



FEASIBILITY STUDY

# Range of motion improves after massage in children with burns: A pilot study

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**Summary** Little is known about the effect of massage on post-burn tissue in children. We conducted a pilot study to examine the effect of massage (3–5 days) on mood and range of motion (ROM) in eight post-burn children. Participants showed significant increases in ROM from Time 1 (pre-massage, first day) to Time 2 (post-massage, last day) in massaged tissue but not control (non-massaged) tissue. Mood was elevated throughout the study and thus did not change across time. Although massage improved ROM, we are cautious in our interpretation because of the small sample size.

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## Introduction

In 2003, approximately 83,300 children in the United States (age 14 years and younger) were treated in emergency rooms for injuries related to burns ([National SAFE KIDS Campaign, 2004](#)). Many children with burn injuries undergo surgeries and skin grafts directed at restoring function and, following hospitalization, receive short-term physical therapy and wound care. Options for long-term treatment are limited and typically consist of medication to address persistent pain and, in many cases, surgery to restore function.

Because treatment options are limited, some burn patients pursue alternative therapies, such as massage, to address issues related to psychological (e.g. mood, anxiety, pain) and physical states (e.g. range of motion, disfigurement, contractures) associated with burns. In one study examining psychological outcomes, depression, anger, and pain were measured via Likert scales among post-burn adult patients ([Field et al., 1998](#)). Patients who were hospitalized with recent burns received either standard care or standard care plus 20 min massage before debridement (removal of burned tissue) daily for 1 week. Patients receiving massage reported decreased depression, anger, and pain compared with patients who did not receive massage.

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Skin grafts from burns or trauma typically limit range of motion (ROM) when the injury occurs near or over a joint. In a case study describing a 74-year-old female with skin grafts due to trauma, the patient exhibited pain and significantly decreased ROM, strength, and function in the affected limb (Bajuk et al., 1996). Friction massage was applied for 10–15 min per day for 5 (non-consecutive) months to soften scars, in addition to other treatments (active/passive ROM exercises, transcutaneous electrical nerve stimulation {TENS}, hydrotherapy, biofeedback, and strengthening exercises) over 12 months. These aggressive therapies resulted in decreased pain and increased ROM of the patient's affected limb. A limitation of this study was that it included multiple treatments and we do not know which specific treatment or combination of treatments produced the effect.

Massage can produce psychological and physical changes in patients with *non-burn* injuries also. For example, patients with chronic low back pain received either 30 min of massage or 30 min of relaxation therapy twice per week for 5 weeks (Field et al., 2007; Hernandez-Reif et al., 2001a). Compared with control patients, massage patients showed decreased anxiety and increased trunk flexion without pain. In addition, a within groups analysis showed that massage patients had significant improvement in ROM across time when comparing pre-treatment (first day) with post-treatment (last day). A third study assessed the effect of massage on shoulder pain and ROM (van den Dolder & Roberts, 2003). Treatment participants received six massage sessions (15–20 min) over 2 weeks. Compared with non-massaged participants, massage participants showed increased ROM and decreased pain.

The research described thus far examined the effect of massage on adults. Little research has examined the effect of massage on *post-burn children*. Two studies we identified, however, provide preliminary evidence that children with burns also benefit from massage. For example, children in one study who were hospitalized with recent burns received either standard care or standard care plus 15 min massage before dressing changes (Hernandez-Reif et al., 2001b). Evidence of discomfort such as crying, facial grimacing, torso, and leg movement were assessed before and during dressing changes. The no-massage group showed increases in *all measures* of discomfort during dressing changes whereas the massage group showed an increase in only torso movements. A second study examined whether massage altered scar characteristics such as vascularity, pliability, and height (Patino et al., 1999). All participants wore pressure garments. Children in the massage group were taught to

self-apply massage to a scar for 10 min per day for 3 months. Although no difference between groups emerged in scar vascularity, pliability, or height, the authors report anecdotal evidence that massage reduced pruritis in some patients.

