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The Effect of Using a Dynamic Wrist Splint on Wrist Pain in Stroke Patients

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ABSTRACT

Background: Hand movement function in hemiplegic stroke patients is impaired due to contractures and spasticity. Pain in the wrist joint often occurs when moved. This research aims to determine how dynamic wrist splints can reduce wrist pain in stroke patients.
Subjects and Method: This was a quasi-experimental study. The subjects were 20 hemiplegic stroke patients in Colomadu Karanganyar. The research was carried out in July – September 2023. The dependent variable was wrist pain. The independent variable was the use of a dynamic wrist splint. measurement the degree of pain using the Visual Analog Scale which is used to determine the level of pain felt by the sufferer. Data normality test using Shapiro-Wilk. The statistical test used in this research is wilxocon.
Results: The ages of subjects ranged from 30 to 62 years. Wrist pain was reduced after the use of a dynamic wrist splint compared to levels before its use.
Conclusion: There is an influence of dynamic wrist splints on wrist pain in stroke patients.

Keywords: Stroke, dynamic wrist splint, pain.

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BACKGROUND

Stroke Hemiplegia is a disease condition with a high prevalence rate, namely 10.9 per mile (Riset Kesehatan Dasar., 2018). The negative impact of Hemiplegia is quite extensive. Hemiplegia can impact hand movements and be associated with contractures (Pandyan *et al.*, 2003), and even further impact the ability to carry out daily functional activities (Chang and Lai, 2015), as well as psychological status and social function (Kwakkel and Kollen, 2012). Hand movement function in Hemiplegic patients is impaired due to contractures and spasticity. Contractures develop due to abnormal shortening of the soft tissue structures that support joints such as skin,

ligaments, tendons, and joint capsules (Sæbø *et al.*, 2022). The joints that most often experience contractures are the wrist and ankle joints (C *et al.*, 2018).

Contractures of the wrist joint occur more often than contractures of the ankle joint. Flexion contractures of the wrist joint develop rapidly after hemiplegia if adequate treatment or restoration of movement is not provided at the onset of the event (Pandyan *et al.*, 2003). Spasticity occurs due to excessive alpha motor neurons in the muscles and disruption of supraspinal inhibition and excitation processes (Ashford *et al.*, 2018). This spasticity will have an impact on movement and posture. To prevent contractures in the wrist joint and spasticity due to hemiplegia, splints are applied to patients during the day or at night as adjunctive therapy which is applied at home (Lannin *et al.*, 2007). Splints as additional therapy are useful for preventing deterioration of function in ligaments, joints and muscle tissue (Brose *et al.*, 2008).

Wrist splints are believed to prevent or reduce contractures and their impact will contribute to the function of hand movement. After a stroke, patients often experience muscle weakness in the wrist. Pain, swelling and movement disorders in the wrist often occur. The problem of pain in the wrist is an area that needs to be treated by medical personnel, and a tool in the form of a dynamic splint needs to be provided to reduce pain in patients.The aim of this research is to determine the effect of using dynamic wrist splints can reduce wrist pain in stroke patients.

SUBJECTS AND METHOD

1. Study design

This was a quasi-experimental study with pre-test and post-test designs. The research was conducted in Colomadu Sub Distric, Karanganyar district, Central Java province, The research was carried out in July – September 2023.

2. Population and Sample

The population in this study were all patients with stroke hemiplegic in Colomadu Karanganyar. The sample for this researcher was determined using a purposive sampling technique.The subjects used were of 20 patients. Where all subjects in this study met the inclusion criteria, namely stroke sufferers aged 30 - 65 years, often experiencing pain in the wrist. The exclusion criteria were sufferers who had no injuries.

3. Study Variables

The dependent variable was wrist pain. The independent variable was the use of a dynamic wrist splint.

4. Operational Definition of Variables

Wrist pain is pain that the patient feels in the area around the wrist, especially when the wrist is moved.

Dynamic wrist splint is a type of wrist splint orthosis which has an angle adjustment at the wrist joint.

5. Study Instruments

This research used the Visual Analog Scale (VAS) instrument which was used to determine the level of pain felt by the sufferer. The results of the measurements are in the form of numbers 0-10 with options, those are no pain, mild pain, moderate pain, severe pain, very severe pain (Smeltzer and Bare, 2002).

