An Innovative Sensory-Training Tool for Re-education Training in Patients with Multiple Sclerosis

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Abstract

Background: Multiple sclerosis (MS) patients suffer from sensory impairments. When involving the hands these sensory impairments can significantly interfere with daily tasks performance, especially tasks associated with fine-motor movements. Treatment approaches are limited, and sensory re-education technique, that was documented successfully in peripheral and central injuries, has not been studied in MS.

Objective: To develop a sensory-training tool that will be used as a treatment aid for sensory education, in order to improve upper limb functions in MS patients with related sensory impairments.

Subjects: MS patients with sensory impairments assessed by the Semmes-Weinstein monofilaments (MF) and the two-point discrimination (2pd.) tests.

Procedure: The sensory-training tool (STT) was developed after comprehensive overview of the sensory impairments in MS patients, assessment of various materials in different size and texture, applying various occupational-therapy fine-motor principles and integrating them with concepts for practical daily use. Using pre-final training tools where in patients gained expertise, patients were asked to interpret various sensations using prior knowledge regarding touch and praxis. The optimal final tool was constructed from 12 (2x1 cm in diameter) aluminum tubes, each covered with different material and/or texture. The next step was assessment of the tool using two sensory tests, before and after a training procedure.

Results: The results demonstrated sensory improvement by 16.5% up to 27.1% in the 2pd test and by 4.3% up to 12.5% in the MF test after 3 weeks of self-training using the STT.

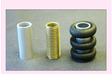
Conclusion: The use of the STT improved sensation skills in MS patients. We suggest the use of this tool in sensory rehabilitation.

Study Procedures & Results

1. Literature review related to sensory impairments in multiple sclerosis (MS), characterization and assessment of these impairments and treatment options like re-education techniques.
2. Sensory training tool (STT) development and construction by pilot observations of MS patients with sensory impairments handling different materials, with various shapes, scales and textures, in order to identify the appropriate sensory training tool.
3. Applying various occupational-therapy (OT) fine-motor principles and integrating them with concepts for practical daily use.
3. Clinical assessment of the sensory training tool in MS patients after a 3-week period of re-education and practice.

STT study design → Literature review → STT development & reconstruction → Integration of OT fine motor principles → STT clinical assessment

Materials, Textures, Shapes & Scales

Material	Texture	Shape	Scale
Plastic, Rubber, Paper, metal, Fabric, Wood, combined	Smooth, Rough, Soft, Stripe	Ball, Square, Hollow Tube	Large (8x5 cm) Small (2x1 cm)
			

Materials & Textures Subgroups: Grading difficulties of sensory recognition using variety of materials in different textures

1=Mild
2=Moderate
3=Severe

Practice: Feel, Touch & Discover

The Sensory-Training Tool - STT

Shape: 3 dimensional hollow tube elements
Scale: small, 2 cm x1 cm diameter
Materials & textures: variety of materials in friendly textures

Enables in-hand manipulation and the practice of fine-motor movements.
Easy to hold and handle.
Enables grading difficulties of texture recognition with individual adaptation.

Final Product Sensory Training Tool

The STT can be worn as a necklace

Additional Usage of The STT: Fine motor practice

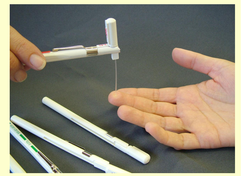
STT Clinical Sensory Assessment

Stage 1: MS patients were examined for sensory impairments using the threshold Semmes-Weinstein MF test and the constant 2pd test.
Stage 2: The first training session was mediated and instructed by a therapist and included familiarization with the tubes (touch – one or both hands, vision, naming). Then, patients were asked to recognize the tubes with closed eyes. During this stage patients underwent a process of sensory education by receiving feedback on their performance.
Stage 3: Patients practiced using the STT at home for 3 weeks; each training session was for ~15 minuets/day.
Stage 4: Sensory post-training examination was performed.

Sensory Tests

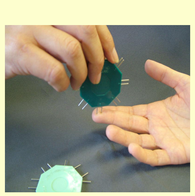
Threshold Semmes-Weinstein monofilaments test:

Tests light touch sensibility level
Uses 5 MF grading from 2.83 to 6.65 g force.
A sensory recognition level ≥3.61 is considered abnormal.
2.83 g - Normal
3.61 g - Diminished light touch
4.31 g - Diminished protective sensation
4.56 g to 6.65 g - loss of protective sensation
(Semmes et al, 1960)

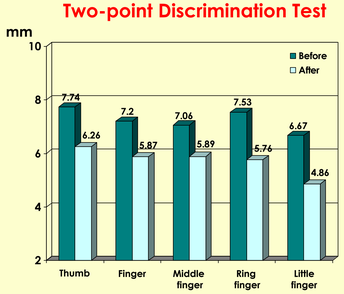


Constant Two-point Discrimination Test:

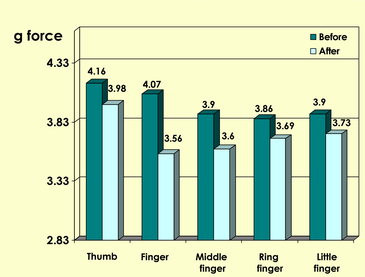
Determines the minimal distance at which a subject can discriminate between being touched with one or two points.
≥ 5 mm distance is considered abnormal.
5 mm - Mild (impairment)
6-10 mm - Moderate
11-15 mm - Severe
>15 mm - Very severe (One point).



Two-point Discrimination Test



Threshold Semmes-Weinstein MF Test



Conclusions

- The developed STT is easy to use and proved effective in sensory impaired MS patients.
- The use of the STT improved sensation skills both for MF and the 2pd tests.
- We suggest the use of this tool in sensory rehabilitation.
- Within the near future we intend to further evaluate the efficiency of the STT on fine motor skills