

## There is fair evidence (level 2b) to support the use of massage following surgical and traumatic hand injuries to increase wrist active ROM

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**CLINICAL SCENARIO:** Much of the literature available recommends the use of massage in treating a variety of hand injuries, as it is beneficial in decreasing oedema, increasing joint movement and overall hand function. To date, these claims remain primarily unsubstantiated by scientific evidence. Clients may experience reduced range of motion (ROM) due to a scar received through trauma or surgery. Does the evidence support the use of massage as an effective intervention in this situation?

**FOCUSSED CLINICAL QUESTION:** Is there any evidence supporting the use of massage to effectively increase wrist or hand range of motion (ROM), compared with no massage treatment, in surgical and traumatic hand injuries? \*

*\*Specifically not burns-related injuries.*

### SUMMARY of Search, 'Best' Evidence' appraised, and Key Findings:

- **SEARCH:**
  - Conducted to find clinical guidelines (National Guideline Clearinghouse), systematic reviews (Cochrane Library) and randomised control trials (7 separate databases).
  - Key terms included massage, intervention, hand, hand injury, hand injuries, hand injur\*, hand surgery, wrist, adult, range of motion, ROM.
  - Located 5 articles (one RCT; four level 5 papers) addressing massage and increased ROM.
- **BEST EVIDENCE:**
  - One randomised controlled trial (RCT) by Donnelly and Wilton (2002) was found and appraised, which addressed the effectiveness of scar massage on increasing active range of motion (AROM) in a surgical and traumatic hand injury population.
  - This **level 2b** evidence examined wrist motion and skin mobility in 22 subjects through goniometry and a subjective skin slide grade scale.
  - The additional intervention of scar massage (self and therapist conducted) was used in combination with client's individualised hand program. Control group also received treatment of an individualised program, but excluded scar massage.
  - This study had some limitations (lack of assessor blinding, varying individual treatment and attendance schedules, and small sample size) that would have affected results.
- **KEY FINDINGS:**
  - Both groups had significant increases in percentage of active ROM, but over the four-week study period, the difference between the group means, in favour of the massage group, was 9.18 percent (95% CI = 1.83 to 16.63).

**CLINICAL BOTTOM LINE:**

Scar massage, completed by the client and therapist regularly over a four week period, when used in conjunction with other treatment modalities, may assist in increasing active wrist ROM by an additional 9.18% (95% CI = 1.83 to 16.63).

**Limitation of this CAT:**

- This critically appraised paper has been individually prepared as part of a university subject, reviewed and marked by a lecturer, but has not been externally peer-reviewed.

**SEARCH STRATEGY:****Terms used to guide Search Strategy:**

- **P**atient/Client: hand, wrist, hand injury, hand injuries, hand injur\*, hand surgery, upper limb, adult
- **I**ntervention: massage
- **C**omparison: no massage
- **O**utcome(s): range of motion, ROM

Databases and sites searched	Search Terms
National Guideline Clearinghouse	Massage <b>AND</b> hand injury, hand injuries, wrist
Cochrane Library	Massage <b>AND</b> hand, hand injury, hand surgery, intervention, adult
PubMED	Massage <b>AND</b> hand surgery, hand injury, hand injur*, wrist, upper limb, muscle, scar, ROM, range of motion
CINAHL/Pre-CINAHL	Massage <b>AND</b> hand, hand injury, hand injur*, hand surgery, wrist, upper limb, intervention
OVID	Massage <b>AND</b> hand injury, hand injuries, hand injur*, hand surgery, range of motion, ROM
CINAHL Via OVID (with auto explode)	Massage <b>AND</b> deep tissue massage, neuromuscular massage, simple massage, swedish massage <b>WITH</b> hand injuries, therapy, symptoms, physiopathology, rehabilitation (auto explode).
OT Seeker	Massage <b>AND</b> hand therapy, hand injury/condition, wrist
PEDRO	Massage <b>AND</b> hand, hand/wrist, hand injury, range of motion, ROM
ProQuest	Massage <b>AND</b> hand, hand injury, hand injuries, hand injur*, intervention, range of motion, ROM
Expanded Academic ASAP Plus	Massage <b>AND</b> hand injury, hand injur*, range of motion, ROM

So few hits were found, relevant to the specific clinical question that limits were not employed at any stage.

