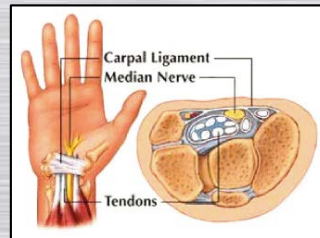


## INTRODUCTION

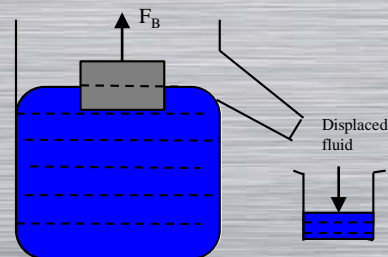
- Sleep disturbance and nighttime symptom prominence are well known carpal tunnel syndrome (CTS) phenomena.
- Up to 80% of patients with CTS demonstrate a decrease in sleep quality, and nocturnal swelling is a possible explanation.
- Physiologic nighttime swelling potentially impacts the pathologic process of CTS and many other hand pathologies; however, no study to date has been performed to test this assumption.
- The purpose of this study is to quantify the amount of normal hand volume fluctuation throughout the day in patients without hand pathology.



## MATERIALS & METHODS

- 36 healthy adult volunteers with no active hand pathology were enrolled.
- Hand volume measurements taken daily: 8AM, 2PM, and 8PM over a consecutive period of 3 days using the Baseline® Volumetric Measuring Device (Fabrication Enterprises Inc., White Plains NY)
- Zeroed → Hand Inserted to Webbing between long and ring finger → Displaced water collected in beaker and measured in a graduated cylinder
- Spearman correlations were used to determine the correlation of hand volume changes and age, gender, and BMI.
- Statistics were performed using SPSS Software (IBM SPSS Statistics, Armonk, NY).

### Archimedes Principle



## RESULTS

	All (n=36)	Male	Female
Age (years)	40.78	39.71	42
Sex	36	21	15
BMI	24.18	24.22189529	24.14853584
	Right	Left	
Handedness	33	3	

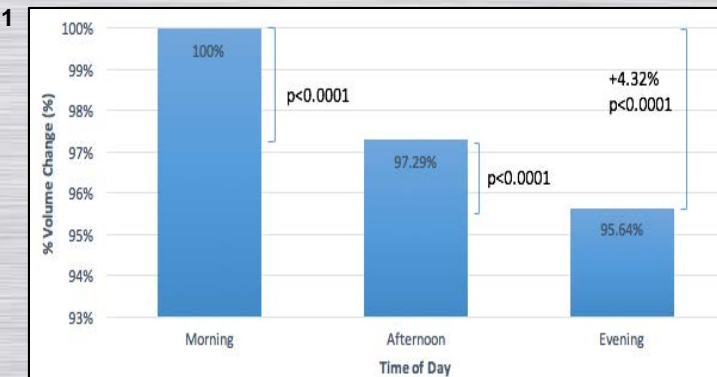
Table 1: Patient demographics. All values displayed as means except for sex and handedness.

- 36 healthy volunteers (Table 1)
- No volunteers were excluded due to active hand pathology or the presence of medical comorbidities

## RESULTS CONTINUED

- Mean hand volume decreased by 2.7% (13.11mL  $p < 0.0001$ ) from the morning to the afternoon and again by 1.6% (7.79mL,  $p < 0.0001$ ) from the afternoon to the evening (Figure 1).
- There was a resultant increase in hand volume overnight of 4.3% (20.90mL,  $p < 0.0001$ ) (Figure 1).
- Age, gender, and BMI were not associated with hand volume changes.

Figure 1



## DISCUSSION

- Diurnal fluctuation of pain with pathological processes such as compressive neuropathies are potentially affected by the volume of the limb.
- A consistent physiologic increase in hand volume occurs overnight in healthy individuals.
- These results support current assumptions and our hypothesis that hand swelling occurs overnight
- Most likely etiology is nocturnal fluid retention regulated by the circadian system.



- Lack of voluntary movement and interstitial/lymphatic return during sleep also likely play a role in nocturnal swelling
- Further investigation is needed to elucidate the etiology of nighttime sleep disturbance related to these findings and how this translates to specific disease processes.

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