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ORIGINAL ARTICLE

Mean Pain Score Before and After Wrist Splinting for Carpal Tunnel Syndrome Presenting to Orthopedic Department Hayatabad Medical Complex, Peshawar

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ABSTRACT

Median nerve neuropathy, often known as carpal tunnel syndrome (CTS), is a pathological condition that develops when the median nerve becomes entrapped within the carpal tunnel, resulting in pain, numbness, and tingling sensations. The most popular non-surgical procedure right now is splinting the wrist with a rigid splint, mainly at night and occasionally in conjunction with other therapies.

Objective: To determine mean change in pain score before and after wrist splinting for carpal tunnel syndrome presenting to orthopedic department Hayatabad Medical Complex, Peshawar.

Methods: This Quasi Experimental Study (Uncontrolled Trial) was held in the Orthopedic Department Hayatabad Medical Complex Peshawar for six months duration from 5th September 2020 to 6th March 2021 after approval of synopsis. A total of 60 patients with CTS were included in the study in a consecutive manner and subjected to wrist splinting. Baseline and follow up pain scores were measured at 6th post splinting week.

Results: The mean age of the sample was 42.3 + 12.8 years. While distributing the patients with regards to gender, we observed that in our study 65% of the sample was male and 35% were female gender. The mean BMI was 25.2 + 3.4kg/m2 and 13.3% of sample was diabetic. Mean use of splint / day was 5.3 + 2.2 hours and 43.3% used ibuprofen as analgesic. Mean baseline pain score of the sample was 8.9 + 0.9 and mean follow up pain score at 6th week of splint use was 4.2 + 1.5 ($p < 0.001$).

Conclusion: Wrist splinting is an effective conservative treatment for CTS in terms of significant pain relief after 6 weeks and is not dependent upon BMI, gender, diabetes or type of NSAIDs used. However, our study sample size was too small to draw conclusions there is no evidence of functional improvement after splinting. We recommend more studies (interventional) on large sample size and taking into account pain as well as functional assessment to develop future guidelines for the treatment of CTS using wrist splinting

Keywords: Carpal tunnel syndrome, Splinting, diabetes, Body mass index, Pain, Visual analogue scale.

INTRODUCTION

Carpal tunnel syndrome (CTS), also known as median nerve neuropathy, is a pathological disease that develops when the median nerve becomes trapped within the Carpal Tunnel, resulting in pain, numbness, and tingling sensations in the hands and arms[1-2]. 3.8% of the general population has CTS, the most common entrapment neuropathy. The patient may wake up numerous times throughout the night when symptoms and accompanying discomfort reach their climax. The median nerve is located anterior to the flexor tendons and just below the palmaris longus tendon in the carpal tunnel[3-4]. The median nerve will be compressed against the transverse ligament encircling the tunnel's roof under circumstances that reduce the tunnel size or enlarge the structures inside of it. Such situations may develop as a result of trauma, a congenital condition, or inflammatory or systemic effects, rheumatoid arthritis, diabetes mellitus, hypothyroidism, acromegaly, tenosynovitis and pregnancy are among the conditions that have been linked to CTS. To address CTS, both non-invasive and surgical methods are employed. Splinting, steroids, activity moderation, non-steroidal anti-inflammatory medications, diuretics, vitamin B-6, and other treatments are considered conservative[5]. However, only splinting and steroids are backed by high quality evidence when it comes to the conservative methods.

CTS treatment aims to reduce symptoms and enhance hand function. The most popular non-surgical procedure right now is splinting the wrist with a rigid splint, mainly at night and occasionally in conjunction with other therapies[6-7]. There is some evidence that wrist splinting may be useful in the short term, but the evidence is generally limited, it is unclear how long treatment should last, and the effectiveness in the long term has not been proven. In trials that compared wrist bracing with surgery, the advantage of bracing itself has frequently been small and of short duration, but the benefit has frequently been increased by significant cross-over to surgery[8-9]. The justification for wrist braces is that they stop wrist flexion, which is known to raise pressure in the carpal tunnel. However, there isn't enough solid data to support the length of splinting that is routinely utilized in clinical practice (4 to 6 weeks). Splinting the wrist for such a brief period of time may not have a significant long-term impact on the pathophysiological elements contributing to the development of CTS[10].

In one study, the mean pain score at baseline was 8.08 + 1.78 which reduced to 4.42 + 2.19 at 6th week of wrist splinting. In another study, the mean baseline pain score was 6·12 + 2.21 which reduced to 4·28 + 2.73 with six weeks of splinting[11]. In another study, clinically excellent results were seen in 15 hands (14.2%), fair in 19 hands (17.9%), good in 51 hands (48.1%) and 21 hands (19.8%) exhibited poor results according to visser's classification after the wrist splint therapy for CTS[12].