## INCLUSION and EXCLUSION CRITERIA

- Included:  
Any article that examined the use of massage for increasing ROM following a surgical or traumatic injury, specifically at the hand and/or wrist.  
*Five articles were located that fitted this inclusion criterion. Only one was of a high level of evidence (RCT) (See Table 1 for details).*
- Excluded:
  - (i) Any articles examining burns-specific hand injuries, or interventions that would not usually be carried out by an occupational therapist (such as manipulation).
  - (ii) Any full-text articles not available in English.  
*This criteria excluded six articles written prior to 1980 that originated in Germany, Poland and Russia (Aizenberg et al., 1971; Demichev et al., 1974; Greither, 1968; Jurczyk & Jaruga, 1967; Kornilov et al., 1975; Urusmambetov, 1971).*
  - (iii) Any articles that did not address injuries of surgical or traumatic origins, or did not specifically treat the hand and/or wrist area.  
*This criterion excluded a systematic review, four clinical trials, and one set of (expert consensus) clinical guidelines. The systematic review (Verhagen et al., 2004) and the four relevant clinical trials that were examined (Ferguson, 1976; Leboeuf, 1987; Levoska, 1993; Vasseljen, 1995) were excluded as the injuries were work-related musculoskeletal disorders (WRMD) which occurred in the upper limb and neck. The clinical guidelines addressed the treatment of reflex sympathetic dystrophy (RSD) or complex regional pain syndrome (CRPS) through the use of massage but did not specifically address the hand or wrist area (International Research Foundation for RSD/CRPS, 2003).*
  - (iv) Any articles that discussed the use of massage but did not investigate it's effect on ROM.  
*This excluded 3 articles. The highest evidence excluded under this criteria was a clinical trial that examined the effect of string-wrapping or massage, or combined methods in reducing oedema in the finger digits (Flowers, 1988). Two articles of expert opinion were also excluded. The first article addressed repetitive strain injury (RSI, which is now also known as occupational overuse syndrome) and discussed the benefits of massage for increasing hand function, not specifically ROM (Sheon, 1997). This article was also excluded, due to the fact that an injury resulting from overuse in the workplace is a more chronic condition and does not arise specifically from surgery or trauma. The second level 5 article addressed general treatments for a variety of hand injuries and recommended the use of massage (with ice) to reduce pain and swelling (Brown, 1999). It did not address scar massage or range of motion in either the hand or wrist.*

## RESULTS OF SEARCH

**Five** relevant articles addressed both massage and increased range of motion, as shown in Table 1. Levels were allocated based on Levels of Evidence, Oxford Centre for Evidence-based Medicine (Phillips, Ball, Sackett et al., 1998).

