POSITION STATEMENT PROPOSAL ON THERAPEUTIC MASSAGE FOR BURN SCARS

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BACKGROUND INFORMATION:

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Every year an estimated 450,000 Americans are treated in hospitals for burn injuries. This number does not include minor burns that are treated outside of the hospital environment. Most burn injuries occur in the home. ¹

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- Scar formation is a normal reaction of the body to injury. Scars develop as a result of damages such as burns, deep lacerations, or a variety of other injuries that penetrate or damage the skin. The development of scarring is the method by which the body heals wounds. There are studies specifically about scar tissue formation on a cellular level and the effects of massage therapy.
- 14 ^{2,3,4,5} Massage may affect the matrix remodeling and fibroblast apoptosis. ^{2,4}

- In cases where injury is too deep or severe, skin grafts are usually performed. In grafts, skin is
- taken from a non-damaged area of the body and reattached over the injured area. 4,6,7,8,9 The risk
- of hypertrophic scars is decreased if the wound heals within three weeks, however even though

skin grafts heal faster it does not decrease the risk of hypertrophic scars. Scar formation may then continue for a period of time after wound closure is accomplished. Massage may help prevent scar formation. Massage potentially aids by õí hastening the release and absorption of buried suturesí ö and aiding swelling. (Cho, Y. S., Jeon, J. H., Hong, A., Yang, H. T., Yim, H., Cho, Y. S., í Seo, C. H., 2014 p. 7)

õPatients who are transferred to a specialized burn center more than 5 days after injury are more likely to require amputation. Amputation is considered only in extreme cases [for which] sepsis and extensive tissue death from inadequate decompression are cited as the main reasons.

Massage helps prevent skin adherence and prevents further problems of pain and skin breakdown at later phase[s] in prosthetic restorationö (Spires, M. C., Kelly, B. M., & Pangilinan, P. H., 2007 p. 941) ⁹

The characteristics of scar tissue vary with the individual, but generally follow a typical pattern of wound healing. At first the scar is usually red in appearance (vascularity) and is considered an õimmatureö scar. As time passes and healing continues the scar will fade and become õmatureö.

7,11 Scar characteristics can include one or more of the following, depending on degree of injury: 6,7,12

- Hard and non-pliable: The scar may also develop bands of fibers on or below the surface that may feel like a cord or a rubber band upon palpation. ¹¹
- Painful: The scar may be painful, itchy (pruritus), sensitive as nerve endings heal. 13,14,15,16,17,18,19
- Contractures: A tightness or shortening of the skin where scars are located 6 especially characteristic across joints. Contractures may limit range of motion, compromise function, or cause deformity. 4,11,20
- Hypertrophic: A scar that becomes raised above skin surface as the body overproduces collagen, the substance found in scar tissue. The appearance can be thick, irregular, and/or rough. Usually found in larger and deeper wounds, wounds that require grafting, and wounds that take a long time to heal. ^{2,3,9,11,15,19,21,22,23,24,25,26,27}
- Keloid: Hypertrophic scars that are considerably larger than the original wound. ^{2,3,21,27}
- Matured scars: Even healed scars may become dry and reopen ó this is especially true for skin grafts which do not produce oil or sweat. 8,28

Individualsøscar characteristics vary drastically and massage therapy has shown improvements in vascularity, pigmentation, texture, thickness, and pliability. ^{2,4, 11,19,26,29,30,31} Once wound care is no longer the primary focus, the stage of intense rehabilitation begins encompassing massage therapy, physical therapy, and exercise therapy geared toward maximizing an individualøs independent functioning and quality of life. ⁹

Burn survivors undergo extensive treatment for their burns while in the hospital. ⁸ However, after release from the hospital, post-treatment care typically consists of outpatient wound care, pharmaceutical pain management, and physical therapy. õPhysical therapy consists notably of hand or mechanical massagesí etc.ö (Masanovic, M. G., 2013 p1) 33. Burn survivors are vulnerable to pain, disfigurement, and emotional turmoil, pediatric survivors are especially vulnerable due to their physical and mental growth. ^{2,17, 20,21,22,23,24,25,28,29,31,34,35} The ultimate goal of rehabilitation after a burn injury, may be a lifelong process to assist an individual in achieving optimal function and independence. ⁹ õSensory impairment and changes in cutaneous sensation is common in burn scars. Regular massage and touching of the scars helps with desensitisation [sic] of hyper-sensitive scars.ö (Procter, F., 2010 p. 8) ^{24,27} Burn rehabilitation lasts for months to vears after the initial injury. 9

Studies have already shown that massage therapy can improve mobility, decrease pruritus, improve skin status and assist in the overall recovery process for burn survivors. Massage assists in recovery by increasing blood flow, softening tissues, releasing scar tissue, and improving lymph drainage in the scarred tissue. ^{2,6,7,13,14,15,16,17,19,24,29,30,36} Scar pliability may increase as massage realigns collagen fibers during scar formation and remodeling.ö (Kania) ^{4,10,11,24,27,30,37,38} Massage can be used to help prevent or contain the negative evolution of pathological scars. ^{2,4,5,39}

Current research on burn-related scar tissue indicates that massage is effective in increasing mobility of previously immobile or restricted tissue. While there has not been a conclusive study on massage and mobility, early studies have been promising. ^{24,25,29,30,31,36,37} Additional research recommends massage as part of an optimal scar modification technique. ^{24,26,29,36} Research has demonstrated the effects of massage on burn scars both using a topical agent and regular lubricant. The effects of massage significantly reduced the thickness of scar tissue, õtherefore improving function for these patientsö. ²⁶

Rationale:

 õFollowing burns, hypertrophic scars have an incident rate of 30%-91%. The reoccurrence rate ranges from 16% - 100% in those treatments reporting a reoccurrence rate.ö (Bloemen, M. C. T., van der Veer, W. M., Ulrich, M. M. W., van Zuijlen, P. P. M., Niessen, F. B., & Middelkoop, E., 2009 p. 464) ³ According to Ahuja õPruritus has an incidence rate of 80%-100%ö. (Ahuja, R. B., & Gupta, G. K., 2013 p. 25). ¹⁹ Since massage therapy has been shown to improve hypertrophic scars ^{2,4,5,39} and pruritus ^{2,7,15,17,18,29,30,31,32} these indicate massage should be considered for a larger part of rehabilitation.

