Effectiveness of Wrist and Hand Splinting for Increasing Recovery of Individuals Post-Stroke

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Disciplines
Occupational Therapy | Rehabilitation and Therapy

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Effectiveness of Wrist and Hand Splinting for Increasing Recovery of Individuals Post-Stroke

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Sanf2312@pacificu.edu

Date: 11-21-09

CLINICAL SCENARIO:

The information provided in this paper has the potential to be beneficial to occupational, physical, and hand therapists who are involved in working with post-stroke individuals on their upper extremities. The reason for this is because it is common practice to provide a person who has had a stroke with a hand or wrist splint for the purpose of either preventing wrist contracture and over stretching, reducing spasticity, edema, and pain, and increasing function. To accomplish these goals, there have been a variety of splints used in various ways such as a custom made static, palmar resting mitt, volar static splint, resting splint, and dorsal splint, among others. Therefore, it can clearly be seen that the use of wrist and hand splints on individuals post stroke consumes large amounts of time, effort, and money for both the patient and therapist.

FOCUSSED CLINICAL QUESTION:

Do individuals who have had a stroke recover more rapidly with the use of a hand/wrist splint or no hand/wrist splint?

SUMMARY of Search, ‘Best’ Evidence’ appraised, and Key Findings:

After reviewing multiple research engines such as Medline – OVID, CINAHL (EBSCOhost), and ERIC, several research articles were found related to the topic. Specifically, results yielded only five articles that directly related to the selected PICO question. In addition, all searches with different but akin key words produced the same articles.

Various papers were excluded based on the methodology of the research such as the intervention process and patient diagnosis.

The key conclusions to the majority of all findings throughout these research papers, in regards to whether hand splinting of an individual after stroke increases function, was shown to either
have inconclusive evidence or no evidence at all that supports the use of splints. However, no clinically or statistically significant results were provided in favor of splinting that would irrefutably indicate splinting to have a clear benefit on a clearly defined intervention group.

CLINICAL BOTTOM LINE:

Hand splinting on individuals post stroke has no clear benefit on any specific population for any specific reason and should be discontinued from clinical use.

Limitation of this CAT: This critically appraised paper (or topic) has /has not been peer-reviewed by one other independent person/a lecturer.

This review is not a complete and exhaustive review or literature search. Furthermore, its writer does not claim to be proficient or a professional on the topic. Although some training was received in a graduate level setting, the author is a relative novice practitioner. This article has not been peer reviewed.

SEARCH STRATEGY:

Terms used to guide Search Strategy:

- **Patient/Client Group:** Post stroke individuals
- **Intervention (or Assessment):** Customized Hand or wrist splints
- **Comparison:** No hand or wrist splints
- **Outcome(s):** Rate of recovery or improvement in function
Databases and sites searched

<table>
<thead>
<tr>
<th>Databases and sites searched</th>
<th>Search Terms</th>
<th>Limits used</th>
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<tbody>
<tr>
<td>A) Medline - OVID</td>
<td>A) stroke AND splints AND upper extremity AND occupational therapy</td>
<td>No limits used</td>
</tr>
<tr>
<td>B) CINAHL (EBSCOhost)</td>
<td>B) hand splints AND Wrist splints AND Upper extremity AND Stroke - also CVA and wrist cock-up</td>
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</tr>
<tr>
<td>C) ERIC</td>
<td>C) Upper extremity splints AND post stroke</td>
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INCLUSION and EXCLUSION CRITERIA

- **Inclusion:**
  - Post-Stoke Patients
  - Hand or wrist splints
  - Upper extremity
  - Current papers published within 10 years
  - Papers written in English

- **Exclusion:**
  - Electric Stimulation used in treatment
  - Lower extremity
  - Done with conditions excluding stroke
  - Prefabricated Splints

