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Manual therapy improves symptom severity and disability in patients with carpal tunnel syndrome

Terapia manualna zmniejsza intensywność objawów i poziom niepełnosprawności u pacjentów z zespołem cieśni nadgarstka

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Abstract

Aim: The aim of the study was to assess early outcomes of manual therapy in patients with carpal tunnel syndrome. **Materials and methods:** In this study, patients diagnosed with electrophysiologically confirmed carpal tunnel syndrome received manual therapy. The therapy was used in 41 individuals who received one session in line with IFOMPT (International Federation of Orthopaedic Manipulative Physical Therapists) standards per week for 5 weeks. Grip strength was assessed using a dynamometer, disability was assessed using the DASH (Disability of Arm, Shoulder and Hand) questionnaire, and the quality of life was assessed using VASEQ5D5L (Visual Analog Scale of the 5-level EQ-5D). Data was collected before the first treatment and one week after the last treatment. **Results:** We observed significant change in DASH score and quality of life. Grip strength tended to improve, but the effect was statistically significant only in patients over 50 years of age. Symptom severity (Carpal Tunnel 6 score, Douleur Neuropathique 4 score and peripheral cutaneous threshold assessed with Semmes–Weinstein monofilament) improved significantly. There was no significant correlation between changes in DASH score and grip strength. **Conclusion:** Manual therapy significantly improves quality of life and reduces upper limb disability in patients with carpal tunnel syndrome.

Keywords: carpal tunnel syndrome, conservative treatment, manual therapy, quality of life

Streszczenie

Cel: Celem pracy była ocena wczesnych efektów terapii manualnej u pacjentów z zespołem cieśni nadgarstka. **Materiał i metody:** W niniejszym badaniu pacjenci z potwierdzonym elektrofizjologicznie rozpoznaniem zespołu cieśni nadgarstka zostali poddani terapii manualnej. Terapię przeprowadzono u 41 osób, które zgodnie ze standardami IFOMPT (International Federation of Orthopaedic Manipulative Physical Therapists) uczestniczyły w jednej sesji terapii manualnej tygodniowo przez 5 tygodni. Siłę chwytu pacjentów oceniano za pomocą dynamometru, niepełnosprawność – za pomocą kwestionariusza DASH (Disability of Arm, Shoulder and Hand), a jakość życia – za pomocą VASEQ5D5L (Visual Analog Scale of the 5-level EQ-5D).

Oceny dokonano przed pierwszą sesją terapii i tydzień po ostatnim zabiegu**. Wyniki:** Zaobserwowano istotną poprawę jakości życia i wyników oceny niepełnosprawności. Siła chwytu wykazywała tendencję do poprawy, jednak efekt był istotny statystycznie u pacjentów w wieku powyżej 50 lat. Nasilenie objawów (Carpal Tunnel 6, Douleur Neuropathique 4 i próg czucia powierzchownego oceniany za pomocą monofilamentu Semmesa–Weinsteina) znacznie się poprawiły. Nie stwierdzono korelacji między zmianą nasilenia niepełnosprawności wg kwestionariusza DASH a siłą chwytu. **Wniosek:** Terapia manualna znacząco poprawia jakość życia i zmniejsza niepełnosprawność kończyny górnej u pacjentów z zespołem cieśni nadgarstka.

Słowa kluczowe: zespół cieśni nadgarstka, leczenie zachowawcze, terapia manualna, jakość życia

