Effect of the Horizontal Extension Technique on the Cross-sectional Area of the Carpal Tunnel

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Conclusions

Horizontal extension technique (HET) may affect the flexibility of the carpal tunnel structure, and helps the carpal tunnel to function more normally.

Introduction

Horizontal extension technique (HET) is a manual therapy for carpal tunnel syndrome (CTS). Tensile load is applied parallel to the transverse carpal ligament (TCL) and deformation of the carpal tunnel structure is expected by this technique.

Purpose

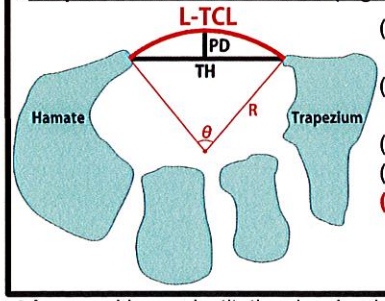
Comparative measurement of in vivo cross-sections of the carpal tunnel by magnetic resonance imaging (MRI) applying HET.

Methods

- 12 healthy women participated. Mean age was 50 years (range, 43-55yrs).
- Performed the HET (Figure 1).
- Kinematic MRI of the right wrist was performed with a 0.2-T horizontally open unit in the state of before, during, and after HET.

Figure 1.*Horizontal extension technique(HET)* Creating a gentle pincer action by therapist' s each hand to produce an increase in tension in the TCL by angling the ulnar and radial structures posteriorly around the capitate as an outward wedging action. Load cells measured the force during the HET. (Intraclass correlation coefficients, 0.96).

- **Carpal Tunnel Measurements (Figure 2)**



(1) Linear distance between the trapezium and hamate hook (TH)
(2) Perpendicular distance(PD) from the top of TCL in TH
(3) Bowing Ratio (BR) : PD/TH
(4) Cross-sectional areas (CSA) at the level TH
(5) Length of TCL (L-TCL) : equal to radius (R) times central angle (θ) when TCL was considered as an arc (L=Rθ)

Modified the method of Mesgarzadeh et al. (1)

- Approved by our institutional review board (IRB).

Results

Figure 3. MRI image in pre-HET and in HET

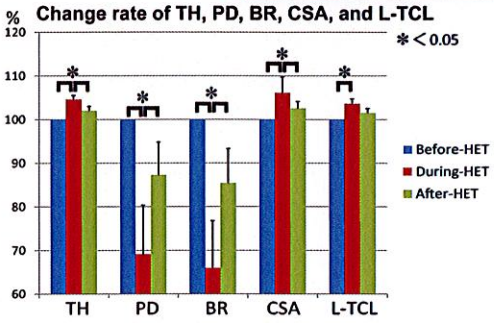


Figure 4. Change rate of TH, PD, BR, CSA, L-TCL between the before-HET, during-HET, and after-HET. Each score in before -HET was represeted by 100% to produce the change rate during-HET and after -HET.

One-way repeated ANOVA with post-hoc Tukey comparisons (α=0.05).

Table 1. TH, PD, BR, CSA, L-TCL in the pre-HET, HET, and post-HET. Mean(SD)

	Before-HET	During-HET	After-HET
TH(mm)	21.2 (0.7)	22.2 (0.8)	21.6 (0.7)
PD(mm)	1.9 (0.5)	1.3 (0.5)	1.7 (0.5)
BR	0.088 (0.02)	0.060 (0.02)	0.076 (0.02)
CSA(mm^2)	193.8 (7.4)	205.7 (7.9)	198.9 (6.7)
L-TCL(mm)	21.7 (0.6)	22.5 (0.7)	22.0 (0.8)

TH: Distance between the trapezium and hamate hook
PD: Perpendicular distance as lowered from the top of the transversal carpal ligament in TH.
BR: Bowing Ratio as PD/TH.
CSA: Cross-sectional areas
L-TCL: Length of the transversal carpal ligament

Discussion

During HET, the TH was increased and PD was decreased. These suggested that the carpal tunnel structure might become more flattened when the carpal tunnel was considered as an ellipse. If the perimeter of the carpal tunnel stayed constant during HET, the carpal tunnel area could not be increased in the flatten process. The significant increase in both the carpal tunnel area *'CSA'* and the transverse carpal ligament *'L-TCL'* were founded in HET, suggesting that the carpal bones were expanded as a variable perimeter by the manual procedure such as **"*open book*"**.

References

(1)Mesgarzadeh M, et al. Carpal tunnel: MR imaging. Part I. Normal anatomy. Radiology 171:743-8, 1989

Acknowledgment

The authors would like to thank Hidenori YOSHIHASHI for his technical supports of the MRI analysis.

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