# 자세교정 도수치료의 정량화를 위한 장갑형 압력피드백 센서 개발 및 임상적 타당성 연구

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# Clinical Feasibility of a Newly Developed Glove-type Pressure Feedback Sensor for Manual orthotherapy

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## Abstract

The purpose of this study was to develop a glove-type wearable pressure sensor with a real-time feedback application for manual orthotherapy and to examine its clinical feasibility for physiotherapists. Study results revealed the sensor's possibilities for clinical use, building therapeutic guidelines for different treatment areas, and setting patient-centered pressure ranges for manual therapy.

## 1. Introduction

Manual orthotherapy is one of the evidence-based, effective treatment techniques used in rehabilitation medicine to treat various musculoskeletal pain and disability [1]. However, numerous systemic reviews have reported questionable reliability and validity of the force applied by therapists and the need for quantifying the pressure and duration of manual orthotherapy [1]. The latest research on validation of palpation assessment stated that there currently is no consensus on objective method to grade manual pressure palpation [2]. Despite medical educations and instructions, the subjective nature of palpation and manual contact inevitably leads to variability in the method, interpretation, and intensity during assessments and treatments using manual pressure. Therefore, this study developed a wearable glove-type pressure feedback sensor to quantify therapeutic pressure and examine its clinical feasibility.

## 2. Methods

Our glove-type pressure feedback sensor was developed with 4 channels using FSR-402 to be located on the finger pads of the thumb, index finger, middle finger, and over the pisiform area on the palm as illustrated in Fig. 1. Atmega328 micro controller unit (Atmel Co., USA) was used to convert analog signals to digital data and to transfer them to our smart monitoring application using Bluetooth communication. The operation voltage was 3.7 V. Data were sampled at 11 Hz and collected from 4 patients with fibromyalgia (male: 1, female: 3, mean age: 32 ± 18.52

yrs.) during their manual orthotherapy sessions. Table 1 shows the results from each patient. Signal processing was performed using moving average filter (5 point) for smoothing and local maxima algorithm was used for peak detection and calculation of the peak average.
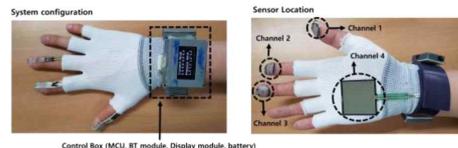


(Fig 1) Glove-type pressure feedback sensor

## 3. Results

Table 1 shows the peak pressure average (Pr) detected during manual orthotherapy on each muscle (sternocleidomastoid (SCM): 15.67, upper extremity (UE): 12.77, quadriceps (Qd): 7.05, upper trapezius (UT): 7.60, Hamstring (Hams): 9.68 in average) and the most used sensor channel is indicated (1 and 4) with regional treatment duration in seconds.

(Table 1) Result of each muscle data using glove-type pressure feedback sensor

| | Therapy Area | | | | |
|---|---|---|---|---|---|
| | (mV) | SCM | UE | Qd | UT | Hams |
| 1 | Pr | 11.99 | 13.05 | 6.86 | 7.53 | 8.41 |
| | Ch | 1(113s) | 1(128s) | 4(82s) | 4(62s) | 4(57s) |
| 2 | Pr | 15.82 | 10.14 | 7.06 | 7.29 | 8.56 |
| | Ch | 1(92s) | 1(54s) | 4(71s) | 4(89s) | 4(55s) |
| 3 | Pr | 22.18 | 14.25 | 7.7 | 7.99 | 12.06 |
| | Ch | 1(61s) | 1(26s) | 4(52s) | 4(190s) | 4(61s) |
| 4 | Pr | 12.69 | 13.64 | 6.59 | | |
| | Ch | 1(203s) | 1(64s) | 4(99s) | | |

Pr: pressure, Ch: channel, SCM: sternocleidomastoid, UE: upper extremity, Qd: quadriceps, UT: upper trapezius, Hams: hamstring

Pain measured by visual analogue scale showed to decrease after therapy (6.5 to 2 in average).

## 4. Conclusions

Our glove-type pressure feedback sensor can be applied in manual orthotherapy for real-time quantification of the therapeutic pressure as well as for rehabilitation assessment in clinical setting.

## Reference

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