INTRODUCTION

Carpal tunnel syndrome (CTS) is a common upper limb nerve entrapment syndrome. It causes significant economic and social burden to those affected. The annual incidence of CTS is 428 in women and 182 in men per 100,000 adults (Atroshi et al., 2011). The prevalence is 3–5% in the general population, with up to 6% of affected women over the age of 40 years (Atroshi et al., 1999; Gelfman et al., 2009; Mondelli et al., 2002; Tadjerbashi et al., 2019). Repetitive movements, exposure to vibration, prolonged dorsal or palmar flexion of the wrist (this increases pressure in carpal tunnel) and changes in dimensions of the carpal tunnel are potential causes of CTS. There are many other possible aetiological factors, with all of them ultimately leading to reversal of pressure gradient in the carpal tunnel, which interrupts nerve blood supply and axonal transport, causes nerve oedema, release of proinflammatory mediators and insertion of abnormal ion channels. Reduced space inside the carpal tunnel, which disturbs the spatial relationship between its contents, causing symptoms distal from the injury site, is the main feature of CTS. The severity of CTS can vary widely between patients, ranging from mild symptoms, such as transient paraesthesia or sensory disturbances, to night aches, sleep disturbances, muscle weakness, and constant pain. Diagnostic work-up should include medical history (including symptoms, family conditions, lifestyle, type of work), neurophysiological examination and provocative tests, including Tinel's sign and Phalen's test (Gołąbek and Majcher, 2018). Tests using a neurotip or a pin to assess sensation and a warm and cold coin to test the threshold of temperature sensation may be additional diagnostic tools for the assessment of thin unmyelinated fibres (Ridehalgh et al., 2018). This study aimed to evaluate early effects of manual therapy on upper limb disability and other parameters that may be associated with CTS.

MATERIALS AND METHODS

In this study, CTS patients (diagnosis confirmed by electrophysiological test – electroneurography, ENG) received manual therapy. A total of 41 patients divided into two groups depending on age (over and under the age of 50 years) received the treatment. The rationale for this division was different characteristics of young and older patients. Younger patients tend to develop more severe clinical symptoms, while older patients have more intense pathophysiological processes in ENG (Aghda et al., 2020). The patients received one manual therapy per week for five weeks. Exclusion criteria included diabetes, thyroid diseases, upper limb trauma in the past 12 months and pregnancy. The therapy was conducted according to International Federation of Orthopaedic Manipulative Physical Therapists (IFOMPT) standards (Rushton et al., 2016). On the first treatment day, the patients were examined by a physical therapist, including medical history and physical examination, then individual treatment plan was established. Apart from self-neuromobilisation exercises performed at home, the therapy consisted only of passive treatment including, but not limited to: carpal joint mobilisations, sliders and tensioners of the median and ulnar nerves, cervical lateral glide, mobilisations in the regions of scalene triangle, subpectoral space and other. We used a hand-held digital dynamometer to measure grip strength, Semmes–Weinstein monofilaments, size 2.83 (0.07 gram), to assess cutaneous perception threshold, the Disability of Arm, Shoulder and Hand (DASH) questionnaire to measure disability, and the Visual Analog Scale of the 5-level EQ-5D (VASEQ5D5L) to assess the quality of life. Symptom severity was evaluated with Six-Item CTS Symptoms Scale (CTS6) and Douleur Neuropathique 4 (DN4). Data was collected before the first treatment and one week after the last treatment. The therapist and patients were not blinded because the assumption was to mirror the clinical conditions as closely as possible, including medical history and physical examination. One therapist was involved in the treatment process. Written consent was acquired from patients before treatment initiation, and the study was approved by the bioethical committee. Statistical calculations were performed using the R v.4.1.1 statistical computing environment (R Core Team, 2021). The significance level was set at $\alpha = 0.05$.

RESULTS

The applied intervention reduced the severity of symptoms based on CTS6 and DN4

Change in CTS6

The treatment of CTS patients <50 years allowed for a statistically significant reduction in the severity of symptoms