The present study aims to determine the mean pain before and after wrist splinting for CTS. The magnitude of CTS is on the rise throughout the globe and apart from other morbidities, it can significantly reduce the quality of life of patients living with it[13]. Moreover, although wrist splinting is recognized as first line treatment for CTS but evidence of its efficacy in terms of reduction in pain is not produced locally and the choice of treatment varies from one population to another. This study will give us an estimate of pain score before and after wrist splinting for CTS. The results of this study will give us local magnitude of the problem and will be shared with other local surgeons and further research studies will be recommended.

METHODS

This Quasi Experimental Study (Uncontrolled Trial) was held in the Orthopedic Department Hayatabad Medical Complex Peshawar for six months duration from 5th September 2020 to 6th March 2021 after approval of synopsis.

Study sample size; Sample size was 60 selected by non-probability consecutive sampling technique on the basis of following assumptions; Mean and SD of pain at baseline: 6.12 + 2.2112. Mean and SD of pain at 6th week of splinting: 4.28 + 2.7312, Statistical significance: 5%, Power: 80%

Inclusion Criteria:

1. Age above 20-60 years.
2. Both genders.
3. All patients with CTS as per operational definition and pain of more than 7 on VAS.
4. Minimum duration of symptoms is 6 weeks.

Exclusion Criteria:

1. Patients with history of fracture of forearm or wrist in last 6 months
2. Patients with intervention for CTS done in last 4 months

The above-mentioned factors act as confounders and if not excluded can create bass in study.

The hospital's ethics committee's approval was taken. Patients who met the inclusion criteria were selected. Patients who had CTS for at least 6 weeks and pain more than a 7 on the VAS were chosen from the outpatient department (OPD). The procedure's goal, the usage of the data, and the publication of the study were all described to all of the enrolled patients. The patients' signed informed consent was attained.

Name, sex, age and address were all documented along with other demographic data. Comprehensive history and physical examination were done in all patients. Both general and specific investigations were conducted. All the patients were subjected to wrist splinting and advised to wear it throughout night and no working hours of the day. All patients were advised NSAIDs and physical therapy to continue throughout the splinting period. All patients were followed to determine the pain score on VAS at 6th week follow up. All the observations were performed by the trainee under supervision of single experienced surgeon having > 7 years' experience to diagnose CTS

All the result was followed by myself and all the above-mentioned information's was recorded in a pre-diagnosed proforma.

Data collected was analyzed using SPSS version 20. Mean + SD was calculated for numerical variables like age, BMI, hours of splint used/day, baseline pain and follow up pain. Frequencies and percentage for categorical variables like type of gender, type of NSAID used and diabetes status. Mean pain before and after splinting was compared with paired T test with p value of < 0.05 as significant. Mean change in pain score was stratified with regards to age, BMI, hours of splint use/day, type of NSAID used and DM to see effect modification using independent sample T test or ANOVA (according to categories of independent variables) with p value of < 0.05 as significant.

RESULTS

The study was conducted on 60 patients with CTS subjected to wrist splinting. The mean age of the sample was 42.3 + 12.8 years. (See table 1 for age categories)

Table 1: shows the age-wise distribution of sample (n=60)

Age Categories	Frequency	Percent
Total	26	43.3
> 40-60 years	34	56.7
Total	60	100.0

While distributing the patients with regards to gender, we observed that in our study 65% of the sample was male and 35% were female gender. (Table 2).

Table-2: shows the gender wise distribution of patients

Gender	Frequency	Percent
Male	39	65.0
Female	21	35.0
Total	60	100.0

The mean BMI was 25.2 + 3.4kg/m2 (see table 3 for categories).

Table-3: shows the BMI of patients

BMI (kg/m^2)	Frequency	Percent
20-24.5	25	41.7
> 24.5-29.9	28	46.7
> 29.9-33	7	11.7
Total	60	100.0

13.3% of sample was diabetic (table 4).

Table-4: shows the patients with diabetes

DM	Frequency	Percent
Yes	8	13.3
No	52	86.7
Total	60	100.0

Mean use of splint / day was 5.3 + 2.2 hours (see table 5 for categories) and 43.3% used ibuprofen as analgesic (table 6).