In sum, evidence suggests that burn and non-burned patients receive psychological benefits from massage in terms of altered mood (decreased depression, anger), decreased pain, and anxiety. In addition, research shows that massage increases ROM in chronically injured (non-burned) patients, but little empirical data exist examining the effect of massage on ROM in burn patients. Finally, we know of only two studies that examined massage in post-burn children. These studies revealed that massage decreases distress related to change in wound dressing and may decrease pruritis. The present study extends research conducted in post-burn children by examining the effect of massage on mood and ROM. In light of the research on adult burn survivors, we predicted that massage would increase mood and ROM.

## Methods

### Participants

Participants were eight children (six females and two males) attending a camp for pediatric burn survivors (Camp Amigo, FL). The mean age was 13.5 ( $\pm 2.6$ ) years (range 10–17 years). All participants had thermal burns (five from fire, two from hot oil, and one from hot water) to several body parts (arms, legs, trunk, and face). Percent of body surface area (BSA) that was burned was not documented. Tissue chosen for massage were third degree burns that required skin grafts. {Note: third degree burns are loss of all skin structures at a depth that reaches the subcutaneous fat and fascia, which included epidermis, dermis, and all skin organs (i.e. hair follicles, sweat glands, etc).} All massaged tissues were well-healed skin grafts that were at least 2 years post-burn (range 2–16 years). The parents of participants provided consent for their children to participate in the study in accordance with federal guidelines for research participation. Children also signed consent forms and gave verbal agreement to receive a massage before each massage session.

### Massage protocol

Massage sessions were offered once per day, every day for a total of 5 days. The sessions were conducted in a quiet building situated away from

the camp activities. All therapists had advanced training in massage for burn scars. The training included lectures on the physiological aspect of scar formation and the psychology of patients with scars. The training also included practical demonstrations of massage techniques for various types of scars including grafted skin. Pre-camp training for data collection included proper use of the goniometer by an experienced hospital burn-unit nurse.

Four therapists participated in data collection at the camp. We controlled for inter-observer error by having the same therapist apply massage to the same participant, and a second therapist collected the data on that same participant. The therapists applying massage were blind to the ROM and mood results until the end of the study.

Each massage session lasted 20–25 min. Pure cocoa butter was warmed in the therapist's hands before application. During the first few minutes of each session, the massage therapist discussed possible physical or emotional concerns with participants. Therapeutic massage on scar tissue consisted of 5 min of lengthening using long light strokes (effleurage), 5 min of stretching and rolling strokes which consisted of lifting and rolling the tissue between hands, fingers, or thumbs (petrissage), and depending on the pain tolerance of the child, 2–5 min of small cross fiber movements (friction) to loosen the scar tissue from the underlying tissue. The last 5 min of the massage session consisted of general lengthening and rolling. At the end of the session, the massage therapist allowed for discussion of possible needs or concerns regarding the massage.

### Treatment and control groups

All participants received massage on a body area with healed skin grafted burn scars. Sites for massage were chosen based on whether a suitable contra-lateral site was available to use as a control. For example, a participant's burned right arm was massaged and the equally burned left arm was not massaged and served as "control tissue".

Five children participated in the study for 4–5 days and three children participated for 3 days. The difference in number of days of participation was due to occasional scheduling conflicts.

### Assessments

Participants reported their mood before the first massage session on the first day (Time 1) and after the massage session on the last day (Time 2). Mood was assessed by having participants point to a

Likert-type pictorial scale using "smiley faces" that corresponded to a numerical scale, i.e. deep frown (0) to a deep smile (10). This scale was chosen because this type of Likert scale may be more effective in assessing children's attitude (Hopkins et al., 1990).

ROM was measured (in degrees) of scarred tissue over joints (knee, neck, shoulder) using a goniometer at Time 1 and Time 2. ROM measurements were taken on non-massaged tissue contra-lateral to scarred tissue, which served as a control comparison.