A major key to acceptance of the effectiveness of a given treatment in the medical and research community is using evidence-based research that clearly demonstrates the efficacy of the

- procedure and/or intervention. The importance of touch to recovering burn survivors cannot be overestimated. Over ten years of research has shown the importance and relevance of therapeutic massage for burn scars. Research has indicated not just psychological benefits ^{13,14,16,17,29,30,31} but reduction in pruritus, ^{2,7,13,15,18,29,30,31,32} improvement in range of motion, ^{20,30,36,37} improvement in scar characteristics, ^{2,4,12,26,29,30,31} reduction in scar formation, ^{2,4,12,26} and significant reduction in pain. ^{2,13,14,16,17,30} There is a clear and consistent relationship between the effects and benefits of massage therapy and burn recovery.
- Scar massage is widely advocated as an integral part of burn scar management. ⁹ õlts effects on decreasing scar vascularity have led to its wide role in scar remodeling and in decreasing hypertrophy and post burn pruritus.ö (Ahuja, R. B., & Gupta, G. K., 2013 p.25) ¹⁹ Massage therapy is routinely used as a standard therapy in the management of scar tissue. ^{7,19,25,30,32,39,40} Kania reports that massage therapy occupies 52% of treatment protocols ³⁰ and Radha mentions that 81% of survey respondents reported using scar massage as part of their treatment plans. ²⁸
- As the body of high quality research of burn treatment grows, and training based on this research develops, massage therapists will be able to apply new techniques to assist clients in recovery.
- 117 This statement is in line with AMTAøs standards of practice:
 - provide safe, consistent care

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- determine the quality of care provided
- 1.4 The Practitioner seeks professional supervision/consultation consistent with promoting and maintaining appropriate application of skills and knowledge.
 - 2.2 Pathophysiology (Contraindications)
- 2.2.1 The Practitioner maintains current knowledge and skills of pathophysiology and the appropriate application of massage/bodywork.
- This statement fully supports portions of AMTA¢s core values:
 - We are a diverse and nurturing community working with integrity, respect and dignity.
- We embrace consistency in education.
- We endorse professional standards.
- We affirm and promote the benefits of massage therapy as validated by research.
- The position statement supports the portions of the Vision Statements of AMTA, as follows:
 - AMTA members are devoted to professionalism and excellence in massage therapy practice.
 - Quality research is the foundation for evidence-informed massage therapy education and practice.
 - AMTA promotes its members as the highest quality professionals in massage therapy.
- Massage therapy is easily accessible.

139 140	 Massage therapy is a vital component of health care and wellness. 	
141 142	The position statement supports the portions of the Goals and Objectives of AMTA, as follows:	
143	ADVOCACY AND INFLUENCE	
144	Goal: The health care and wellness industry accepts the value of massage therapy.	
145	Objective: Increase understanding of the benefits of massage therapy through education of the	
146	health care and wellness industry.	
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148	INDUSTRY RELATIONSHIPS	
149	Goal: AMTA is a respected leader within the health care and wellness industry.	
150	Objective: Increase collaboration between AMTA, its members and other health care and	
151	wellness industry leaders.	
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153	RESEARCH	
154	Goal: AMTA members are aware of the importance of scientific research to the massage therapy	
155	industry.	
156	Objective: Increase the opportunities for members to access massage therapy scientific research	
157	through AMTA sources.	
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159	In line with AHRQ guidelines on the value of high quality research, AMTA has also stated in	
160	previous strategic plans that õMassage therapy education and practice is evidence- informedö.	
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162	Position Statement	
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164	It is the position of the American Massage Therapy Association (AMTA) that massage therapy	
165	can assist in the rehabilitation of burn scars.	
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167	References:	
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169	1. American Burn Association 2014. http://www.ameriburn.org/resources factsheet.php	
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171	Burn Incidence and Treatment in the United States: 2013 Fact Sheet	
172	The following annual estimates have been derived from statistics provided by the U.S.	
173	Vital Statistics, several ongoing national surveys, selected states and the National Burn	
174	Repository of the American Burn Association. Repository reports describe admissions to	
175	hospitals with specialized services provided by "burn centers."	
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177	Burn Injuries Receiving Medical Treatment: 450,000	

178	This general estimate is derived mainly from federal surveys which provide annual
179	estimates of hospital admissions and visits to hospital emergency departments. The
180	estimate range acknowledges that some burns may have been treated solely at hospital
181	clinics, community health centers, or private medical offices. Such burns are more likely
182	to be minor, and the number of such facilities sampled is too small to provide reliable
183	estimates for burns.
184	Sources: National Electric Injury Surveillance System-All Injury Project (NEISS-AIP);
185	National Emergency Department Survey (HCUP-NEDS) (2010 Data); National
186	Ambulatory Medical Care Survey.
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188	Fire/Burn/Smoke Inhalation Deaths Per Year: 3,400
189	This total includes 2,550 deaths from residential fires, 300 from vehicle crash fires, and
190	550 from other sources (approximately 150 deaths from flame burns or smoke inhalation
191	in non-residential fires, 400 from contact with electricity, scalding liquids or hot objects).
192	Fire and burn deaths are combined because deaths from burns in fires cannot always be
193	distinguished from deaths from toxic smoke or other non-burn causes.
194	Sources: National Fire Protection Association (2011 Fire Loss Report); National Safety
195	Council (2012 Injury Facts, based on 2008 data, the latest available from the National
196	Vital Statistics System).
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198	Hospitalizations Related to Burn Injury: 40,000, including 30,000 at hospital burn centers
199	Over 60% of the estimated U.S. acute hospitalizations related to burn injury were
200	admitted to 127 burn centers. Such centers now average over 200 annual admissions for
201	burn injury and skin disorders requiring similar treatment. The other 4,500 U.S. acute
202	care hospitals average less than 3 burn admissions per year.
203	Sources: National Inpatient Sample (HCUP-NIS: 2010 data); National Hospital
204	Discharge Survey (2010 data); recent 100% hospitalization data from several states.
205	Selected Statistics: 2003-2012 Burn Admissions to Burn Centers
206	Survival Rate: 96.6%
207	Gender: 69% male, 31% female
208	Ethnicity: 59% Caucasian, 20% African-American, 14% Hispanic, 7% Other
209	Admission Cause: 43% fire/flame, 34% scald, 9% contact, 4% electrical, 3% chemical,
210	7% other
211	Place of Occurrence: 72% home, 9% occupational, 5% street/highway, 5%
212	Recreational/Sport,
213	9% Other
214	Source: American Burn Association National Burn Repository (2013 report)
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2. Cho, Y. S., Jeon, J. H., Hong, A., Yang, H. T., Yim, H., Cho, Y. S., í Seo, C. H. (2014). The effect of burn rehabilitation massage therapy on hypertrophic scar after burn: A randomized

controlled trial. Burns: journal of the International Society for Burn Injuries. 218 doi:10.1016/j.burns.2014.02.005 PMID: 24630820 219 220 OBJECTIVE: To evaluate the effect of burn rehabilitation massage therapy on 221 222 hypertrophic scar after burn. METHOD: One hundred and forty-six burn patients with hypertrophic scar(s) were 223 224 randomly divided into an experimental group and a control group. All patients received standard rehabilitation therapy for hypertrophic scars and 76 patients (massage group) 225 additionally received burn scar rehabilitation massage therapy. Both before and after the 226 treatment, we determined the scores of visual analog scale (VAS) and itching scale and 227 assessed the scar characteristics of thickness, melanin, erythema, transepidermal water 228 loss (TEWL), sebum, and elasticity by using ultrasonography, Mexameter(®), 229 Tewameter(®), Sebumeter(®), and Cutometer(®), respectively. 230 RESULTS: The scores of both VAS and itching scale decreased significantly in both 231 groups, indicating a significant intragroup difference. With regard to the scar 232 233 characteristics, the massage group showed a significant decrease after treatment in scar 234 thickness, melanin, erythema, TEWL and a significant intergroup difference. In terms of scar elasticity, a significant intergroup difference was noted in immediate distension and 235 gross skin elasticity, while the massage group significant improvement in skin 236 distensibility, immediate distension, immediate retraction, and delayed distension. 237 CONCLUSION: Our results suggest that burn rehabilitation massage therapy is effective 238 in improving pain, pruritus, and scar characteristics in hypertrophic scars after burn. 239 240 3. Bloemen, M. C. T., van der Veer, W. M., Ulrich, M. M. W., van Zuijlen, P. P. M., Niessen, F. 241 B., & Middelkoop, E. (2009). Prevention and curative management of hypertrophic scar 242 formation. Burns: Journal of the International Society for Burn Injuries, 35(4), 4636475. 243 doi:10.1016/j.burns.2008.07.016PMID: 18951704 244 245 Although hypertrophic scarring commonly occurs following burns, many aspects such as 246 incidence of and optimal treatment for scar hypertrophy remain unclear. This review will 247 focus on hypertrophic scar formation after burn in particular, exploring multiple 248 treatment options and describing their properties as well as effectiveness. To evaluate 249 treatment efficacy and scar development, clinical scar assessment is of eminent 250 importance. Furthermore, recommendations regarding the classification of hypertrophy in 251 the daily practice and in clinical trials are implemented. 252 253 4. Kanazawa, Y., Nomura, J., Yoshimoto, S., Suzuki, T., Kita, K., Suzuki, N., & Ichinose, M. 254