Table-5: shows the duration of splint use per-day

Splint use hours/day	Frequency	Percent
3-6 hours	41	68.3
> 6-9 hours	19	31.7
Total	60	100.0

Table-6: shows the NSAIDS use among patients

Type of NSAID used	Frequency	Percent
Ibuprofen	26	43.3
Naproxen	23	38.3
Aspirin	11	18.3
Total	60	100.0

Mean baseline pain score of the sample was 8.9 + 0.9 and mean follow up pain score at 6th week of splint use was 4.2 + 1.5 ($p < 0.001$). See table 7.

Table-7: shows the follow-up and baseline pain on VAS

		Mean	SD	P value
Pain	Baseline VAS	8.9	.9	< 0.001
	Follow up VAS	4.2	1.5	

The subsequent tables elaborate age, gender, BMI, diabetes, hours of splint user per day and type of NSAID use wise stratification of mean baseline and follow up pain scores on VAS.

DISCUSSION

In addition to limiting daily activities, causing occupational disability, and degrading quality of life, carpal tunnel syndrome (CTS) is a highly frequent cause of hand pain, weakness, and loss of sensation. About 5% of women and 2% of males in the general adult population are affected by it. CTS treatment aims to enhance hand function and reduce discomfort[14]. Currently, splinting the wrist with a rigid splint, generally at night, and occasionally combining other treatments, is the most popular non-surgical treatment worldwide. Although there is some evidence that wrist splinting may be useful in the short term, the data is generally weak, the ideal treatment length is ambiguous, and the long-term efficacy has not been proven. The treatment advantage of wrist bracing has frequently been minimal and short-lived, but in trials that compared bracing with surgery, the benefit has frequently been increased by significant cross-over to surgery[15]. A wrist splint is justified on the grounds that it restricts wrist flexion, which is known to raise pressure in the carpal tunnel. However, there isn't enough evidence to support the 4 to 6-week splinting period that is

routinely employed in clinical practice. The pathophysiological processes implicated in the development of CTS may not be significantly affected in the long run by the wrist splint during this brief period[16]. It is not apparent why wrist splinting in cases of idiopathic CTS can continue to be beneficial even after the splinting has stopped.

The use of wrist splints in the treatment of CTS has previously been compared to surgery or other non-surgical procedures like steroid injection or exercises[17]. Only local steroid injection offers significant evidence for short-term efficacy from placebo-controlled trials among the non-surgical therapies. A referral to a specialist may be necessary because it is still an invasive operation that is not frequently provided in primary care[18]. The few randomized studies that looked at wrist splinting for CTS patients were not placebo-controlled, therefore the claimed improvement could have been attributed to general effects or the course of the illness. Compliance with using the splint was frequently not tested or was determined by having patients record information in a diary, an approach with questionable reliability. Patients often overestimate their use of splints, according to a prior study[19].

Splinting has certain drawbacks while being a quick and secure medical procedure. Patients may discover that using a splint restricts their ability to perform certain tasks at work or in their daily lives, or both. The price of the splint plus the therapy sessions may be expensive[20]. The effectiveness of wrist bracing in the treatment of CTS patients requires evaluation in a randomized placebo-controlled trial.

According to several publications, the 2L-INT LD approach was more accurate and reliable in patients with varying degrees of CTS than both the DML and the DSL[21]. It also had a better sensitivity for the diagnosis of CTS. Additionally, Meena et al. listed the benefits of the 2L-INT LD trial as follows: 1. From the same recording electrode in the mid-lateral proximal palm, it is simple to assess both the interosseous and second lumbrical muscles. Each distal nerve segment and muscle has a similar temperature. Utilizing identical distances to every muscle enables direct comparison of the distal motor latencies. For research on median motor function, it produces the best internal control[22]. Additionally, some writers claimed that the second lumbrical fibers were less extensively damaged than the thenar motor fibers in CTS because their fascicles were located more dorsally and may have been better shielded from the transverse carpal ligament[23].

Currently, there aren't many researches looking at prognostic markers for CTS patients' response to splint therapy. To predict the outcome of CTS treatment at the wrist, an electrophysiological investigation is important. Which electrophysiological CTS severity, nevertheless, should be treated with a splint remains unclear. Poor outcomes were noted in cases with delayed DML of more than 6 ms and no sensory response, according to Gelberman et al[24]. According to Nobuta et al., individuals with DML less than 8 ms saw positive clinical outcomes from splinting[25].

CONCLUSION

Wrist splinting is an effective conservative treatment for CTS in terms of significant pain relief after 6 weeks and is not dependent upon BMI, gender, diabetes or type of NSAIDs used. However, our study sample size was too small to draw conclusions there is no evidence of functional improvement after splinting. We recommend more studies (interventional) on large sample size and considering pain as well as functional assessment to develop future guidelines for the treatment of CTS using wrist splinting

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