**Table 1: Summary of Retrieved Articles (specific to Massage Increasing Range of Motion)**

Level of Evidence	Methodology of Retrieved Articles	Number Located	Sources	Citation
N/A	Clinical Guidelines	0	-	-
1	Systematic Reviews	0	-	-
2b	Randomised Controlled Trials	1	<ul style="list-style-type: none"> <li>▪ CINAHL</li> <li>▪ CINAHL Via OVID (with Auto Explode)</li> </ul>	Donnelly & Wilton (2002) <i>Examines the effectiveness of scar massage in increasing active ROM and skin mobility.</i>
3	Cohort/ Case-control Studies	0	-	-
4	Case Series	0	-	-
5	Survey Results	1	<ul style="list-style-type: none"> <li>▪ CINAHL</li> </ul>	Michlovitz (2001) <i>Discusses survey findings of clinician's practice patterns for massage and ROM, in distal radius fractures.</i>
	Descriptive Case Histories	1	<ul style="list-style-type: none"> <li>▪ PubMed</li> </ul>	Robbins & Reece (1985) <i>Discusses massage and ROM in the context of great toe to thumb transfer.</i>
	Literature Review	1	<ul style="list-style-type: none"> <li>▪ CINAHL</li> <li>▪ CINAHL Via OVID (with Auto Explode)</li> </ul>	Ronon (2001) <i>Discusses collagen synthesis and the usefulness of massage to increase ROM.</i>
	Expert opinion	1	<ul style="list-style-type: none"> <li>▪ CINAHL</li> <li>▪ CINAHL Via OVID (with Auto Explode)</li> </ul>	Kasch (1988) <i>Describes the use of scar massage to increase ROM</i>

## BEST EVIDENCE

The study by Donnelly and Wilton (2002) was identified as the 'best' evidence and selected for critical appraisal. Reasons for selecting this paper were because it:

- Addressed the specified intervention (massage), outcome (increased range of motion) and population group (adults with injuries/scars originating from surgical or traumatic origins, located in the hand or wrist region of the body).
- Was the highest level evidence found to address this particular clinical question. Given the lack of other evidence found (clinical guidelines, systematic reviews or well designed RCTs), this paper was chosen as the best level of evidence to address the clinical question, and was therefore appraised.

## SUMMARY OF BEST EVIDENCE

**Table 2:** Description and appraisal of RCT by Donnelly and Wilton (2002).

### PART A - Description of study

#### *Aim of the Study:*

To determine the effect of scar massage, when combined with standard therapy modalities, on active wrist range of motion and skin mobility following injuries involving surgical or traumatic scars.

#### *Intervention Investigated:*

Daily self-scar massage undertaken by the clients in their own environment, and 10 minutes of therapist-administered scar massage at each therapy session attended. Clients in the treatment group received an average of 373 minutes of massage over the 4-week study period (range 155 to 910 minutes). All clients participating in the study continued their customised hand rehabilitation program for the 4-week duration of study.

#### *Inclusion/Exclusion Criteria:*

Inclusion Criteria: clinically healed, linear scar between 3 to 12 weeks in age, which displayed soft tissue restriction upon palpation and reduced active range of motion in either, or both, planes of wrist extension/flexion and ulnar/radial deviation.

Exclusion Criteria: inability to understand English, existence of a skin ailment (such as dermatitis) known to affect the wrist area, and the presence of an active inflammatory wrist joint condition (*Donnelly & Wilton, 2002, p. 7*)

#### *Outcome Measures:*

##### Primary - Goniometry

Measuring active range of motion [AROM] at the wrist joint, a "half-circle 15cm goniometer with the forearm in a gravity-eliminated position" (*Donnelly & Wilton, 2002, p. 8*). Only one researcher (C.D.) responsible for carrying out the assessments and this increased the reliability (note: intra-rater considered to be more reliable than inter-rater).

### Secondary - Skin slide grade scale

Created initially by Silverberg and colleagues (1996), this subjective measure used to quantify the restriction in skin mobility upon palpation. Remains untested for validity and reliability at present, but is a simple, quick and practical assessment for use in the clinical setting (Donnelly & Wilton, 2002, p. 6). The authors of this study reversed the scoring system that the original scale used, with a '0' grade now referring to complete restriction and '4' signifying no restriction in the skin mobility compared with normal skin.

### **TABLE 2.1 - Mann-Whitney Test:**

Difference in overall change between massage and control groups in active range of motion and skin slide grade scale.

		<b>N</b>	<b>Mean Rank</b>	<b>Z</b>	<b>p-value</b>
<b>Difference % AROM</b>	Massage group	11	14.64	-2.268	0.023*
	Control group	11	8.36		
<b>Difference in Skin Scale</b>	Massage group	11	9.82	-1.373	0.170
	Control group	11	13.18		

\* Below 0.05 level of significance.