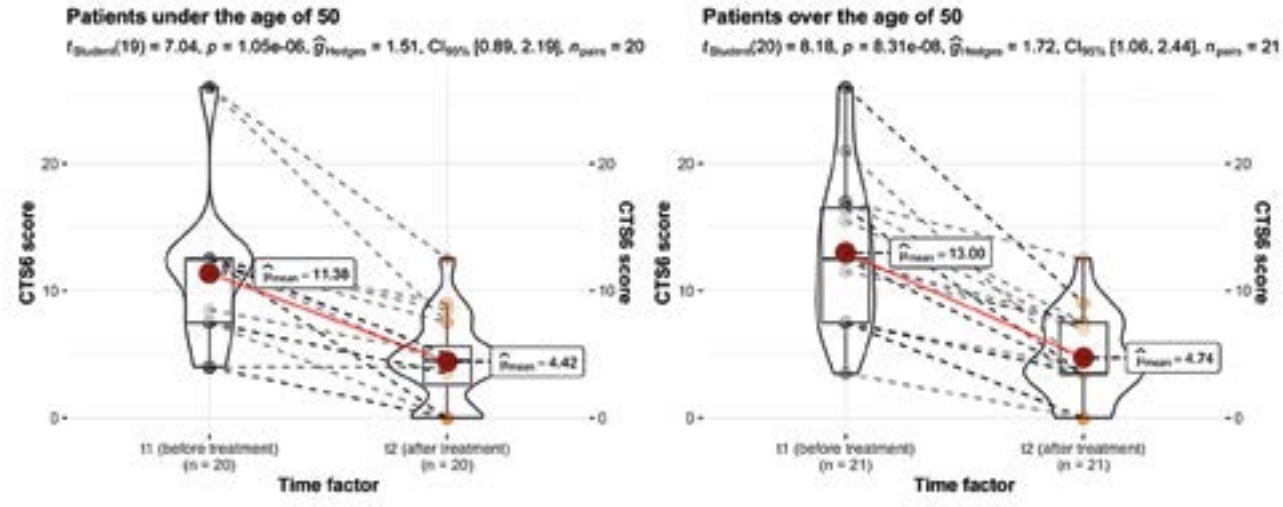

Fig. 1. Differences in means between the carpal tunnel syndrome (CTS6) score before and after treatment by the patient's age

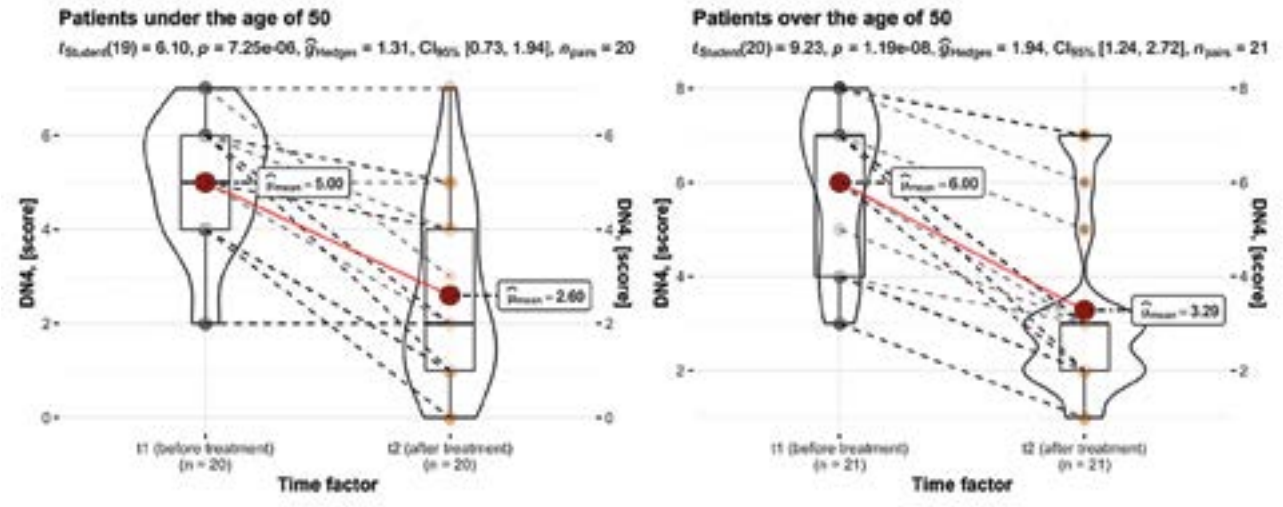

Fig. 2. Differences in means between the Douleur Neuropathique (DN4) score before and after treatment by the patient's age

according to CTS6 from M = 11.38, standard deviation (SD) = 5.95 at baseline to M = 4.42, SD = 3.43 after treatment; $t_{Student}(19) = 7.04$, $p < 0.001$, $g_{Hedges} = 1.51$. The treatment of CTS patients >50 years allowed for a statistically significant reduction in the severity of symptoms according to CTS6 from M = 13.00, SD = 6.20 at baseline to M = 4.74, SD = 3.40 after treatment; $t_{Student}(20) = 8.18$, $p < 0.001$, $g_{Hedges} = 1.72$ (Fig. 1).

