

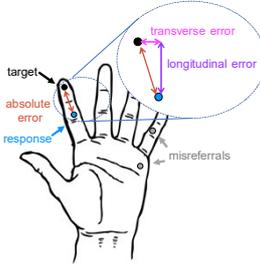
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Introduction

- Touch localisation—**locognosia**—is impaired following surgical repairs of the major nerves of the hand, yet our understanding of the nature of these impairments is limited.
- Available methods ignore or lack sufficient repeated measures necessary to reliably estimate **absolute and directional—transverse, longitudinal—error**.
- Available methods also tend to conflate measures of localisation error with **misreferrals**—large errors that span between digits, or between digits and the palm.



Aim

Develop a new test of locognosia that enables reliable measurement of absolute and directional error, and misreferrals, in patients with hand-nerve injuries.

Methods

Locognosia: Digital-Photograph Method



- The hand is blocked from participants view and points are marked with a UV pen.
- Points are made on the distal-pad of each finger, and on the radial side of the distal-pad of the thumb.
- Each point is stimulated using a 6.1 Semmes-Weinstein monofilament, with UV lighting on, and the participant uses a computer mouse to indicate their felt position on a photograph of their hand, taken with UV lighting off.
- The mean absolute and directional error are computed.
- Misreferrals—wherein responses are made to an incorrect digit or to the palmar surface of the hand—are analysed separately.

Locognosia: Marsh Method



- Standardised test of touch localisation after median/ulnar nerve repair, with established external validity, reliability, and sensitivity³.
- Zones are defined on the hand. Each zone is stimulated using a 6.1 Semmes-Weinstein monofilament while the hand is blocked from view.
- Participants verbalise the felt position of each stimulation, and responses are converted to a score according to whether the correct zone is reported.

Participants

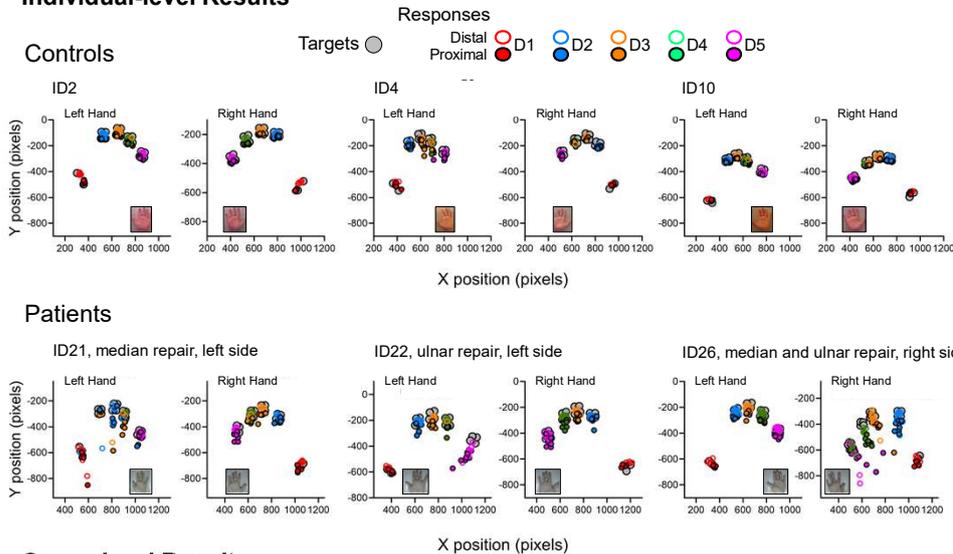
- Controls 'Group 1' — proof-of-concept**
N = 16; Age: mean = 26y, range: 20 – 41y; Gender: 11 female; Handedness: 11 right-handed.
- Controls 'Group 2' — replication test & comparison against nerve repair patients**
N = 25; Age: mean = 24y, range: 19 – 52y; Gender: 20 female; Handedness: 24 right-handed.
- Patients**
N = 14; Repair: median = 5, ulnar = 4, both = 5; Time since repair: mean = 34 mo., range = 8 – 82 mo.
Age: mean = 37, range: 23 – 68 y; Gender: 6 female; Handedness: 13 right-handed.