6. Data Analysis

The data in this study were analyzed using bivariate analysis with Wilcoxon test.

7. Research Ethics

This research has received ethical clearance from the Surakarta Poltekkes Kemenkes Surakarta Ethics Commission.

RESULTS

The results of this study explain the effect of using a wrist elastic splint to reduce wrist pain in stroke. From the results of this study, the characteristics of respondents, variables and hypothesis testing will be explained in answering the problem formulation.

1. Sample Characteristics

Table 1. Frequency distribution of respondents' characteristics by age, occupation, and Gender.

Variable	Category	Frequency (n)	Percentage (%)
Age	26-35 years	2	10.0
	36-45 years	2	10.0
	46-55 years	4	20.0
	56-65 years	12	60.0
Occupation	Private	9	45.0
	Self employed	5	25.0
	Civil Servant	2	10.0
	Unemployment	4	20.0
Gender	Male	15	75.0
	Female	5	25.0

Table 1 shows frequency distribution of respondents' characteristics by age, occupation, and Gender. Table 1 shows the Frequency distribution of respondent characteristics by age, occupation, and Gender. consisting of variable categories, number of samples, and also the percentage of each variable. Based on table 1. The age of the subjects is divided into 4 categories and the majority are late elderly (aged 56-65) as many as 12 subjects (60%), the remainder are early elderly (aged 46-55) as many as 4 subjects (20%), early adults (aged 26-35 years) as many as 2 subjects (10%) and late adulthood (aged 26-35 years) as many as 2 subjects (10%). Based on occupation, the most subjects were private with 9 subjects (45%), self-employee with 5 subjects (25%), civil servant with 2 subjects (10%), unemployed with 4 subjects (20%). Subject characteristics: 20 respondents were male - 15 subjects (75%), while the remaining 5 respondents (25%) were female.

Table 2. Degree of pain before and after use of Dynamic Wrist splint

Degree of Pain	Mean	SD	Min	Max
Pre-intervention	4.90	1.05	4	8
Post-intervention	2.95	1.09	2	6

Table 2 shows the results of degree of pain measurements using VAS before using the Dynamic splint, and after using the Dynamic wrist splint for 3 months. In the pre-intervention pain measurement, the mean was 4.90, the minimum pain was 4 (moderate pain) and the maximum pain was 8 (severe pain). In the post-intervention pain measurement, the mean was 2.90, the minimum pain was 2 (mild pain) and the maximum pain was 6 (moderate pain).

2. Bivariate Analysis

Table 7. Difference in wrist pain among stroke sufferers (Wilcoxon test)

Degree of Pain	Mean	SD	Sig
Pre-Test	4.95	1.05	<0.001
Post Test	2.95	1.09	

The difference in the reduction of wrist pain in stroke sufferers was carried out using the Wilcoxon test. It was obtained that the average reduction in wrist pain in stroke sufferers after being given a Dynamic Wrist Splint (Mean= 2.95; SD= 1.09) was lower than the pain before being given a Dynamic Wrist Splint. (Mean= 4.95; SD= 1.05) and the results are statistically significant (p< 0.001).

DISCUSSION

Researchers in conducting this research used a quasi-experimental research design with pre-test and post-test design methods to determine the effect of using a wrist elastic splint on wrist pain in stroke sufferers. The subjects in this study were stroke sufferers who were selected using a purposive sampling method who met the inclusion and exclusion criteria so that there were 20 subjects. This research was carried out by filling in the Visual Analog Scale pain scale during the pre-test and post-test by stroke sufferer subjects before and after using a Dynamic Wrist elastic splint. The statistical test results were carried out using the Wilcoxon test which showed a p value of 0.000 < 0.05 so it could be concluded that There is an effect of using a wrist elastic splint on wrist pain in stroke sufferers. Apart from looking at the results of the probability value analysis (p), it can also be seen from the average (mean) pain degree in the pre-test group of 10.50, while the average (mean) pain degree in the post-test group is 0.00.

This shows that the degree of pain in stroke sufferers before using a Wrist elastic splint is higher than the degree of pain in stroke sufferers after using a Dynamic Wrist splint, so in this case the use of a Dynamic Wrist splint has a significant effect in reducing the degree of pain stroke sufferers.