Change in DN4

The treatment of CTS patients <50 years allowed for a statistically significant reduction in the severity of symptoms according to DN4 from M = 5.00, SD = 1.41 at baseline to M = 2.60, SD = 1.93 after treatment; $t_{Student}(19) = 6.10$, $p < 0.001$, $g_{Hedges} = 1.31$. The treatment of CTS patients >50 years allowed for a statistically significant reduction in the severity of symptoms according to DN4 from M = 6.00, SD = 1.70 at baseline to M = 3.29, SD = 1.93 after treatment; $t_{Student}(20) = 9.23$, $p < 0.001$, $g_{Hedges} = 1.94$ (Fig. 2).

Manual therapy increased the strength of the grip and improved the cutaneous perception threshold

Change in grip strength

The treatment of CTS patients <50 years only led to a non-statistically significant tendency to increase in strength from M = 22.64 kg, SD = 8.52 kg at baseline to M = 24.75 kg, SD = 7.94 kg after treatment; $t_{Student}(19) = -1.65$, $p = 0.115$, $g_{Hedges} = -0.35$. The treatment of CTS patients >50 years allowed for a statistically significant increase in strength from M = 20.82 kg, SD = 8.55 kg at baseline to M = 24.29 kg, SD = 9.34 kg after treatment; $t_{Student}(20) = -5.04$, $p < 0.001$, $g_{Hedges} = -1.06$ (Fig. 3).

Change in cutaneous perception threshold

The treatment of CTS patients <50 years allowed for a statistically significant increase in cutaneous perception from

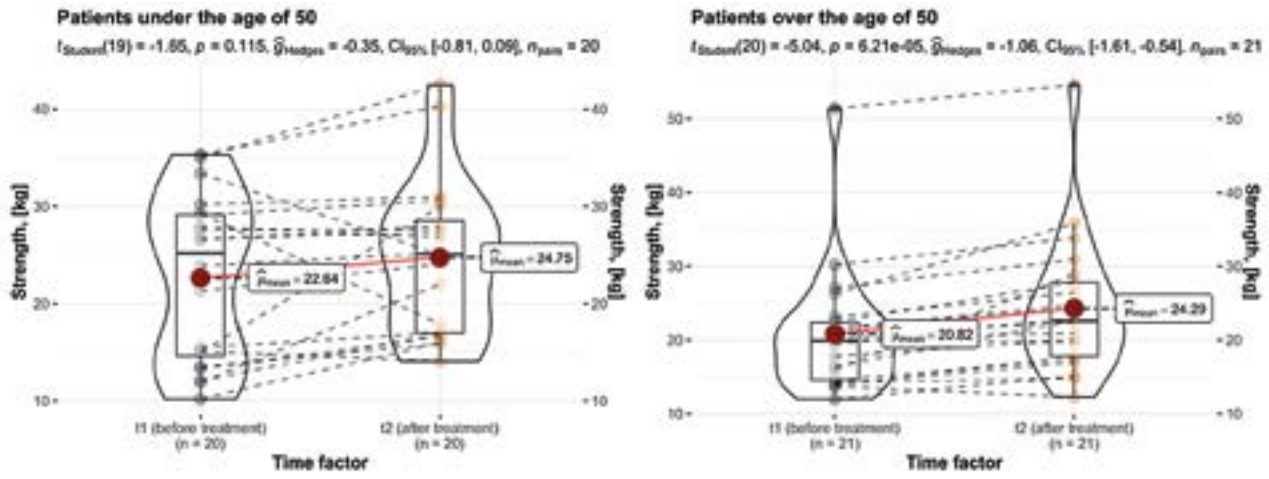

Fig. 3. Differences in means between the strength before and after treatment by the patient's age