Rosén Sensory Score

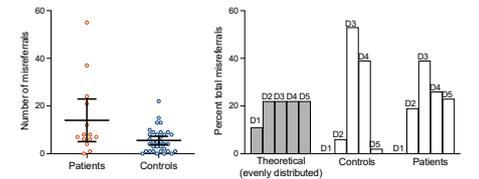
- Standardised test of hand function after median/ulnar nerve repair, with established validity, reliability, and sensitivity^{7,8}.
- Subtests include Semmes-Weinstein touch detection, two-point discrimination, shape-texture-identification, and the Sollerman hand function subtests 4, 8, and 10.

Results

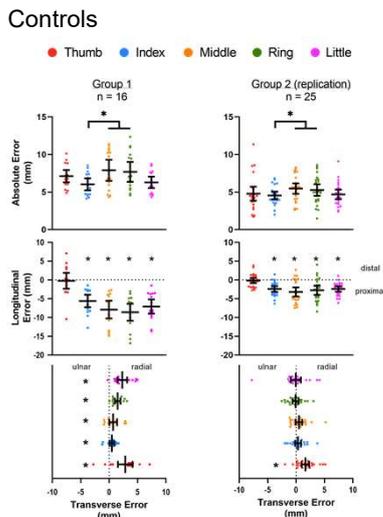
Individual-level Results



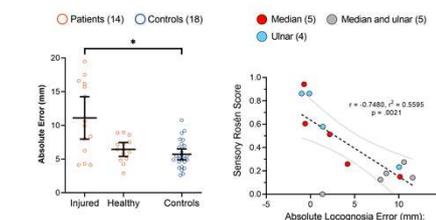
Misreferrals



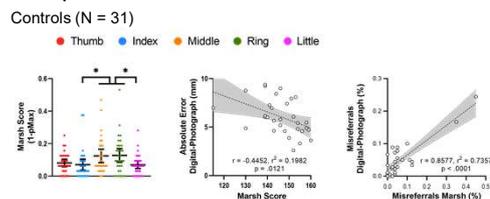
Group-level Results



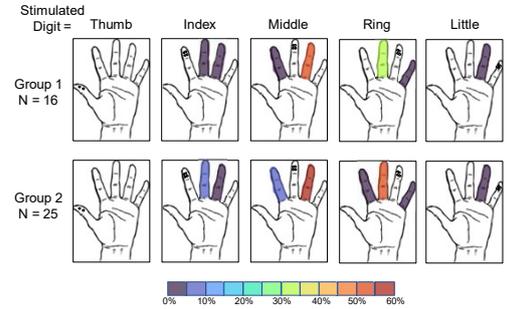
Patients vs. Controls



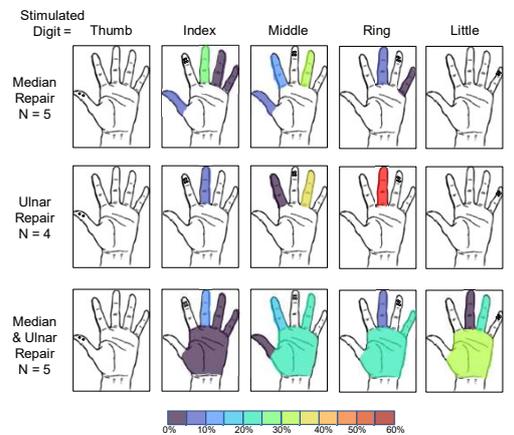
Comparison with Marsh Method



Controls



Patients



Discussion

- Our new method enables detailed characterisation of locognosia performance with high sensitivity and reliability, and is practical for use as a clinical research tool.
- Healthy controls show performance differences between the distal pads of the fingers. The index finger shows smaller absolute localisation error compared to the long and ring fingers, and this was observed across two independent groups.
- Patients show increased absolute localisation error within the injured nerve territory, and these effects correlate significantly with sensory Rosen scores. And, some individual patients show a high number and/or unique pattern of misreferrals.
- Patient results may help to understand changes in peripheral⁴ and/or central organisation⁵ after hand-nerve injury and repair.

References

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