RESULTS OF SEARCH

Table 1: Summary of Study Designs of Articles retrieved

<table>
<thead>
<tr>
<th>Study Design/ Methodology of Articles Retrieved</th>
<th>Level</th>
<th>Number Located</th>
<th>Author (Year)</th>
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Prepared by Dana Sanford (11-21-09)
Randomized Control Trial / Intervention Specific to Wrist/Hand Splinting

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|   |   | Sheehan, J. L. et al. (2006)
|   |   | Lannin, N.A. et al. (2007) |

Before and After / Intervention Specific to Wrist/Hand Splinting

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<tr>
<td>IV</td>
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<td>Pizzi, A., et al. (2005)</td>
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Systematic Review/ Intervention Specific to Wrist/Hand Splinting

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BEST EVIDENCE

The following study/paper was identified as the ‘best’ evidence and selected for critical appraisal. Reasons for selecting this study were:


This paper was selected based on its method of intervention, being current, and having a control group verifying its claim to being a RCT.

SUMMARY OF BEST EVIDENCE

Table 2: Description and appraisal of “Effects of splinting on wrist contracture after stroke: A randomized controlled trial” by Natasha A. Lannin, Anne Cusick, Annie McCluskey, & Robert Herbert (2007).

Aim/Objective of the Study/Systematic Review:

The objective of this randomized control trial was to assess whether or not using custom-made, static, palmar mitt splints would improve the function of an affected upper extremity post stroke in comparison to not wearing any splint.

Study Design:

The author reported that this was an assessor-blind, randomized, controlled, multicenter trial. The overall trial took place between October of 2002 and September 2004 in 9 inpatient rehabilitation and stroke units in Sydney, Australia. (Lannin, Cusick, McCluskey, & Herbert, (2007)). This design was appropriate for the study question because it allowed appropriate time and conditions to possibly give the desired outcome and explore possible options. Furthermore, the design relied on the diligence of its subjects adhering to the schedule of wearing a splint while at a rehab setting and trusted in their reported schedule of application, which is consistent with current practice.

Participants:
Out of the original 95 people screened, 82 were identified as eligible, and 63 of these inpatients agreed to participate. Eligibility for participation in this study included participants having to have the following characteristics: a stroke within the previous 8 weeks, over 18 years of age, no active wrist extension, sufficient cognitive and hearing function (to be able to provide informed consent and fully participate in the trial), and to have resided in the greater Sydney metropolitan area. (Lannin, Cusick, McCluskey, & Herbert, 2007). Standard deviation of individual characteristics of participants were established for each of the 3 groups. These included percent of women, mean age, score on Mini-mental exam, right hand dominance, years of education, percent of non-English speaking background, Canadian Neurological Scale mean score standard deviation, time post-stroke, unaffected wrist degrees, degree of wrist extensibility, and percent of patients with right-sided hemiplegia. All of these results add to the validity of the test results and ensure that these differences are accounted for and not dismissed.

According to the author, no participant withdrew from the study. However, one participant in each group refused to be measured at the 6 week mark. In addition, one participant’s diagnosis of stroke was retracted, thus making them ineligible for continuing in the experiment. (Lannin, Cusick, McCluskey, & Herbert, 2007).

**Intervention Investigated**

**Control Group**

Control group participants (n=21) did not wear a hand splint for the study period. Participants in all 3 groups received therapy, except that stretches of the wrist or long finger flexor muscle were not performed. In addition, each day a maximum of 10 minutes of isolated wrist and finger extension practice was permitted. (Lannin, Cusick, McCluskey, & Herbert, 2007). This allowed researchers to see if there was a difference between those with who received usual manual rehab and those who received rehab and a splint. This also ensured that none of the subjects were denied therapy for their condition.