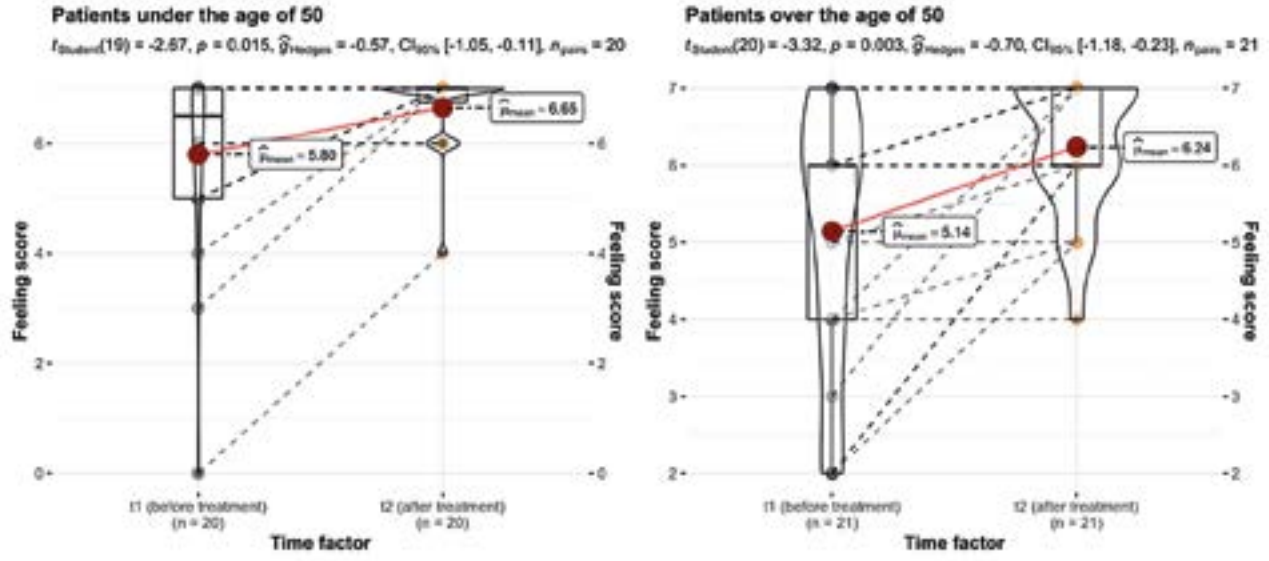

Fig. 4. Differences in means between the cutaneous perception threshold before and after treatment by the patient's age

M = 5.80, SD = 1.79 at baseline to M = 6.65, SD = 0.75 after treatment; $t_{Student}(19) = -2.67$, $p = 0.015$, $g_{Hedges} = -0.57$. The treatment of CTS patients >50 years allowed for a statistically significant increase in cutaneous perception from M = 5.14, SD = 1.74 at baseline to M = 6.24, SD = 0.89 after treatment; $t_{Student}(20) = -3.32$, $p = 0.003$, $g_{Hedges} = -0.70$ (Fig. 4).

The applied intervention contributed to reduced disability (DASH)

The treatment of CTS patients <50 allowed for a statistically significant reduction of disability according to DASH from M = 32.03, SD = 20.17 at baseline to M = 24.68, SD = 21.35 after treatment; $t_{Student}(19) = 3.89$, $p < 0.001$, $g_{Hedges} = 0.84$. The treatment of CTS patients >50 years allowed for a statistically significant reduction of disability according to DASH from M = 34.13, SD = 27.18 at baseline to M = 17.12, SD = 10.87 after treatment; $t_{Student}(20) = 3.65$, $p = 0.002$, $g_{Hedges} = 0.77$ (Fig. 5).

The applied intervention improved the quality of life (VASEQ5D5L)

The treatment of CTS patients <50 years allowed for a statistically significant improvement in the quality of life according to VASEQ5D5L from M = 68.25, SD = 14.17 at baseline to M = 73.75, SD = 15.55 after treatment; $t_{Student}(19) = -3.49$, $p = 0.002$, $g_{Hedges} = -0.75$. The treatment of CTS patients >50 years allowed for a statistically significant improvement in the quality of life according to VASEQ5D5L from M = 73.43, SD = 18.97 at baseline to M = 79.33, SD = 12.29 after treatment; $t_{Student}(20) = -2.69$, $p = 0.014$, $g_{Hedges} = -0.56$ (Fig. 6).