(2009). Cyclical cell stretching of skin-derived fibroblasts downregulates connective tissue growth factor (CTGF) production. Connective Tissue Research, 50(5), 3236329PMID: 19863391

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Delayed healing of skin wounds can be caused by wound instability, whereas appropriate massage or exercise prevents sclerosis and scar contracture. However, the mechanism by which wound healing is related to mechanical stress has not been fully elucidated. The present study aimed to identify whether mechanical stretching of fibroblasts reduces their production of extracellular matrix. We transferred skin fibroblasts into collagen-coated elastic silicone chambers, cultured them on a stretching apparatus, and used RT-PCR to examine the effects of mechanical stretching on the expression levels of 17 genes related to extracellular matrix production and growth factor secretion. We found that connective tissue growth factor (CTGF) was downregulated after 24 hr of cell stretching. Specifically, the CTGF mRNA and protein levels were 50% and 48% of the control levels, respectively. These findings suggest that cyclic stretching of fibroblasts contributes to anti-fibrotic processes by reducing CTGF production.

5. Leask, A., & Abraham, D. J. (2004). TGF-beta signaling and the fibrotic response. FASEB journal: official publication of the Federation of American Societies for Experimental Biology, 18(7), 8166827. doi:10.1096/fj.03-1273revPMID: 15117886

The cause of fibrotic diseases, pathologies characterized by excessive production, deposition, and contraction of extracellular matrix, is unknown. To understand the molecular basis of fibrotic disease, it is essential to appreciate how matrix deposition is normally controlled and how this process is dysregulated in fibrogenesis. This review discusses the current state of knowledge concerning interactions among the profibrotic proteins transforming growth factor-beta (TGF-beta), connective tissue growth factor (CTGF, CCN2), and ED-A fibronectin (ED-A FN) and the antifibrotic proteins tumor necrosis factor-alpha (TNF-alpha) and gamma-interferon (IFN-gamma).

6. Bloemen, M. C. T., van der Veer, W. M., Ulrich, M. M. W., van Zuijlen, P. P. M., Niessen, F. B., & Middelkoop, E. (2009). Prevention and curative management of hypertrophic scar formation. Burns: Journal of the International Society for Burn Injuries, 35(4), 463ó475. doi:10.1016/j.burns.2008.07.016. PMID: 9212487

The cosmetic and functional result in post burn scar deformities is influenced by following factors: 1. The type of patient's central nervous system and his response to burn injury. 2. Depth and site of burn areas. 3. Early excision and grafting. 4. Infection complications, their severity and location. 5. Fixation of dressings should be done using elastic materials and applied for so long until stabilization of scars is completed. Elastic materials should be combined with rigid pressure and pressure massage. 6. Congenital predisposition of the patient to hypertrophic scarring.

7. Rochet JM; Zaoui A. Burn scars rehabilitation and skin care. Rev Prat. 2002 Dec 15;52(20):2258-63. Review. French. PMID: 12621946

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Burn rehabilitation main goal is to minimize the consequences of hypertrophic scars and concomitant contractures. The treatment principles rely on the association of joint posture, continuous pressure completed with range of motion to prevent joint fusion (which happens to adults but not to children). Throughout the different treatment phases and wound evolution, reassessment is necessary to review rehabilitation goals and activities. During the acute phase the alternance of positioning is prioritized in order to keep the affected extremities in anti-deformity positron using splint or other devices. At the rehabilitation phase, treatment is focused on active/passive range of motion (skin posture) strengthening exercises and use of dynamic splint is introduced to correct contractures. After their discharge home, patients benefit from outpatient rehab until scar maturation (approximately 18 months). The treatment consists mainly on active/passive range of motion, scar massage, strengthening exercise and endurance retraining. Also modalities (such as thermal bath and high pressure water spray) are used to address itching problems and for scar softening. Finally, reconstructive surgery can be performed to correct excessive scarring or joint contracture for better functional or cosmetic outcome.

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8. Ward, R. S. (1991). Pressure therapy for the control of hypertrophic scar formation after burn injury. A history and review. The Journal of Burn Care & Rehabilitation, 12(3), 2576262. PMID: 1885644

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Devastating functional problems can result from the formation of hypertrophic scar tissue after burn injury. Although a patient with burns may have several medical problems to contend with because of the injury, most ongoing rehabilitation difficulties are a consequence of the continual wound contraction that occurs in immature burn scars. Treatment of hypertrophic burn scar consists of several surgical options and of pressure therapy, which traditionally involves wearing garments made from elasticized fabric. This article reviews the treatment of hypertrophic scar tissue, with emphasis on its history and on nonsurgical methods of managing the burn scar.

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9. Spires, M. C., Kelly, B. M., & Pangilinan, P. H. (2007). Rehabilitation methods for the burn injured individual. Physical Medicine and Rehabilitation Clinics of North America, 18(4), 9256 948, viii. doi:10.1016/j.pmr.2007.07.002. PMID: <u>17967369</u>

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Physiatrists play a critical role in managing the medical and functional consequences of serious burn injuries. Goals of rehabilitation include wound healing, scar prevention, hypertrophic scarring suppression, full range of motion, strengthening, and independent

