist extension, Tendon transfer, Nerve transfer*

Received: May 31, 2021; Accepted: Mar. 17, 2022
Published online: Apr. 19, 2022
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INTRODUCTION

Patients with extended upper brachial plexus palsy present with variable loss of wrist extension. Typically, patients with C5-7 palsy have loss of function of only the radial wrist extensors and those with C5-8 palsy have loss of all wrist extensors.[1,2] However, in a few patients, the thumb and finger extensors remain active because of their T-1 root innervation.[2] These patients may seem to have active wrist extension because the finger and thumb extensors cross the wrist and can result in secondary wrist extension.[3] An assessment for the presence of wrist extensors is important because the wrist extension caused by finger extensors is weak. The reconstruction of wrist extension by a nerve or tendon transfer in these patients can result in improved function as a wrist extension improves grip.[4] We describe a simple clinical test to unmask the effect of the digital extensors on the wrist. We have been using this test for the last 5 years to determine the need for a nerve/ tendon transfer to restore wrist extension.

TECHNIQUE

The patient is first asked to extend the wrist in whichever finger/thumb position he is comfortable (Fig. 1). Once the wrist is extended, he is asked to grasp an object in his hand, while maintaining the wrist in extension. If he can hold the object as well as keep the wrist in extension, his wrist extensors are functional. If he is unable to hold the object with the wrist in extension or needs to flex the wrist to maintain his hold (Fig. 2) (Video 1), it indicates that the wrist extensors are not functional, and the wrist extension seen earlier is produced by the digital extensors. Patient's failure to perform this '***Wrist Extensor Deficit Detection***' test would suggest the need for augmenting the wrist extensor function.

