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A Cross-Sectional Observational Study Testing Reliability and Validity for Tactile Acuity with Grid Localization in Healthy Individuals

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Study Design

Cross-sectional observational study testing reliability and validity

Purpose

The purpose of this research is to establish a protocol for testing grid localization and explore its reliability. Also we will look at its relation to a currently established tactile acuity measure of two-point discrimination (TPD).

Background

The somatosensory cortex can be altered in people who have chronic pain that results in an altered interpretation of sensory stimuli.^{1,2,3,4} Altered brain structure, neurochemistry, and changes in the activation pattern or cortical reorganization most likely play a role in the altered sensation. Tactile acuity is the ability to discern the sense of touch or stimuli and is a clear clinical signature of primary sensory cortex organization.⁵ Grid localization is a new assessment that can measure tactile acuity.

Methods

Participants completed consent and demographic forms

Participant assumed a prone position and exposed skin on low back

TPD

- One researcher conducted TPD testing at the L3 spinal level: 3 ascending and 3 descending on both right and left sides (total of 12 trials)

Grid

- Two separate researchers took turns conducting grid localization testing
- Grid was centered on participants back and bottom was in line with iliac crests
- Participants were given representation of the grid to reference during testing and familiarized with the squares before beginning
- Testing consisted of 12 squares being touched in random order and having the participant verbalize which square they believe was touched



Data Analysis

- Data was analyzed using IBM SPSS statistic version 25
- Means and frequencies were calculated for demographics data
- Pearson correlation coefficient: Grid scores vs TPD scores
- Intraclass correlation coefficients (ICC): Interrater reliability for grid localization

Results

- Demographics: total of 36 participants with a mean age of 23 (27 females and 9 males)
- Pearson's data analysis revealed a weak, negative correlation (Table 1)
- Intraclass correlation coefficient revealed a moderate reliability between testers (Table 2)
- Grid mean percentage correct: 78% (Table 3)

Table 1. Pearson Correlations between tactile acuity methods

Tactile Acuity Method	Pearson Correlation		P-value	
	Grid Researcher 1	Grid Researcher 2	Grid Researcher 1	Grid Researcher 2
TPD Ascend-descend	-0.242	-0.099	0.156	0.566

Table 2. Intraclass correlation coefficients: Comparisons to determine interrater reliability.

Grid Localization	ICC	P-value
	0.735	<0.001*

Table 3. Grid localization testing (n=36)

	Mean (%)	MDD (%)	SEM
Grid Localization	78.34	29	10.61

Conclusion

ICC average measures indicates a moderate level of reliability. Grid localization demonstrated good inter-rater reliability. The ICC value for grid average measures was 0.735, SEM was 10.61 and MDD was 29.41.

Limitations

Patient factors include body hair, fatigue, epidermis thickness and patient cooperation. BMI was found to have no correlation to either grid localization or TPD scores. Age was also a limitation because one's older age could lead to a decreased peripheral nerve function.⁶ Due to the small sample size and a mean age of 23, it is difficult to generalize results to all healthy individuals.

Clinical Relevance

This research demonstrated the new grid localization test has fair inter-rater reliability. TPD and grid localization test may assess different components of tactile acuity. TPD tests the ability to sense two nearby stimuli within one dermatomal level on either the right or left side of the subject,⁵ while grid localization is the sense of one stimulus location between both right and left sides along with multiple dermatomal levels. Just as the stimuli is being sensed differently at the dermatomal level, the sensory system is also sensing these stimuli differently. Therefore, TPD and grid localization may be evaluating different sensory systems of tactile acuity. This demonstrates the importance of utilizing TPD and grid localization when evaluating tactile acuity among patients, giving clinicians a wider understanding of the patient's somatosensory system. It has also been previously shown tactile acuity training may reduce pain in some conditions.^{5, 7, 8, 9, 10}

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