mobility and activities of daily living. This article is an overview of burn rehabilitation 337 principles and patient management. The ultimate rehabilitation goal is independence in 338 all spheres of an individual's life. Achievement of independence depends on the 339 commitment of the injured individual and the entire health care team. 340 341 342 10. Edwards, J. (2003). Scar management. Nursing Standard (Royal College of Nursing (Great Britain): 1987), 17(52), 39642. doi:10.7748/ns2003.09.17.52.39.c3456. PMID: 14533225 343 344 345 Scarring has major psychological and physical repercussionsô for example, scarring on the face and visible regions of the body can be very distressing for the patient, whether it 346 is simple acne scars or large, raised surgical or traumatic scars. This article discusses the 347 process of scar formation, the differences between scars and proposes a number of ways 348 in which the nurse can manage scars. 349 350 351 11. Van Zuijlen, P. P. M., Angeles, A. P., Kreis, R. W., Bos, K. E., & Middelkoop, E. (2002). Scar assessment tools: implications for current research. Plastic and Reconstructive Surgery, 352 109(3), 110861122.. PMID: 11884845 353 354 Scarring is considered a major medical problem that leads to cosmetic and functional 355 sequelae. Scar tissue is clinically distinguished from normal skin by an aberrant color, 356 rough surface texture, increased thickness (hypertrophy), occurrence of contraction, and 357 firmness. Marked histologic differences are the change in dermal architecture and the 358 359 presence of cell: the myofibroblast. Many assessment tools are available for analysis of pathologic conditions of the skin; however, there general agreement as to the most 360 appropriate tools for evaluation of scar tissue. This review critically discusses current 361 available objective measurement tools, subjective assessment tools, and potential devices 362 363 that may be available in the scar assessment. 364 365 12. Gangemi, E. N., Gregori, D., Berchialla, P., Zingarelli, E., Cairo, M., Bollero, D., í Stella, M. (2008). Epidemiology and risk factors for pathologic scarring after burn wounds. Archives of 366 367 Facial Plastic Surgery, 10(2), 93ó102. doi:10.1001/archfaci.10.2.93 PMID: 18347236 368 OBJECTIVE: To describe the clinical characteristics of post burns scars and determine 369 the independent risk factors specific to these patients. While burns may generate 370 widespread and disfiguring scars and have a dramatic influence on patient quality of life, 371 the prevalence of post burn pathologic scarring is not well documented, and the impact of 372 certain risk factors is poorly understood. 373 374 METHODS: A retrospective analysis was conducted of the clinical records of 703

patients (2440 anatomic burn sites) treated at the Turin Burn Outpatient Clinic between January 1994 and May 15, 2006. Prevalence and evolution time of post burn pathologic

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scarring were analyzed with univeriate and multivariate risk factor analysis by sex, age, burn surface and full-thickness area, cause of the burn, wound healing time, type of burn treatment, number of surgical procedures, type of surgery, type of skin graft, and excision and graft timing.

RESULTS: Pathologic scarring was diagnosed in 540 patients (77%): 310 had hypertrophic scars (44%); 34, contractures (5%); and 196, hypertrophic contracted scars (28%). The hypertrophic induction was assessed at a median of 23 days after reepithelialization and lasted 15 months (median). A nomogram, based on the multivariate regression model, showed that female sex, young age, burn sites on the neck and/or upper limbs, multiple surgical procedures, and meshed skin grafts were independent risk factors for post burn pathologic scarring (Dxy 0.30).

CONCLUSION: The identification of the principal risk factors for post burn pathologic scarring not only would be a valuable aid in early risk stratification but also might help in assessing outcomes adjusted for patient risk.

13. Field, T., Peck, M., Scd, null, Hernandez-Reif, M., Krugman, S., Burman, I., & Ozment-Schenck, L. (2000). Postburn itching, pain, and psychological symptoms are reduced with massage therapy. The Journal of Burn Care & Rehabilitation, 21(3), 1896193.PMID: 10850898

Twenty patients with burn injuries were randomly assigned to a **massage therapy** or a standard treatment control group during the remodeling phase of wound healing. The massage therapy group received a 30-minute massage with cocoa butter to a closed, moderate-sized scar tissue area twice a week for 5 weeks. The massage therapy group reported reduced itching, pain, and anxiety and improved mood immediately after the first and last therapy sessions, and their ratings on these measures improved from the first day to the last day of the study.

14. Field, T., Peck, M., Krugman, S., Tuchel, T., Schanberg, S., Kuhn, C., & Burman, I. (1998). Burn injuries benefit from massage therapy. The Journal of Burn Care & Rehabilitation, 19(3), 2416244. PMID: 9622469

Twenty-eight adult patients with burns were randomly assigned before debridement to either a massage therapy group or a standard treatment control group. State anxiety and cortisol levels decreased, and behavior ratings of state, activity, vocalizations, and anxiety improved after the massage therapy sessions on the first and last days of treatment. Longer-term effects were also significantly better for the massage therapy group including decreases in depression and anger, and decreased pain on the McGill Pain Questionnaire, Present Pain Intensity scale, and Visual Analogue Scale. Although the underlying mechanisms are not known, these data suggest that debridement sessions were less painful after the massage therapy sessions due to a reduction in anxiety, and

that the clinical course was probably enhanced as the result of a reduction in pain, anger, and depression.

15. Goutos, Ioannis BSc (Hons), MBBS (Hons), MRCSEd; Dziewulski, Peter FRCS, FRCS (Plast); Richardson, Patricia M. MRCP, FRCA. (2009). Pruritus in Burns. *Journal of Burn Care & Research*, *30*(2),pgs. 221-228.

Pruritus represents a common and distressing feature of burn wounds. Over the last decades, significant advances in neuroanatomical and neurophysiological knowledge have resulted in the elucidation of the mediators and pathways involved in the transmission of pruritic impulses. A plethora of therapeutic approaches have been evaluated mostly in small-scale studies involving burns patients targeting both the peripheral and the central components of the neurologic pathway. Antihistamines, doxepin, massage therapy, and transcutaneous electrical nerve stimulation are effective strategies to combat pruritus in burns patients. Recent studies have provided preliminary evidence regarding the effectiveness of gabapentin and ondansetron. The area of burns pruritus is under-researched and large-scale studies are required to reinforce the armamentarium of specialists with evidence-based regimens for the treatment of this highly distressing symptom.

16. Li, Adrienne L. K. BASc; Gomez, Manuel MD, MSc; Fish, Joel S. MD, MSc, FRCS(C). Effectiveness of Pain Management Following Electrical Injury. Journal of Burn Care & Research, January/February 2010,31(1):73-82. PMID: 20061840

The purpose of this study was to evaluate the effectiveness of pain management after electrical injury. A retrospective hospital chart review was conducted among electrically injured patients discharged from the outpatient burn clinic of a rehabilitation hospital (July 1, 1999, to July 31, 2008). Demographic data, numeric pain ratings (NPRs) at initial assessment and discharge, medications, nonpharmacologic modalities, and their effects before admission and after rehabilitation were collected. Pain management effects were compared between high (×1000 v) and low (<1000 v) voltage, and between electrical contact and electrical flash patients, using Student's t-test and 2, with a P < .05 considered significant. Of 82 electrical patients discharged during the study period, 27 were excluded because of incomplete data, leaving 55 patients who had a mean age ±SD of 40.7 ± 11.3 years, TBSA of $19.2 \pm 22.7\%$, and treatment duration of 16.5 ± 15.7 months. The majority were men (90.9%), most injuries occurred at work (98.2%), mainly caused by low voltage (n = 32, 58.2%), and the rest caused by high voltage (n = 18, 32.7%). Electrical contact was more common (54.5%) than electrical flash (45.5%). Pain was a chief complaint (92.7%), and hands were the most affected (61.8%), followed by head and neck (38.2%), shoulders (38.2%), and back torso (38.2%). Before rehabilitation, the most common medication were opioids (61.8%), relieving pain in 82.4%, followed by acetaminophen (47.3%) alleviating pain in 84.6%. Heat treatment was the most common nonpharmacologic modality (20.0%) relieving pain in 81.8%, followed by massage therapy (14.5%) alleviating pain in 75.0%. During the rehabilitation program, antidepressants were the most common medication (74.5%), relieving pain in 22.0%, followed by nonsteroidal anti-inflammatory drugs (61.8%), and alleviating pain in 70.6%. Massage therapy was the most common nonpharmacologic modality (60.0%), alleviating pain in 75.8%, and then cognitive behavioral therapy (54.5%), alleviating pain in 40.0%. There were pain improvements in all anatomic locations after rehabilitation except for the back torso, where pain increased 0.7 ± 2.9 points. Opioids were more commonly used in high voltage (P < .05), and cognitive behavioral therapy in low-voltage injuries (P < .05). Opioids were used in both electrical flash and electrical contact injuries. Pain in electrically injured patients remains an important issue and should continue to be addressed in a multimodal way. It is hoped that this study will guide us to design future interventions for pain control after electrical injury.