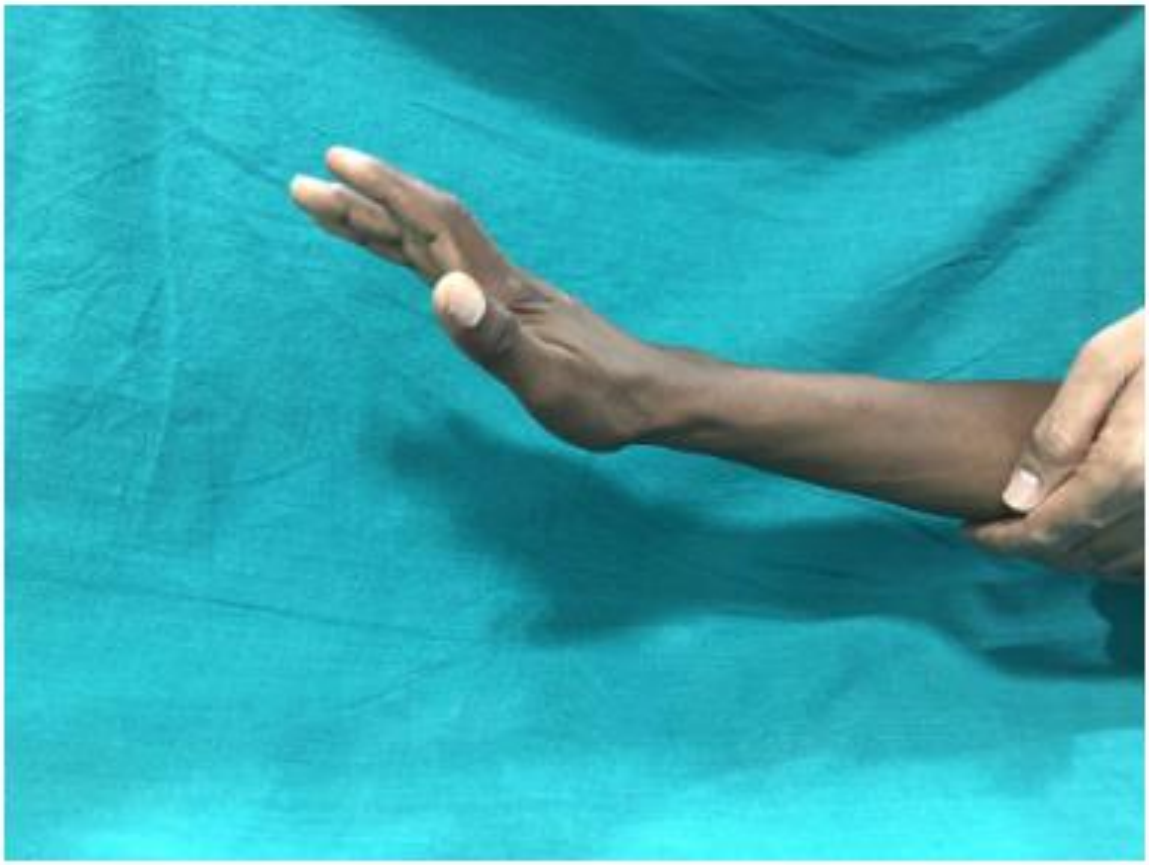

Fig. 1. The patient seems to be extending his wrist and fingers. In fact, it took a while to convince this patient that he did not have a wrist extension and required surgery to improve it.

The Journal of Hand Surgery (Asian-Pacific Volume) • 2022;27(2) • www.worldscientific.com/worldscinet/jhs

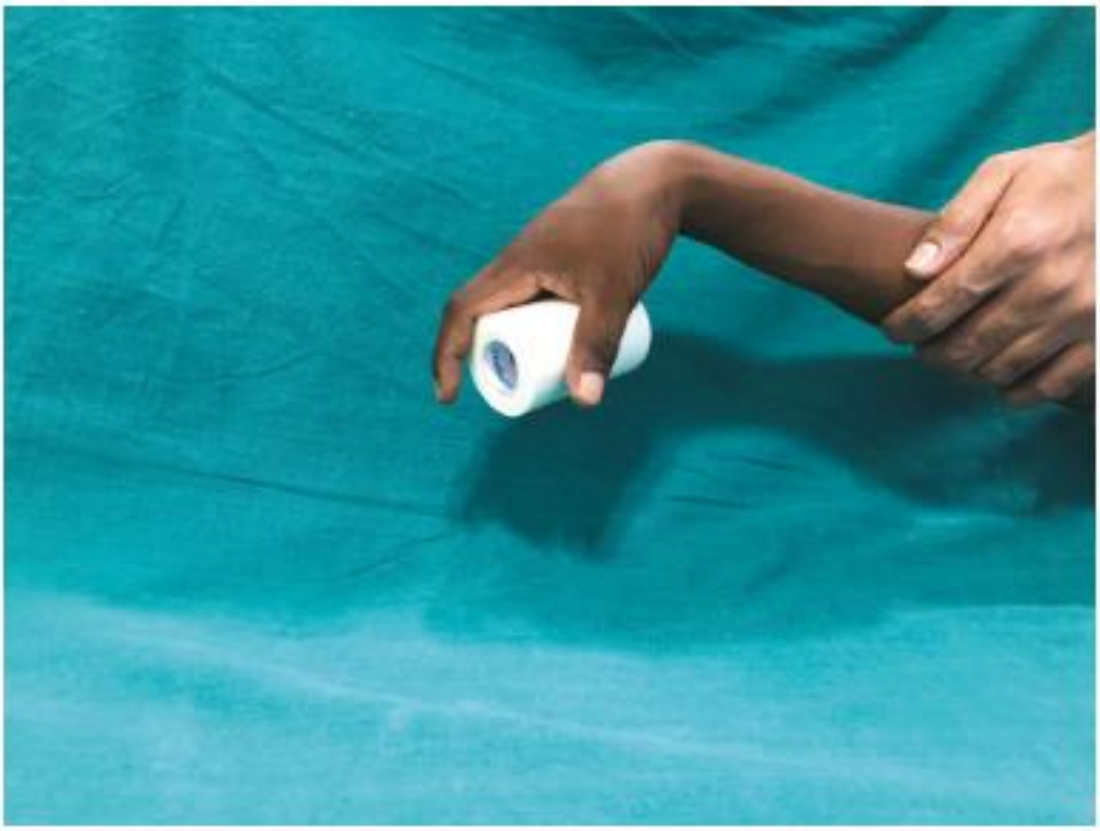

Fig. 2. Patient is asked to perform wrist extension while firmly grasping an object in his hand and not letting it fall. The figure shows his inability to extend the wrist, indicating that the wrist extensors are not functional, and the finger extensors were producing the wrist extension seen before.