### *Original Authors' Conclusions:*

The inclusion of scar massage into a client-specific hand therapy program significantly accelerated the recovery of wrist active range of motion in the four-week study period. No significant difference was found in skin mobility on the skin slide grade scale.

## **PART B - Critical Appraisal**

### **Validity**

#### *Methodology:*

A pre-test, post-test control group design, with scar massage being chosen as the independent variable (see discussion in the 'Biases' section below). Pseudo randomisation/ systematic sampling was used to allocate clients to either the intervention (massage) or control group (no massage).

#### *Rigour:*

Ethical approval was gained through the Human Ethics Committee of Curtin University. Voluntary written informed consent from each participant was obtained prior to the study and assessments being initiation. Scar massage was not commenced on any study participants prior to their inclusion in the study. All measurements of active ROM and skin mobility were taken at the beginning of the therapy session, prior to treatment, to ensure greater consistency between all measurements taken.

**Sampling:**

Twenty-two patients (12 males, 10 females) who were referred to a private hand clinic in regional Western Australia were included in the study (convenience sampling). Sampling was not masked. Authors outlined the inclusion/exclusion criteria used to screen clients for this study (Donnelly & Wilton, 2002, p. 7).

**Biases:**

- Lack of assessor blinding. Despite best efforts of the assessor to remain objective, her knowledge of group allocation and therefore client treatment means results may be biased. In this case it is likely to have favoured the intervention group, to improve the results for the massage group and the effectiveness of the treatment being trialed.
- The client-specific hand treatment programs varied widely between the 22 participants. Up to 9 patients received eight additional treatment modalities such as continuous passive motion (CPM), heat, pressure glove, contact media, retrograde massage, vibration, TENS and iontophoresis. Frequencies of use are not given. The use of vibration with 2 clients (20%) in the intervention group may have influenced the outcomes. If applied near or over the scar, it may have similar effects in releasing the scar tissue as massage and therefore increase the clients ROM. In this case massage would not be the only independent variable. More details are required to determine further if this fact would have biased the results of the study (Co-intervention Bias).
- Small sample size may influence the results, as this may prevent results that are both statistically *and* clinically significant being seen due to a lack of power in the completed study. The authors make no mention of power calculations. A statistically significant difference between the groups in active ROM was found. No statistical or clinically significant results were found for the Skin Slide Scale and the small sample size may have contributed to this outcome.

**Results**

Results favour the intervention (massage) group for wrist active ROM, despite both groups showing gains on this primary outcome measure. No significant difference (statistical or clinical) was found in skin mobility from the Skin Slide Scale.

Tables 2.2 and 2.3 were composed from the baseline and post-intervention data published in Appendix 1 of the original article (Donnelly and Wilton, 2002).

**Table 2.2 - PERCENTAGE OF ACTIVE ROM\*:  
GROUP MEANS AND DIFFERENCES**

	Pre-Intervention	Post-Intervention	Difference
<b>Massage Group</b>	<b>48 (M)</b> 16.35 (S.D)	<b>77.36 (M)</b> 13.85 (S.D)	<b>29.27 (M)</b> 7.84 (S.D)
<b>Control Group</b>	<b>50 (M)</b> 19.60 (S.D)	<b>70.10 (M)</b> 16.68 (S.D)	<b>20.09 (M)</b> 8.41 (S.D)

M = mean, S.D = standard deviation

\* Mean % AROM = mean percentage of full wrist active range of wrist motion (a composite of extension/flexion, ulnar/radial deviation measurements converted to percentages). Definition by Donnelly and Wilton (2002).