17. Parlak Gürol, A., Polat, S., & Akçay, M. N. (2010). Itching, pain, and anxiety levels are reduced with massage therapy in burned adolescents. Journal of Burn Care & Research: Official Publication of the American Burn Association, 31(3), 4296432.

doi:10.1097/BCR.0b013e3181db522c. PMID: 20453734

Burn can be among the most severe physical and psychological traumas a person may face. Patients with burns commonly have severe itching and pain. Severe itching has also been associated with anxiety, sleep disturbance, and disruption of daily living activities. The addition of complementary treatments to standard care may lead to improved pain management and may offer a safer approach for reducing pain and procedural anxiety for patients with burns. The authors conducted an experimental study to examine whether the effects of massage therapy reduced burned adolescents' pain, itching, and anxiety levels.

Sixty-three adolescents were enrolled in this study shortly after admission (mean days = 3 ± 0.48) at a burn unit in a large university hospital from February 2008 to June 2009. The measures including the pain, itching, and state anxiety were collected on the first and last days of the 5-week study period. The participants had an average age of 14.07 ± 1.78 years and came usually from the lower socioeconomic strata. The authors observed that massage therapy reduced all these measures from the first to the last day of this study (P <.001). In most cultures, massage treatments are used to alleviate a wide range of symptoms. Although health professionals agree on the use of nonpharmacologic method for patients with burns, these applications are not yet common.

18. Bell, P. L., & Gabriel, V. (2009). Evidence based review for the treatment of post-burn pruritus. Journal of Burn Care & Research: Official Publication of the American Burn Association, 30(1), 55661. doi:10.1097/BCR.0b013e318191fd95. PMID: 19060768

Pruritus is one of the most common and distressing complications of burns. It is often debilitating and interferes with sleep, activities of daily living and may cause additional tissue damage from scratching. This systematic review classified and ranked 10 trials and one case report for the effective treatment of post-burn pruritus. A literature search was performed using Ovid Medline from 1950 to present; limited to English and used the search terms pruritus, itching, and burns. The studies available were evaluated using the Physiotherapy Evidence Database scoring system. Each article was then classified according to the Practice Guidelines for Burn Care 2006, a practice guideline published in the Journal of Burn Care and Research. Ten trials were available and all were accepted for analysis. The evidence was classified class II or class III, meeting criteria for guideline status according to the Practice Guidelines of Burn Care 2006. The best quality study for the pharmacological treatment of post-burn pruritus was selective histamine receptor antagonists. The best quality study for the non-pharmacological treatment of post-burn pruritus was the use of pulse dye laser. A paucity of literature exists for the treatment of post-burn pruritus. Also, in the search for effective treatments of post-burn pruritus, there is not a consistent and detailed instrument of measure available for use. Currently, there is no quality evidence available for the treatment of post-burn pruritus and prospective, randomized controlled trials are needed.

19. Ahuja, R. B., & Gupta, G. K. (2013). A four arm, double blind, randomized and placebo controlled study of pregabalin in the management of post-burn pruritus. Burns: Journal of the International Society for Burn Injuries, 39(1), 24629. doi:10.1016/j.burns.2012.09.016. PMID: 23089176

Post-burn itch is a distressing symptom in burns rehabilitation and its treatment often proves frustrating for the patient and the multidisciplinary burns team. Traditionally, the mainstay of antipruritic therapy for decades has been antihistamines and massage with emollients. With a better understanding of the neurophysiology of itch emerged a new dimension in the treatment of post-burn pruritus. Gabapentin, a centrally modulating antiepileptic agent and 2 ligand, proved in clinical trials to be immensely better in the treatment of post-burn pruritus. Pregabalin is a newer structural analog of gabapentin. It has a much better anxiolytic effect and pharmacokinetic profile as compared to gabapentin. The current study was initiated to specifically study the role of pregabalin in relieving post-burn itch as this has never been investigated before. This double blind, randomized and placebo controlled study had four arms and was carried out on 80 adult patients (20 each). The four arms were: pregabalin, cetirizine with pheniramine maleate,

combination of pregabalin, cetirizine and pheniramine maleate, and placebo (vit. B comp.). Massage with coconut oil was integral to all groups. Drug dosage was determined by initial VAS (visual analog scale) scores. All groups matched in demographic data and initial VAS scores. VAS scores were evaluated over next 28 days (days 3, 7, 14, 21 and 28). In patients with mild itch (VAS scores 2-5) or moderate itch (VAS scores 6-8) near complete remission of itch was seen in combination group and pregabalin group where the response was comparable and close to 95%. This was significantly better response than antihistaminic combination or massage alone. However, massage alone was sufficient in decreasing mean scores in mild itch, in a large percentage of patients. Amongst the patients with severe itch (VAS scores 9-10), 3/6 and 6/7 patients dropped out of trial in the antihistaminic and placebo groups, respectively. Combination therapy and pregabalin alone had exactly similar decrease in itch scores by day 28 (78.9%). This far exceeded the response in the antihistaminic and placebo groups (23.9% and 9.2% respectively). We conclude that moderate to severe pruritus (VAS 6-10) should be treated with a systemic, centrally acting agent like pregabalin or gabapentin to eliminate itch or bring it down to tolerable limits. Patients with mild itch having VAS scores between 4 and 5 may be better served with addition of pregabalin even if massage and antihistaminics can control post-burn itch to a reasonable extent because of quicker, predictable and complete response, along with anxiolysis.

20. Neugebauer, C. T., Serghiou, M., Herndon, D. N., & Suman, O. E. (2008). Effects of a 12-week rehabilitation program with music & exercise groups on range of motion in young children with severe burns. Journal of Burn Care & Research: Official Publication of the American Burn Association, 29(6), 9396948. doi:10.1097/BCR.0b013e31818b9e0e. PMID: 18849852

Previous studies indicate that rehabilitation programs supplemented with a strength and endurance-based exercise program improve lean body mass, pulmonary function, endurance, strength, and functional outcomes in severely burned children over the age of 7-years when compared with standard of care (SOC). To date, supplemental exercise programming for severely burned children under the age of 7-years has not yet been explored. The purpose of this study was to determine if a 12-week rehabilitation program supplemented with music & exercise, was more effective in improving functional outcomes than the SOC alone. This is a descriptive study that measured elbow and knee range of motion (ROM) in 24 severely burned children between ages 2 and 6 years. Groups were compared for demographics as well as active and passive ROM to bilateral elbows and knees. A total of 15 patients completed the rehabilitation with supplemental music and exercise, and data was compared with 9 patients who received SOC. Patients receiving the 12-week program significantly improved ROM in all joints assessed except for one. Patients receiving SOC showed a significant improvement in only one of the joints assessed. Providing a structured supplemental music and exercise program in

conjunction with occupational and physical therapy seems to improve both passive and active ROM to a greater extent than the SOC atone.