Based on the research results, research subjects were used as samples aged between 30 – 62 years. At the (McGeer and McGeer, 2004), tissue replacement into scar tissue, fluid reduction. This causes the stability of the bones and muscles to decrease. So, the older a person is, the higher the risk of that person experiencing a decrease in bone elasticity, which triggers muscle complaints. According to (Tisya Aulia, Tarwaka Tarwaka, Dwi Astuti, 2023)states that in general skeletal muscle complaints begin to be felt at working age, namely 25 - 65 years.

In another study by (Ural and Öztürk, 2017) on the effect of acupuncture on median nerve morphology in carpal tunnel syndrome patients. The 27 women who experienced carpal tunnel syndrome were divided into two groups, where the first group received night wrist splint treatment and acupuncture therapy and the second group only received night wrist splints. Both groups were given intervention for 4 weeks. After 4 weeks of treatment, the results showed that in both groups there were improvements in scores on the Visual Analog Scale (VAS): p 0.004; Duroz Hand Index (DHI): p 0.001; and on quick Disabilities of Arm, Shoulder, and Hand (DASH): p <0.001.

The efficacy of hand splints for post-stroke patients has been reviewed repeat-

edly. The results of the review are still debated (Gambhir, 2016), and the evidence is insufficient to support its effectiveness (Lannin *et al.*, 2007). There was previous research on the application of hand splints after stroke using a control group (Lannin *et al.*, 2007), but compared neutral splint positions, extensions, and groups that did not use splints. Apart from that, a lack of rationalization of the timing of initiation of splint use, usage schedule and type or position of splint use, namely immobilization of the finger hand in the volar/dorsal position (volar/dorsal wrist/hand immobilization) was found in several studies (Gambhir, 2016). To overcome the shortcomings mentioned above, research has been carried out by implementing new designs and using new materials. (Chang and Lai, 2015) have designed and implemented a dynamic hand splint in their research. Dynamic hand splints are believed to be able to increase hand muscle strength in post-stroke patients but do not automatically improve hand movement function. Dynamic Lycra Splint used lycra material to make hand splints (Morris *et al.*, n.d.). However, the results of the study showed that there were negative effects from the use of splints which were problematic and the effects were not clinically relevant (Morris *et al.*, 2019).

Based on the results of research entitled the effect of using dynamic wrist splints on wrist pain in stroke sufferers in Karanganyar and measuring the degree of pain using the Visual Analog Scale. The results of the normality test with Shapiro Wilk showed that in the pre-test group the pain p-value was 0.00 so the data was normally distributed, while in the post-test group, the pain p-value was 0.037 the data was not normally distributed. Because the two treatment groups were not normally distributed, non-parametric statistics were used, namely the Wilcoxon test. The study results showed that the average pain in the pre-test group was (4.95) while the average pain in the post-test group was (2.95). The results of statistical tests using the Wilcoxon test show a p-value of 0.000, so there is an influence of using a wrist elastic splint on the wrist. The subjects of this research were 20 subjects. By using a Dynamic wrist splint, it must be positioned correctly, namely neutralizing the position of the wrist so that no muscles contract and no nerves are compressed, which will reduce pain in the wrist area.

The research results show that the use of dynamic wrist splints can reduce pain in stroke. The implication of these results is that if wrist pain sufferers use wrist elastic splints in treatment, the pain in the wrist will decrease. Suggestion fot stroke patients who experience wrist pain should use an elastic wrist splint. . It is recommended that further research increase the number of samples in order to strengthen the research results, categorizing women and men, so that the results of the research are specific and show differences between female subjects and male subjects regarding the reduction in pain that occurs.

AUTHOR CONTRIBUTION

The first author took part in conducting the research The Effect of Using a Dynamic Wrist Splint on Wrist Pain in Stroke Patients and explained the research procedures, as well as observations on the intervention group who received treatment using a dynamic wrist splint, as well as writing the final report and article. The second and third author contributed to assisting preliminary research in conducting research, processing data, data analysis.

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CONFLICT OF INTEREST

There is no conflict of interest in this study.

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