**Experimental Groups:**

For this study, there were two experimental groups. Participants in both splint groups wore custom-made, static, palmar mitt splints for up to 12 hours overnight for the 4-week intervention period. However one group wore a neutral hand splint (n=21) which positioned the wrist in 0° to 10° extension. The other wore an extension hand splint (n=21) that positioned the wrist in a comfortable end-of-range position (>45° wrist extension) with the metacarpophalangeal and interphalangeal joints extended. (Lannin, Cusick, McCluskey, & Herbert, 2007). The organization of this study allowed for multiple positions to be compared to a control group showing if varying degrees in the angle and positioning of a splint altered results. According to the report, trial protocol dictated that each participant receive 28 nights of splinting at up to 12 hours per night with a maximum total of 336 hours of affected limb splinting total. Participants wore their splints for a mean of 10 hours, 11 minutes per night (SD, 2.0 hours). Outcomes of all participants were assessed within 2 days of the final night of splinting. (Lannin, Cusick, McCluskey, & Herbert, 2007).

**Outcome Measures**
Spasticity was measured with the Tardieu scale that is reported to be a valid clinical measure. The report described this scale as giving both a spasticity rating and a spasticity rating.

The level of individual disability was assessed with the Disabilities of the Arm, Shoulder, and Hand Outcome Measure (DASH). This is a 30-item assessment that provides a percentage rank from 0-100 where 0 is no having no disability and 100 is severe disability. Pain scores were also obtained from a section of this test. (Lannin, Cusick, McCluskey, & Herbert, 2007). According to the author, it is a valid, reliable, and responsive for clinical and research purposes.

The Motor Assessment Scale which tests upper arm function, advanced hand activity, and hand movement, was conducted to rate upper limb function, which provided an individual with a score from 0-18 (Lannin, Cusick, McCluskey, & Herbert, 2007).

Main Findings:

As reported in the study, the average participant experienced a moderate loss of range of motion (mean, 16.7°; SD, 15.1°) as measured at the end of a 7-week study period. Furthermore, splinting was stated to have little or no effect on the loss of range of motion and the mean effect in the neutral splint group was 1.4° at 4 weeks and 4.2° at follow-up compared with the control group. The treatment effect on the mean for the extension splint group was –1.3° at 4 weeks and 1.8° at follow-up compared with the control group. (Lannin, Cusick, McCluskey, & Herbert, 2007). This study used an ANCOVA to determine the effects of splinting and a statistical significance of P<0.05.

Data Sheet from Study Attached (Table 2) : (Lannin, Cusick, McCluskey, & Herbert, 2007).
Original Authors’ Conclusions

“The results of this study showed that four weeks of overnight splinting in either a neutral or extended wrist position did not result in an increased range of motion thus indicating that the use of a splint has no benefits over not splinting” (Lannin, Cusick, McCluske, & Herbert, 2007, p115). Therefore, the author concludes that the practice of splinting hands to prevent contracture in post stroke patients in acute rehab should be halted.

Critical Appraisal:

Validity

The methodology used for this study appeared to be appropriate for measuring the desired outcomes. According to the PEDro scale, 9 of the 11 criteria were located within the paper with the exceptions of 5 which the paper addressed, and 6, which was not addressed. The headings were accurate pertaining to the information given and charts were clear and appropriately displayed. Overall, this RCT was found to have good reliability and validity in both design and assessments used.

Interpretation of Results

The data collected throughout this study by Lanin, N.A., et al, (2007) used valid and reliable measurements and assessments to capture the overall change in participant condition and compare it to the other groups. For these reasons, the results of this study were found to be accurate and clearly articulated while supporting them with appropriate data. The results clearly show that an improvement of wrist extensibility of any of the 3 groups when compared to the others is not clinically important, thus verifying the authors conclusions.

When compared to similar studies, the conclusions this intervention experiment yielded were on par with their results. The vast majority of these results indicated that splinting the upper extremity post stroke to reduce spasticity, increase mobility, decrease pain, etc. was ineffective in providing clinically statistically or relevant results. Although the systematic review indicated that there was insufficient evidence to support or refute the use of hand splinting as a means of treatment, it is clear that no strong evidence from a test with good validity and reliability exists in support of this intervention method. In the one study that did report positive affects of upper extremity splinting, it is clear that the methodology used is not appropriate for the findings to be considered valid or reliable.