21. Berman, B., Viera, M. H., Amini, S., Huo, R., & Jones, I. S. (2008). Prevention and management of hypertrophic scars and keloids after burns in children. The Journal of Craniofacial Surgery, 19(4), 98961006. doi:10.1097/SCS.0b013e318175f3a7. PMID: 18650721

Hypertrophic scars and keloids are challenging to manage, particularly as sequelae of burns in children in whom the psychological burden and skin characteristics differ substantially from adults. Prevention of hypertrophic scars and keloids after burns is currently the best strategy in their management to avoid permanent functional and aesthetical alterations. Several actions can be taken to prevent their occurrence, including parental and children education regarding handling sources of fire and flammable materials, among others. Combination of therapies is the mainstay of current burn scar management, including surgical reconstruction, **pressure therapy**, silicon gels and sheets, and temporary garments. Other adjuvant therapies such as topical imiquimod, tacrolimus, and retinoids, as well as intralesional corticosteroids, 5-fluorouracil, interferons, and bleomycin, have been used with relative success. Cryosurgery and lasers have also been reported as alternatives. Newer treatments aimed at molecular targets such as cytokines, growth factors, and gene therapy, currently in developing stages, are considered the future of the treatment of post burn hypertrophic scars and keloids in children.

22. Bombaro, K. M., Engrav, L. H., Carrougher, G. J., Wiechman, S. A., Faucher, L., Costa, B. A., í Honari, S. (2003). What is the prevalence of hypertrophic scarring following burns? Burns: Journal of the International Society for Burn Injuries, 29(4), 2996302. PMID: <u>12781605</u>

Hypertrophic scarring after burns remains a major problem and is considered to be "common". Pressure garments are commonly used as treatment even though there is little sound data that they reduce the prevalence or magnitude of the scarring. In 1999 we began a study of the efficacy of pressure garments on forearm burns. After studying 30 patients, mainly white adults, we found no hypertrophic scar in either those treated with pressure or without. This prompted us to review the literature on the prevalence of hypertrophic scarring after burns and found only four articles with a relatively small number of patients and only three geographical locations. It became clear that the prevalence of hypertrophic scarring is really unknown. We then did a retrospective study of 110 burn survivors and counted all hypertrophic scars of all sizes and locations in all races and found the prevalence hypertrophic scarring to be 67% which conflicts with the published reports and our prospective study and suggests that further research is necessary. We concluded that a worldwide, prospective survey is necessary to establish

the prevalence of hypertrophic scarring after burns. In this article we are calling for and offering to organize this survey.

23. Staley, M. J., & Richard, R. L. (1997). Use of pressure to treat hypertrophic burn scars.
 Advances in Wound Care: The Journal for Prevention and Healing, 10(3), 44646. PMID:
 9306778

Pressure has been used since the early 1970s by burn care provides to help minimize the formation of hypertrophic scars. Although the exact mechanism of action is unknown, pressure appears clinically to enhance the scar maturation process. Bandages that can be wrapped and unwrapped or are made of a soft material are used in early scar management. Custom made pressure garments generally are used for definitive scar management. Inserts are placed in concavities to aid in compression. Whatever intervention is used for scar management, patient and family should be educated about the realistic, potential outcome.

 24. Holavanahalli, R. K., Helm, P. A., Parry, I. S., Dolezal, C. A., & Greenhalgh, D. G. (2011). Select practices in management and rehabilitation of burns: a survey report. Journal of Burn Care & Research: Official Publication of the American Burn Association, 32(2), 2106223. doi:10.1097/BCR.0b013e31820aadd5. PMID: 21240002

The purpose of this study is to document the organization and current practices in physical rehabilitation across burn centers. An online survey developed for the specific purposes of this study sought information regarding a) logistics of the burn center; b) inpatient and outpatient treatment of patients with burn injury; and c) specific protocols in the treatment of a few complications secondary to burn injuries. Of the 159 responses received, 115 were received from the United States, 20 from Australia, 16 from Canada, and 7 from New Zealand. The overall sample included responses from 76 physical therapists (PTs) and 78 occupational therapists. Seventy-three of those surveyed considered themselves primarily a burn therapist. Nurses (86%) were reported as primarily responsible for wound care of inpatients, followed by wound care technicians (24%). Ninety-seven percent of the therapists reported following their own treatment plans. The trunk and areas of head and neck were treated by both PTs and occupational therapists, whereas the lower extremities continue to be treated predominantly by PTs. Some common practices regarding treatment of a few complications secondary to burn injuries such as splinting to prevent contractures, treatment of exposed or ruptured extensor tendons, exposed Achilles tendons, heterotopic ossification, postoperative ambulation, conditioning, scar massage, and use of compression garments are described. Opportunities exist for 1) developing a common document for practice guidelines in

physical rehabilitation of burns; and 2) conducting collaborative studies to evaluate 654 treatment interventions and outcomes. 655 656 25. Richard, R., Baryza, M. J., Carr, J. A., Dewey, W. S., Dougherty, M. E., Forbes-Duchart, L., 657 658 í Young, A. (2009). Burn rehabilitation and research: proceedings of a consensus summit. Journal of Burn Care & Research: Official Publication of the American Burn Association, 30(4), 659 5436573. doi:10.1097/BCR.0b013e3181adcd93. PMID: 19506486 660 661 Burn rehabilitation is an essential component of successful patient care. In May 2008, a 662 group of burn rehabilitation clinicians met to discuss the status and future needs of burn 663 rehabilitation. Fifteen topic areas pertinent to clinical burn rehabilitation were addressed. 664 Consensus positions and suggested future research directions regarding the physical 665 aspects of burn rehabilitation are shared. 666 667 26. Ko, W. J., Na, Y. C., Suh, B. S., Kim, H. A., Heo, W. H., Choi, G. H., & Lee, S. U. (2013). 668 The effects of topical agent (kelo-cote or contractubex) massage on the thickness of post-burn 669 scar tissue formed in rats. Archives of Plastic Surgery, 40(6), 6976704. 670 671 doi:10.5999/aps.2013.40.6.697 PMID: 24286041 672 BACKGROUND: We conducted an experimental study to compare the effect of massage 673 using topical agents (Kelo-cote or Contractubex) on scar formation by massaging the 674 healed burn wound on the dorsal area of Sprague-Dawley (SD) rats. 675 METHODS: Four areas of second degree contact burn were made on the dorsal area of 676 677 each of 15 SD rats, using a soldering iron 15 mm in diameter. After gross epithelialization in the defect, 15 SD rats were randomly divided into four groups: the 678 Kelo-cote group, Contractubex group, Vaseline group, and control group. Rats in three of 679 the groups (all but the Control group) were massaged twice per day for 5 minutes each 680 day, while those in the Control group were left unattended. For histologic analysis, we 681 682 performed a biopsy and evaluated the thickness of scar tissue. 683 RESULTS: In the Kelo-cote and Contractubex groups, scar tissue thicknesses showed a significant decrease, compared with the Vaseline and control groups. However, no 684 significant differences were observed between the Kelo-cote and Contractubex groups. In 685 the Vaseline group, scar tissue thicknesses showed a significant decrease, compared with 686 687 the control groups. CONCLUSIONS: The findings of this study suggest that massage using a topical agent is 688 689 helpful in the prevention of scar formation and that massage only with lubricant (no use of a topical agent) also has a considerable effect, although not as much as the use of a 690 topical agent. Thus, we recommend massage with a topical agent on the post-burn scar as 691 an effective method for decreasing the scar thickness. 692