DISCUSSION

Examination of the wrist extensor muscle function by direct palpation of the muscle or the tendon is logical. However, it does not often reveal the true strength in the presence of functional digital extensors. It is difficult to overcome the effect of finger extensors on wrist extension by conventional muscle testing. Bertelli et al recommended examining for isolated wrist extensor muscle function by making an intrinsic minus position of the hand with metacarpophalangeal joints fully extended and interphalangeal joints fully flexed.[2] However, the assessment of isolated 'functional strength' of the wrist extensors is challenging in a patient who is used to do trick movements over time. For the same reason, asking them to perform wrist extension while maintaining a tight fist also is not very assuring for true wrist extensor function.

The 'Wrist Extensor Deficit Detection' test described reliably unmasks the true wrist extension power by negating the secondary wrist extension caused by the functioning digital extensors. Our test is based on the fact that when the finger flexors are being used for grasping, it results in relaxation of the digital extensors – the principle of reciprocal inhibition, hence unmasking the lack of the wrist extension power, which was being compensated by the digital extensors. The test, in essence, is just a manoeuvre to unmask the disability the patients experience when they use their hand for activities. Moreover, the test also detects the patients in whom the strength of the partly recovered wrist extensors is insufficient to resist grasping function, thus, making the test more valuable than the conventional tests for muscle testing.

'Wrist Extensor Deficit Detection' test to disclose the 'true' wrist extensor power should form part of the

examination of all the patients with extended upper brachial plexus palsy, and the wrist extension deficit, if revealed by the test, should be addressed along with other deficits being considered for reconstructive surgery to get an optimal outcome. We have found this test an easy and valuable supplement to the conventional clinical evaluation as it helps in decision-making for this uncommon group of patients.

DECLARATIONS

Conflict of Interest: The authors do NOT have any potential conflicts of interest with respect to this manuscript.

Funding: The authors received NO financial support for the preparation, research, authorship and/or publication of this manuscript.

Ethical Approval: Ethical approval is not required for technical notes.

Informed Consent: There is no information (names, initials, hospital identification numbers or photographs) in the submitted manuscript that can be used to identify patients.

Acknowledgements: None.

REFERENCES

1. Brendler SJ. The human cervical myotomes: Functional anatomy studied at operation. *J Neurosurg*. 1968;28(2):105–111. https://doi.org/10.3171/jns.1968.28.2.0105.
2. Bertelli JA, Ghizoni MF. C5-8 brachial plexus root injury: The "T-1 hand." *J Neurosurg*. 2012;116(2):409–413. https://doi.org/10.3171/2011.7.JNS11672.
3. Bertelli JA, Ghizoni MF, Tacca CP. Results of wrist extension reconstruction in C5-8 brachial plexus palsy by transferring the pronator quadratus motor branch to the extensor carpi radialis brevis muscle. *J Neurosurg*. 2016;124(5):1442–1449. https://doi.org/10.3171/2015.3.JNS142428.
4. Li ZM. The influence of wrist position on individual finger forces during forceful grip. *J Hand Surg Am*. 2002;27(5):886–896. https://doi.org/10.1053/jhsu.2002.35078.

Supplementary Files: The supplementary files for this manuscript (listed below) are online only and can be accessed at http://www.worldscientific.com/doi/suppl/10.1142/S2424835622710023

Video 1: A video showing the test wherein the patient appears to be able to extend the wrist, however, when asked to extend the wrist while firmly grasping an object and not letting it fall unmasked the lack of wrist extension – 'Wrist Extensor Deficit Detection' Test.