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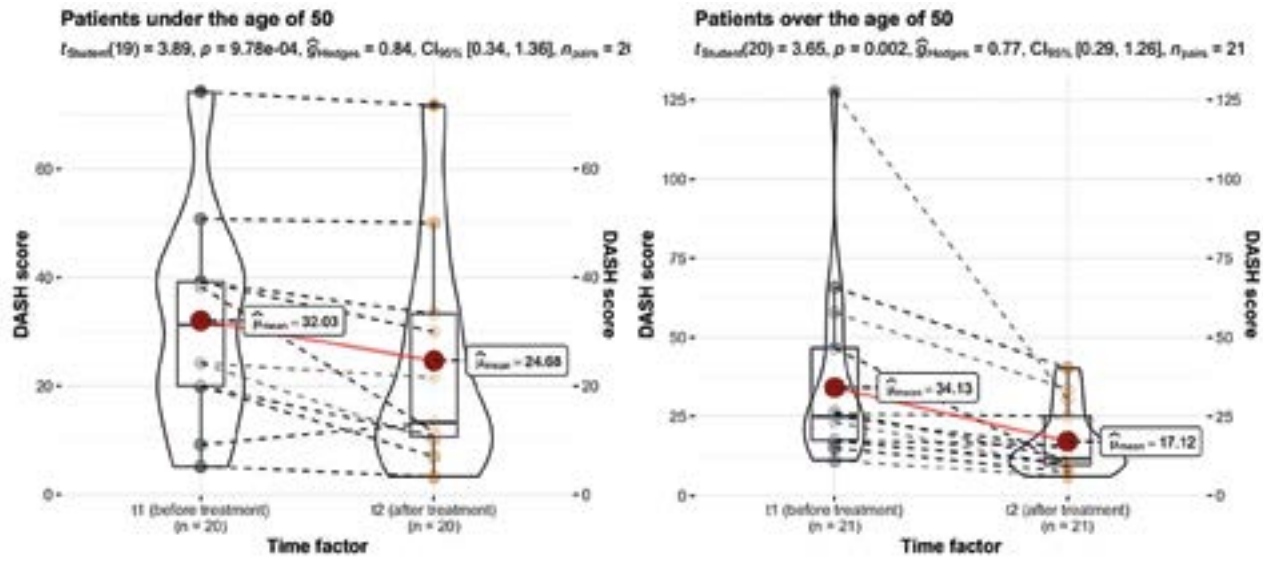

Fig. 5. Differences in means between DASH before and after treatment by the patient's age

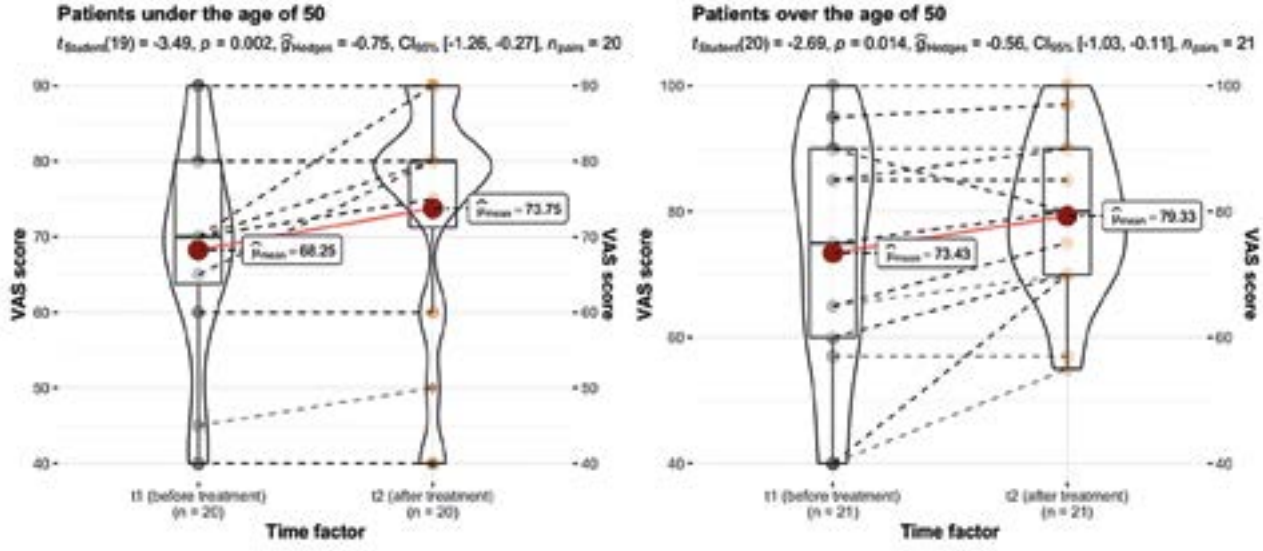

Fig. 6. Differences in means between the quality-of-life assessment scores from the EQ5D5L questionnaire before and after treatment by the patient's age