27. Procter, F. (2010). Rehabilitation of the burn patient. Indian Journal of Plastic Surgery:
 Official Publication of the Association of Plastic Surgeons of India, 43(Suppl), S1016113.
 doi:10.4103/0970-0358.70730. PMID: 21321643

Rehabilitation is an essential and integral part of burn treatment. It is not something which takes place following healing of skin grafts or discharge from hospital; instead it is a process that starts from day one of admission and continues for months and sometimes years after the initial event. Burns rehabilitation is not something which is completed by one or two individuals but should be a team approach, incorporating the patient and when appropriate, their family. The term 'Burns Rehabilitation' incorporates the physical, psychological and social aspects of care and it is common for burn patients to experience difficulties in one or all of these areas following a burn injury. Burns can leave a patient with severely debilitating and deforming contractures, which can lead to significant disability when left untreated. The aims of burn rehabilitation are to minimise the adverse effects caused by the injury in terms of maintaining range of movement, minimising contracture development and impact of scarring, maximising functional ability, maximising psychological wellbeing, maximising social integration.

28. Holavanahalli, R. K., Helm, P. A., & Kowalske, K. J. (2010). Long-term outcomes in patients surviving large burns: the skin. Journal of Burn Care & Research: Official Publication of the American Burn Association, 31(4), 6316639. doi:10.1097/BCR.0b013e3181e4ca62. PMID: 20523226

The objective of this study was to evaluate persons who have survived severe burns and to describe the long-term residual problems relating to the skin. This is a cross-sectional descriptive study that included a one-time evaluation of 98 burn survivors (18 years old or older) who survived >30% TBSA burns, were >3 years post injury, and consented to participate. Study participants were required to undergo a physical examination conducted by the Physical Medicine and Rehabilitation physicians in addition to completing study questionnaires. Participants were predominantly male (63%) and Caucasian (69%). The average time from injury was 17 years (range 3653 years), and the average TBSA burn was 57% (range 30697%). Problems with hot and cold temperature, sensory loss, raised scars, and itching continued to pose problems many years after burn injury. Reports of open wounds, skin rash, painful scars, and shooting pain in scars tended to decrease over time, whereas reports of fragile burns, including cuts and tears, tended to increase over time. Findings from the physical examination of the participants include hypertrophic scars in grafted areas (92%) and in nongrafted areas (38%), decreased sensation to pain in grafted areas (71%), and hyperpigmentation in grafted areas (53%), fingernail deformities (35%), and skin breakdown (32%). Individuals with

732 large burns deserve more long-term attention. As survivors of large burns continue to face significant burn-related issues, there is a critical need for long-term follow-up both 733 734 in the clinic and in research. 735 29. Roh, Y. S., Cho, H., Oh, J. O., & Yoon, C. J. (2007). Effects of skin rehabilitation massage 736 737 therapy on pruritus, skin status, and depression in burn survivors. Taehan Kanho Hakhoe Chi, 738 37(2), 2216226. PMID: 17435407 739 740 PURPOSE: Hypertrophic scarring and depression are the principal problems of burn rehabilitation. This study was done to verily the effects of skin rehabilitation massage 741 therapy (SRMT) on pruritus, skin status, and depression for Korean burn survivors. 742 METHODS: A pretest-posttest design using a non-equivalent control group was applied 743 to examine the effects of SRMT for 3 months in a group of 18 burn survivors. The major 744 dependent variables-including pruritus, objective and subjective scar status, and 745 depression-were measured at the beginning and at the end of the therapy to examine the 746 effects of SRMT. 747 748 RESULTS: Burn survivors receiving SRMT showed reduced pruritus, improved skin status, and depression. The remaining scar also showed improvement in skin 749 pigmentation, pliability, vescidarity, and height (compared to the surrounding skin) as 750 measured on the Vancouver Scar Scale (VSS). 751 CONCLUSIONS: The findings demonstrate that SRMT for burn survivors may improve 752 their scars both objectively and subjectively, and also reduce pruritus and depression. 753 754 30. Kania, A. (2012). Scars. In Moyer, C, Dryden, T, Massage Therapy: Integrating Research 755 756 and Practice (pp 173-184) Champaign, IL Human Kinetics. 757 758 Several mechanisms of action of massage have been proposed to explain the effects of massage therapy may have on scar tissue. Scar pliability may increase as massage 759 realigns collagen fibers during scar formation and remodeling. It is also postulated that 760 the direct mechanical effect of massage may break down adhesions of the scar to 761 underlying tissue, allowing for increased movement of the scar tissue and underlying soft 762 tissues and increased range of motion in affected joint structures. The mechanical effects 763 may also displace fluid in maturing scar tissue, flattening the scar. While these are 764 plausible theories, it must be noted that they still require scientific examination. 765 Massage therapy is considered a standard therapy in the treatment of scar tissue. In 766 767 rehabilitation centers specializing in the treatment of scars and burns, it is routinely used

in the management of scar tissue, occupying a place in 52% of treatment protocols.

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31. Roh, Y. S., Cho, H., Oh, J. O., & Yoon, C. J. (2007). Effects of skin rehabilitation massage therapy on pruritus, skin status, and depression in burn survivors. Taehan Kanho Hakhoe Chi, 37(2), 2216226. PMID: 16112449

Two studies are reviewed that highlight the positive effects of **massage therapy** on skin conditions in young children. In the first study children being treated on a burn trauma unit received 30-minute massages before debridement or dressing change. The children who received massage therapy were more relaxed during the procedure. In the study on children with eczema, those who were massaged during the application of their skin medication showed less anxiety after the massage sessions. Across the massage period the children also showed an improved clinical condition including less redness, lichenification, scaling, excoriation, and pruritus.

32. Patiño, O., Novick, C., Merlo, A., & Benaim, F. (1999). Massage in hypertrophic scars. The Journal of Burn Care & Rehabilitation, 20(3), 2686271; discussion 267. PMID: 10342484

Various attempts have been made to intervene with the formation of hypertrophic scarring (HTS) or to ameliorate it once it has developed, but none have yet proved effective. Massage therapy is routinely used by therapists for the treatment of various conditions, and there have been reports of increased scar pliability and decreased scar banding with the use of massage. This study examines the use of friction massage over a 3-month period in a group of 30 pediatric patients with HTS. The patients were randomly assigned to receive either therapeutic massage sessions of 10 minutes per day in combination with treatment with pressure garments or they were treated with pressure garments alone. A modified Vancouver Burn Scar Assessment Scale was used to measure the characteristics of the identified scars (10 cm by 10 cm) before and after the implementation of massage therapy. The study failed to demonstrate any appreciable effects of massage therapy on the vascularity, pliability, and height of the HTS studied, although there were reports of a decrease in pruritus in some patients. Further studies, with prolonged treatment intervals, are necessary to conclusively demonstrate the ineffectiveness of this therapy for HTS.