### Statistical analysis

We conducted a paired *t*-test to explore differences in ROM of massaged tissue before massage was initiated (Time 1) and after the final massage (Time 2). Similarly, we conducted a paired *t*-test to determine differences in ROM in control (non-massaged) tissue at Time 1 and Time 2. Mood was assessed in all participants at Time 1 and Time 2 using paired *t*-tests. All analyses were computed using SAS version 9.0 and alpha was set at  $p < 0.05$ .

### Results

As predicted, we observed an increase in ROM from Time 1 to Time 2 in massaged tissue,  $t(3) = 3.70$ ,  $p = .03$ , and no change in ROM across time in the control tissue,  $t(2) = 3.21$ ,  $p = .09$ . Table 1 presents mean ROM scores of participants in massaged versus control (non-massaged tissue) groups at Times 1 and 2. There was no significant difference in mood across time,  $t(7) = 0.81$ ,  $p = .44$ . Table 2 presents mean mood scores of participants at Times 1 and 2.

Although objective scar assessment was not conducted, the massage therapists noted that scars were red and firm (non-pliable) before massage. Post-massage, participants' scars were pink/flesh colored, supple, softer, and the skin more easily stretched.

### Discussion and conclusion

We found that massage increased ROM in children with burn scars. Although no comparable studies have examined ROM in adults or children with burn scars, our findings are consistent with studies showing that massage increases ROM in patients with non-burned injuries (Field et al, 2007; van den Dolder and Roberts, 2003; Hernandez-Reif et al., 2001a). Our study found no change in mood

**Table 1** Mean range of motion (ROM) scores for participants at two assessment times.

Group	Time 1: mean $\pm$ SD	Time 2: mean $\pm$ SD	<i>p</i> -value*
ROM massaged tissue	132.5 $\pm$ 9.6	140.5 $\pm$ 11.1	.03
ROM control tissue	144.6 $\pm$ 16.6	140.0 $\pm$ 19.1	.09

SD, standard deviation.

\*Tests are significant when  $p < .05$ .

**Table 2** Mean mood scores for participants at two assessment times.

	Time 1: mean $\pm$ SD	Time 2: mean $\pm$ SD	<i>p</i> -value*
Mood	9.0 $\pm$ 1.5	9.4 $\pm$ 0.9	.44

SD, standard deviation.

\*Tests are significant when  $p < .05$ .

following massage. This finding was surprising in light of previous studies that have found decreased distress in children undergoing burn wound dressing changes (Hernandez-Reif et al., 2001b), and adult burn studies showing that massage decreased depression and pain (Field et al., 2000; Field et al., 1998). Most likely our null effect was due to a *ceiling effect* because participants arrived at camp in an elevated mood that could not be further increased by massage. Indeed, the average mood at Time 1 was virtually identical to the highest value possible on our mood instrument.

Our study has several limitations. First, our sample size was small and effects based on small samples can be unreliable. Clearly, additional research using a larger sample is needed. Second, our mood instrument assessed positive affect, which, as we noted earlier, was highly elevated at the outset of the study. Although administering the pictorial (smiley face) Likert scale for mood was quick and easy, it was likely too simple and lacked the ability to determine meaningful affective states such as anxiety and dysphoria. And third, because the participants were 2–16 years post-burn, their “adaptation” or coping strategies toward their scars likely occurred in the early years of post-burn. Our measure of mood may simply be a “snap-shot” in time of a stable attitude toward their appearance. We plan to address specific questions regarding attitude, anxiety, and self-esteem in a follow-up study.

Finally, future research on burn scars and massage must consider the “evolution” of the patient’s scar. Typically, burn scars undergo hypertrophy between 6 and 12 months and tend to regress between 18 and 24

months (Oliveira et al., 2005). In addition, there may be a positive correlation between pruritis and hypertrophy of the burn scar. Thus, the effect of massage may differ depending on whether the burn scar is in the early versus later stages of maturation. Future studies should include evaluating the effect of massage on “new” versus “old” burn scars, and perhaps evaluate the effect of massage on non-burned fascia.

In sum, we are cautious in our interpretation of our results. However, the data are encouraging and add to the growing evidence of the benefit of massage for burn survivors.

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**Conflict of interest:** The authors have no conflict of interest to disclose.

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