DISCUSSION

The inclusion of manual therapy in the clinical practice guidelines for the treatment of CTS is a novelty, as no such treatment was included in 2016 (Graham et al., 2016). This status changed in 2019 (Carpal tunnel syndrome: a summary of clinical practice guideline recommendations…, 2019), necessitating further research. According to the Guidelines, manual therapy can provide short-term relief in patients with mild to moderate CTS (Carpal tunnel syndrome: a summary of clinical practice guideline recommendations…, 2019). We have also observed this effect in our studies, but to eliminate short-term neuro-modulatory effects, e.g. arthrogenic muscle inhibition (Lepley and Lepley, 2022), we took our measurements one week after the last treatment. Follow-up and further assessment of measured parameters will define if these effects are only short term or long term. In their recent article, Fernández-de-Las-Peñas et al. (2020) concluded that parameters such as symptom severity, pain and functional status at four-year follow-up resulted in similar outcomes compared with surgery. The outcome of this study indicates that manual therapy has a positive influence and can be a valuable treatment option for patients with CTS. Although this study had no control group, it is unlikely for CTS symptoms to significantly improve on their own over such a short period of time, as indicated in a study on the natural course of CTS (Puchalski et al., 2017). It seems to be important to combine different manual therapy techniques, as using only neurodynamic moblilisations does not significantly improve symptom severity, distal motor

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latency and grip strength (Núñez de Arenas-Arroyo et al., 2021); however, it positively influences pain and functioning of patients with CTS. Results of this meta-analysis are in line with clinical framework and guidelines, which describe neuromobilisations as a mere element of comprehensive treatment. The supposed joint interaction of neural structures and what is known as mechanical interface is the rationale for such approach. Mechanical interface is what surrounds the nervous system. It consists of tendons, muscles, bone, intervertebral discs, ligaments, fascia, and blood vessels. In our study, we have not observed significant changes in the grip strength in the younger group of patients; however, the strength of our patients compared to normative reference values (Wang et al., 2018) was within normal range, thus it probably accounts for the lack of significant change in grip strength. Maybe this fact also explains the lack of correlations between the grip strength and disability, as strength is within the normal range and is not a limiting factor. The same was observed by Wolny and Linek (2019). Patients achieved an increase in conduction velocity, improvement of symptoms, but no increase in grip strength. This may indicate that symptom severity (DN4, CTS6, peripheral cutaneous threshold) is the most debilitating factor in terms of CTS-related disability. It is exactly what patients have reported in Puchalski et al. (2017), and what can be found in Aghda et al. (2020), who reported that younger patients with CTS have generally more severe symptoms, while older patients tend to have more intense pathophysiologic changes in ENG. In our study, we can observe a trend towards increase in strength in the older group, and this difference between groups can be explained by these findings. This study was limited by the lack of control group and the lack of blinding patients and the therapist. Although lack of blinding may introduce bias, it may be impossible for a manual therapist to perform treatment closely resembling the therapy under clinical settings while blinded (Kamper, 2018). A recent meta-analysis of six studies highlights the effectiveness of manual therapy techniques, including neuromoblisations, on improving pain, physical function and nerve conduction (Jiménez-Del-Barrio et al., 2022). The results of this meta-analysis further prove that manual therapy techniques can be used as safe, and most importantly, effective treatment for CTS.

CONCLUSION

Manual therapy significantly improves the quality of life, decreases the severity of symptoms, and reduces upper limb disability in patients with CTS. This method of conservative treatment also improves cutaneous perception and strength, although the improvement of strength was significant only in patients over 50 years of age. Manual therapy in line with the IFOMPT standards can be successfully offered to patients waiting for surgery or with contraindications to surgery. Manual therapy seems to be a valuable supplement of other CTS treatment options, but further studies are needed to confirm this thesis.

Conflict of interest

The authors have no conflicts of interest to declare that are relevant to the content of this article.

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