**Table 2.3 - SKIN SLIDE GRADE SCALE SCORES:  
GROUP MEANS AND DIFFERENCES**

	Pre-Intervention	Post-Intervention	Difference
<b>Massage Group</b>	<b>1.64 (M)</b> 0.48 (S.D)	<b>2.18 (M)</b> 0.72 (S.D)	<b>0.55 (M)</b> 0.66 (S.D)
<b>Control Group</b>	<b>1.55 (M)</b> 0.50 (S.D)	<b>2.09 (M)</b> 0.67 (S.D)	<b>0.55 (M)</b> 0.50 (S.D)

M = mean, S.D = standard deviation

*Size of treatment effect:*

It can be seen from the primary outcome measurements, that the treatment effect is a 9.18% increase in overall active ROM. (Concluded by deducting the control group mean [20.09%] from intervention group mean [29.27%]).

*Statistical and clinical significance*

A statistically significant difference between the group means in the active ROM measure was found to exist ( $z = -2.268$ ,  $p = 0.023$ ). The confidence interval (CI) calculated from the raw data was quite wide (95% C.I. = 1.83 to 16.63)#. Therefore, clinicians using this study could not be sure that all patients would receive an outcome close to the 9.18% average increase in active ROM. (Clients could have extremely good outcomes with 16.63% improvement or as little as 1.83% improvement. Clinicians may deem this minimum outcome to not be a cost-effective use of time and resources.

(# Confidence interval determined through use of the formula 95% C.I.= Difference between group means,  $\pm 3 \times \frac{\text{standard deviation av.}}{\text{(square root of no. av.)}}$ )

### *Minimal clinically important difference*

A 10% change from baseline measurements is considered a clinically important change. In this case, it would be a change of 10% in overall active ROM. The group mean difference in active ROM was 9.18% overall. No power calculations are recorded and therefore the minimum number of subjects necessary to see any real change is not known. There is the possibility that had a larger sample size been used a greater increase (above 10%) may have been found. If this is the case, it would in fact be a type 2 error, when a real clinically significant difference that exists, is not found.

### **IMPLICATIONS FOR PRACTICE/ APPLICABILITY**

- This study supports the use of massage for the management of scars in the hand injury population to address impairment in active ROM (the specified clinical question only).
- Massage techniques are used frequently by therapists in hand injuries, despite the fact that there is little scientific research to support the use of this technique. Further research is necessary to confirm and expand upon these results.
- The scar massage (intervention) is outlined well by the authors, including the amount of time it was carried out by therapist and client, the method and recording process so that it can be reproduced within the clinical setting.
- The various components used in the client-specific hand therapy regimes, that scar massage can be used to complement, are outlined by the authors to ensure the study may be replicated. The use of these modalities (splint, resistive exercises, continuous passive motion, heat, pressure glove, contact media, retrograde massage, vibration, TENS and iontophoresis) must be determined primarily by the therapist's clinical reasoning and personal judgement for individual cases.

### **REFERENCES**

- Phillips, B., Ball, C., Sackett, D., Haynes, B., Straus, S., & Dawes, M. (1998). *Levels of evidence and grades of recommendations* [Online]. Available: <http://cebm.jr2.ox.ac.uk/docs/levels.html> (Accessed: 20/10/03).
- Silverberg, R., Johnson, J., & Moffat, M. (1996). The effects of soft tissue mobilisation on the immature burn scar. *Journal of Burn Care and Rehabilitation*, 17(3): 252-259.

### **Critically Appraised Paper:**

- Donnelly, C.J., & Wilton, J. (2002). The effect of massage to scars on active range of motion and skin mobility. *British Journal of Hand Therapy*, 7(1): 5-11.

**Relevant Articles:** (included, not individually appraised)**Levels 1 to 4 Evidence**

Nil

**Level 5 Evidence**

Kasch, M.C. (1988). Clinical management of scar tissue. *Occupational Therapy in Health Care*, 4(3): 37-52.

Michlovitz, S.L. (2001). Distal radius fractures: Therapy practice patterns. *Journal of Hand Therapy*, 14(4): 249-57.