Summary/Conclusion:

The primary finding of this study as discussed by the authors was that a splinting program did not increase the extensibility of the wrist and that the overall effect of splinting did not outweigh that of not splinting an effected wrist post stroke. (Lannin, Cusick, McCluskey, & Herbert, 2007). Furthermore, splinting was found to have little or no effect on the loss of range of motion. Lastly, the authors concluded that the effects of splinting on secondary outcomes (upper limb function, spasticity, and self reported disability and symptom) were clinically unimportant and statistically nonsignificant. Therefore, the common belief that hand splinting reduces spasticity and improves function was not supported by this study and indicates that neither the primary nor secondary measured outcomes of this intervention would be of benefit to the patient. As a result, these findings
suggest that the routine practice of hand splinting to prevent muscle contracture during acute rehabilitation after stroke should be discontinued. These finding by the authors were supported by the date results.

### Table x: Characteristics of included studies

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<td>Various relevant studies concerning upper extremity splinting post stroke were analysed for validity and reliability.</td>
<td>Experimental group participated in therapy and also wore a static, palmar resting mitt splint.</td>
<td>What is the amount and rate of change generated by a resting splint in an affected limb post-stroke?</td>
<td>An immobilization custom-fitted hand splint which was fitted in the functional position for 90 minutes per day over a span of 3 months on chronic patients. This is referred to as reflex inhibitory splinting (RIS).</td>
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<tr>
<td>This systematic review compared the various studies results against each other while taking into account their level of validity and reliability.</td>
<td>Control group participated in same therapy as control group but did not wear a splint.</td>
<td>There were two groups. For the first week neither wore a splint but on the second and third week group 2 wore splints. Group one only wore one during week 3. Both groups wore splints during weeks 4-7.</td>
<td>This was a pretest-post test trial meaning that a comparison group was not used.</td>
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<td>Types of splints, treatment lengths, validity, and reliability</td>
<td>Effects on contractures, effects of splinting on function, effects of splinting on pain.</td>
<td>Amount of resistance and rate of change</td>
<td>Upper limb pain, spasticity of upper limb, elbow and wrist PROM</td>
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<td>According to the author, level 1 evidence was found to indicate that splinting the hand post stroke in a functional position</td>
<td>This experiment found that the effects of splinting on upper limb function were not clinically significant and that it did not</td>
<td>The author suggests that the results indicated that splinting to decrease the amount and rate of change in</td>
<td>According to this study, patients who participated in this study without discomfort had improved elbow spasticity and PROM.</td>
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was not effective. In addition, it concluded that there is insufficient evidence to refute or support this intervention strategy for those who are not receiving prolonged stretches to their upper limb. reduce pain in the upper limb. stroke affected upper-extremities is not worthwhile. Furthermore, pain was found to be reduced. However, the author states that “due to the methodological limitations of this study...we cannot show a clear effectiveness of splinting for post stroke spasticity of the upper limb.

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<tr>
<th><strong>IMPLICATIONS FOR PRACTICE, EDUCATION and FUTURE RESEARCH</strong></th>
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<td>As current clinical practice continues to use splint as a means to benefit people post stroke, it should be addressed that no current research clearly supports the continuation of this practice. The study addressed in this paper, along with others, found that wrist/hand splinting showed no clinical or statistical benefits. Therefore, to continue this intervention method would go against the practice of using evidence based treatment and perhaps even be on the verge of doing harm to patients by depriving them of funds and time for a treatment that has not yielded clinically significantly results. Furthermore, education should be provided to all relevant medical staff as to the implications of these findings and it is the opinion of this paper that, unless additional funding is provided for a longitudinal RCT to be conducted, no additional funds or research time should go towards this “clinically insignificant” intervention.</td>
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