Introduction
Some studies have evaluated sono graphic quantification of the thenar muscle to indicate the severity of CTS. [1] However the morphometry may easily change with transducer pressure on the curved surface of the thenar region.

The aim of this study was to compare reliability and measurement between water bath technique (WBT) and the direct contact method (DM) in ultrasound quantification of thenar muscles and to determine whether measurements were influenced by transducer compression.

Methods
- This study included 40 healthy adults (19 men and 21 women; mean age, 37.8 years; range, 23 - 56 years). The abductor pollicis brevis (APB) of 80 hands was measured with axial ultrasound scans.
- The ultrasound evaluation was conducted using B-mode US equipment (Aplo™ MX SSA-780A: Toshiba Medical systems corporation, Otawara, Japan) with 8 MHz linear array transducer.
- Subjects were in relaxed sitting position with the elbow in 90°flexion, forearm in supination, hand in neutral position, and thumb in maximum abduction. WBT was performed in a plastic container filled with water. The forearm and hand were immersed in the container. (Figure 1A) The transducer was placed adjacent to the skin surface without touching it. DM was carried out with sufficient transmission gel and a transducer was placed on the skin surface without touching the skin as much as possible.
- A line was marked between the radial sesamoid bone of the thumb and the scaphoid tuberosity. An axial image was acquired at the midpoint of the line and the transducer and placed as perpendicular as possible to the flexor pollicis longus (FPL). (Figure 1B)

![Figure 1A. Measuring position](image1.png)

![Figure 1B. The line for measuring](image2.png)

The thickness and cross-sectional area (CSA) of the APB were calculated with the measurement function of the ultrasound device. In the axial image, the APB thickness was calculated on the perpendicular line of the most volar point of the first metacarpal bone. (Figure 2)

![Figure 2. Ultrasound image of thickness and CSA of APB](image3.png)

All subjects underwent three ultrasound examinations by two examiners to calculate the interclass correlation coefficients (ICC) for estimating inter- and intraobserver reliability. Bland-Altman analysis was carried out to compare the agreement between the methods.

Result
- Thickness and CSA of the APB by both methods showed almost perfect interobserver reliability (ICC range, WBT 0.90 - 0.94, DM 0.87 - 0.94) and intraobserver reliability (ICC range, WBT 0.94 - 0.96, DM 0.92 - 0.93). (Table 1)

| Table 1. Inter- and intraobserver reliability of the measurement in APB thickness and CSA (ICC values [95% confidence intervals]) |
|---|---|---|---|
| Observer 1 | WBT | DM |
| APB thickness | 0.89 (0.85–0.93) | 0.92 (0.88–0.94) | NS |
| APB CSA | 0.94 (0.91–0.97) | 0.93 (0.90–0.95) | NS |
| Observer 2 | WBT | DM |
| APB thickness | 0.87 (0.82–0.91) | 0.90 (0.86–0.93) | NS |
| APB CSA | 0.93 (0.93–0.98) | 0.94 (0.92–0.96) | NS |

Intraobserver
- APB thickness: 0.92 (0.87–0.93) 0.94(0.90–0.96) NS
- APB CSA: 0.93 (0.90–0.95) 0.96(0.93–0.97) NS

* Each ICC value between WBT and DM was considered as significant when the upper and lower boundaries of the 95% confidence intervals did not overlap. [2]
- The mean ± SD (WBT/DM) of APB thickness was 5.76 ± 0.90/5.83 ± 0.90 mm and CSA values were 0.88 ± 0.20/0.91 ± 0.21 cm².
- In the Bland-Altman analysis, measurements by WBT were found to overestimate the APB thickness by an average (limits of agreement) of 0.05 ± 0.38 mm, 0.01 ± 0.07 cm², respectively. However we did not show systematic bias between the WBT and DM measurements for neither the thickness nor CSA.

Discussion
- Some investigators have demonstrated that the pressure of the transducer affect the thickness of the muscle. [3]
- WBT is used to diagnose abscess, tendon injury, and fracture of the hand area when rendering with ultrasound image. It also helps to remove compression by a transducer. [4]
- In the current study, sonographic measurement of APB thickness and CSA showed no statistically significant difference between WBT and DM. This result indicates that use of sufficient transmission gel and careful transducer compression on the curved surface of the thenar area will have little influence on measurements of APB thickness and CSA.

![Figure 3. Bland-Altman Plotting](image4.png)

Conclusion
- The measurement difference between both methods could be very small if we use sufficient transmission gel and take compression by the transducer into consideration.

Reference