Robbins, F., & Reece, T. (1985). Hand rehabilitation after great toe transfer for thumb reconstruction. *Archives of Physical Medicine and Rehabilitation*, 66(2): 109-12.

Ronon, C. (2001). The use of massage to influence collagen synthesis in the hand: A physiological justification. *British Journal of Hand Therapy*, 6(3): 95-9.

**Related Articles:** (excluded, not individually appraised)**Level 1**

Verhagen, A.P., Bierma-Zeinstra, S.M.A., Feleus, A., Karelis, C., Dahaghin, S., Burdorf, L., de Vet, H.C.W., & Koes, B.W. (2004). Ergonomic and physiotherapeutic interventions for treating upper limb extremity work related disorders in adults (Cochrane Review). In: The Cochrane Library, Issue 2, 2004. Chichester, UK: John Wiley & Sons Ltd.

**Level 2**

Ferguson, D., & Duncan, J. (1976). A trial of physiotherapy for symptoms in keyboard operating. *The Australian Journal of Physiotherapy*, 22(2): 61-72.

Flowers, K.R. (1988). String wrapping versus massage for reducing digital volume. *Physical Therapy*, 68(1), 57-59.

Vasseljen, O., Johansen, B.M., & Westgaard, R.H. (1995). The effect of pain reduction on perceived tension and EMG-recorded trapezius muscle activity in workers with shoulder and neck pain. *Scandinavian Journal of Rehabilitation Medicine*, 27: 243-52.

Leboeuf, C., Grant, B.R. & Maginnes, G.S. (1987). Chiropractic treatment of repetitive strain injuries: A preliminary prospective outcome study os SMT versus SMT combined with massage. *The Journal of the Australian Chiropractors' Association*, 17(1): 11-4.

Levoska, S., & Keinanen-Kiukaanniemi, S. (1993). Active or passive physiotherapy for occupational cervicobrachial disorders? A comparison of two treatment methods with a one-year follow-up. *Archives of Physical Medicine and Rehabilitation*, 74: 425-30.

**Levels 3 and 4**

Nil

**Level 5**

Brown, P.W. (1999). Pointers for managing common hand injuries. *Journal of Musculoskeletal Medicine*, 16(12): 675-681.

Sheon, R.P. (1997). Repetitive strain injury: 2. Diagnostic and treatment tips on six common problems. *Postgraduate Medicine*, 102(4): 72-8.

**Expert Consensus Guidelines (excluded)**

International Research Foundation for RSD/CRPS. (2003). *Reflex sympathetic dystrophy / complex regional pain syndrome* (3<sup>rd</sup> ed., 1<sup>st</sup> January 2004). Tampa: Author.

**No level assigned (excluded, paper not available in English)**

Aizenberg, E.A., Aksenova, E.N., & Beneson, S.N. (1971). Post-operative treatment of injuries to the flexor tendon of the finger. *Khirurgiia (Mosk)*, 47(6): 64-7.

Demichev, N.P., Bespalova, V.G., & Khlopunova, S.I. (1974). Therapeutic physical exercise in lesions of the tendons of the hand in middle aged and elderly patients. *Vopr Kurortol Fizioter Lech Fiz Kult*, 4: 317-21.

Greither, A. (1968). On an unusual finger injury of a professional musician and it's expert evaluation. *Berufsdermatosen*, 16(6): 325-32.

Jurczyk, A., & Jaruga, M. (1967). Pre- and post-operative rehabilitation after free graft procedures on the hand. *Chir Naradow Ruchu Ortop Pol*, 32(4): 477-9.

Kornilov, N.V., Gol'dblat, V.I., & Iur'ev, P.V. (1975) Treatment of injuries of the tendons of the digital flexors. *Vestn Khir Im I I Grek*, 114(1): 91-6.

Urusmambetov, S.N. (1971). The clinical picture and treatment of ganglionic syndromes caused by injury. *Zh Nevropatol Psikhiatr Im S S Korsakova*, 71(5): 650-6.

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