33. Masanovic, M. G. (2013). [Physical therapy for scars]. Soins; La Revue De Référence Infirmière, (772), 41643. PMID: <u>23539850</u>

Physical therapy consists notably of hand or mechanical massages, pressure therapy using various fabrics or splints, cryotherapy, laser therapy, etc. It forms part of the range of therapies used to treat pathological scars, including medical and surgical treatment. While the results are often satisfactory for hypertrophic scars, they remain uncertain for major keloids.

34. Willebrand, M., Sveen, J., Ramklint, M. D. M., Bergquist, R. N. M., Huss, M. D. F., & Sjöberg, M. D. F. (2011). Psychological problems in children with burns--parentsøreports on the Strengths and Difficulties Questionnaire. Burns: Journal of the International Society for Burn Injuries, 37(8), 130961316. doi:10.1016/j.burns.2011.08.003. PMID: 21924557

Burns may have a devastating effect on psychological health among children, although previous studies report difficulties as well as positive findings. The aims were to describe the rate of psychological problems in children with burns using a standardized instrument and to explore statistical predictors of these problems. Parents (n=94) of children aged 36 18 years who sustained burns 0.369.0 years previously answered the Strengths and Difficulties Questionnaire (SDQ) covering Emotional symptoms, Conduct problems, Hyperactivity/Inattention, Peer relationship problems, Prosocial behavior, and a Total difficulties score. Questions regarding parental psychological health and family situation were also included. The results for three of the SDQ subscales were close to the norm (10%) regarding the rate of cases where clinical problems were indicated, while the rate of cases indicated for Conduct, Peer problems and Total difficulties was 18620%. Statistical predictors of the SDQ subscales were mainly parents@psychological symptoms, father's education, and changes in living arrangements. Visible scars were relevant for the Total difficulties score and Hyperactivity/Inattention. In summary, a slightly larger proportion of children with burns had psychological problems than is the case among children in general, and family variables exerted the most influence on parental reports of children's psychological problems.

35. Stavrou, D., Weissman, O., Winkler, E., Millet, E., Nardini, G., Tessone, A., í Haik, J. (2011). Managing the relationship between quality and cost-effective burn care. Burns: Journal of the International Society for Burn Injuries, 37(3), 367ó376. doi:10.1016/j.burns.2010.10.006 PMID: 21130580

In the modern era of fiscal prudence, managing the relationship between quality health care and cost reduction is a complex and challenging task for policy makers and health care providers. Health economics is an applied field that aids in assessing the feasibility of incorporating new interventions in a certain field. Applying these tools when allocating funds for burn care is even more complicated due to the lack of clinical data regarding the cost effectiveness of different aspects in burn care. Herein we review the existing literature and summarize different approaches for achieving cost effective health care in general and in burn care specifically. Special considerations to funds allocation in burn care are also discussed.

36. Garrison, DK, BA LMT; Smith, NK, LMT; et al. (Nov. 2010). Therapeutic Massage for 849 Pediatric Burn Survivors, Poster # 5. Presented at: Southern Region Burn Conference, November 850 12-14, 2010 at Cook Convention Center in Memphis, TN. 851 852 853 OBJECTIVE: These 2 projects were designed to 1) determine if therapeutic massage 854 intervention produced clinically meaningful changes in ROM, keloid size/shape, and mood variances in children ages 8-18 (2006 project); and 2) to determine if massage 855 alone or massage with AIS produced greater changes in ROM (2010 project). 856 857 DESIGN: Data collected at Camp Amigo 2006 and at Camp Amigo & the Central Virginia Burn Camp in 2010. 858 PARTICIPANTS: From an initial screening of 30 children, 8 children were eventually 859 selected for full protocol in 2006. From an initial screening of 47 children in 2010, no 860 861 children met the criteria for full protocol, and 24 children were given general therapeutic massage sessions. All were burn survivors living in the Southeastern US and all had 862 thermal burns > 2 years. 863 RESULTS: Massage significantly increased ROM in participants with scars when 864 comparing the first day of measurement to the last day. Neither circumference nor mood 865 was significantly altered. 866 CONCLUSIONS: Although ROM was significantly different when comparing first and 867 last day measurements, we are cautious to contribute this entirely to massage because of 868 869 the small number of participants in the study. More research is needed on both massage 870 & ROM and massage with AIS. We would also strongly encourage studies with adult 871 populations. 872 37. Morien, A., Garrison, D., & Smith, N. K. (2008). Range of motion improves after massage in 873 874 children with burns: a pilot study. Journal of Bodywork and Movement Therapies, 12(1), 67671. 875 doi:10.1016/j.jbmt.2007.05.003. PMID: <u>19083657</u> 876 877 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 878 879 (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 880 tissue but not control (non-massaged) tissue. Mood was elevated throughout the study 881 882 and thus did not change across time. Although massage improved ROM, we are cautious 883 in our interpretation because of the small sample size. 884 38. Edgar, D., & Brereton, M. (2004). Rehabilitation after burn injury. BMJ: British Medical 885 Journal, 329(7461), 3436345. Retrieved from 886

http://www.ncbi.nlm.nih.gov/pmc/articles/PMC506862/

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Prevention of scarring should be the aim of burn management. For every member of the burn team, rehabilitation must start from the time of injury. Having a substantial burn injury is frightening, particularly as patients will not know what to expect and will be in pain. Consistent and often repetitive education is a vital part of patient care. Oedema management, respiratory management, positioning, and engaging patients in functional activities and movement must start immediately. Patients need to be encouraged to work to their abilities and accept responsibility for their own management. Functional outcome is compromised if patients do not regularly engage in movement.

CONCLUSION: The rehabilitation of burns patients is a continuum of active therapy. There should be no delineation between an õacute phaseö and a õrehabilitation phaseöò instead, therapy needs to start from the day of admission (and before if possible). Education is of paramount importance to encourage patients to accept responsibility for their rehabilitation. A consistent approach from all members of the multidisciplinary team facilitates ongoing education and rehabilitation.

39. Roques, C. (2013). [Burn scars]. Soins; La Revue De Référence Infirmière, (772), 47649. PMID: 23539853

 Burns often result in extensive scars which can change the body aesthetically and/or functionally. Rapid scarring is a sign of a good prognosis. Preventative actions such as hydration, compression, massage, posture and splints help to prevent or contain the negative evolution of pathological scars.

40. Sheridan, R. Burn Rehabilitation. (2012). Retrieved from http://emedicine.medscape.com/article/318436-overview

 OVERVIEW: Burn rehabilitation is an undeniably difficult and time consuming effort that, to attain the objective of optimal long-term function, must begin at the outset of burn care. Treatment goals and strategies vary, depending on the patient injury, stage of treatment, age, and comorbidities. Goals range from minimizing loss of range of motion (ROM) in the critically ill patient to establishing a work-hardening program in recovered patients.

Survival was once the only gauge of success in managing serious burn cases. Today, however, the overriding objective of burn care has become reintegration of the patient into the home and community. This goal has extended the traditional role of the burn care team beyond acute wound closure.