Scar Wars Episode VII

No J.J. Abrams, but some really cool burn therapists will have practical information you can use!

Burn Therapist’s will discuss the pathophysiology of burn scar and burn assessment and then have the opportunity to apply scar management techniques in breakout sessions designed to address difficult areas including: web space contractures of the hands, facial scars using a total face orthotic and low tech management of facial scars. We are happy to bring you this comprehensive program to address assessment, treatment planning and problem solving in addressing this very difficult issue. This topic was chosen by a large margin from the participants in 2012. Please look at the objectives and goals of each breakout session. You will be choosing one session to allow a more comprehensive learning experience in each break out session.
8:00 - 9:10  Welcome & Business Meeting:
- Announcements
- MAC Update
- Abstract Manuscript Submission Updates
- Acknowledgement of Therapist Presentations and Posters
- Burntherapist.com update
- Barbara Knothe Burn Therapist Achievement Award
- Introduction of Topics and Speakers

9:15 - 9:45  Lecture 1: Pathophysiology of Burn Scar
David J. Lorello, PT, DPT
Arizona Burn Center, Phoenix, AZ
Midwestern University, AZ

9:45 - 10:15  Lecture 2: Assessment of the Burn Scar
Lisa Forbes, MSc, OT Reg (MB)
Winnipeg Health Sciences Centre, Winnipeg, MB

10:15 - 10:30  Discussion with David and Lisa
Announcements for Breakouts

10:30 - 10:45  Break
Refreshments provided by Bio Concepts

10:45 - 11:45  Breakout sessions: Presentations and hands on practice:
Participants are asked to choose one presentation

- Face mask: techniques and problem solving
  Beth Franzen, OTR/L
  Regions Hospital Burn Center

- Low tech treatment of the face when a total contact mask is not available or appropriate
  Karen Hulin Poli, OT, CHT & Doug Baron, BSc PT
  Alberta Children’s Hospital

- Hard to treat areas of the hand (adult and pediatric views)
  Christie Bice, OT
  Nora Barrett, MS, OTR/L, CHT
  Arizona Burn Center
  Medstar National Rehab Network
  MedStar Washington Hospital Center

11:45 - 12:00  Wrap up and adjourn
The Membership Advisory Committee (MAC) committee is comprised of dedicated non-physician burn care professionals who serve the ABA in a variety of ways. It is the responsibility of all MAC members to facilitate the appropriate expression of concerns, questions, issues, needs and recommendations that the At-Large Members wish to bring before the Board of Trustees. Members of the MAC Committee attend each of the SIG meetings at the annual meeting in order to disseminate information regarding the ABA activities and general ABA information and opportunities.

Membership Advisory Committee Therapist Members:
Ingrid Parry, MS, PT, Chair
Michael A. Serghiou OT, MBA
Dana Y. Nakamura, OTR/L, CLT, CLMC

Special Interest Groups

Background
Special Interest Groups (SIGs) originated out of the expressed need of the ABA membership to have small, informal groups in which to link with others with similar interests in an effort to exchange ideas, network with colleagues, share information and problem-solve. As the ABA grew, so did the number of SIGs. By 2003, there were 18 SIGs ranging in size from 10 to over 300 individuals attending various SIG meetings in conjunction with the ABA Annual Meeting.

The Special Interest Groups (SIG) hold meetings in conjunction with the Annual Meeting of the ABA. These meetings provide an opportunity for exchange of ideas, networking with colleagues, and information sharing. All ABA meeting participants are encouraged to attend these meetings, which are scheduled at times that do not conflict with the general meeting. These meetings are open to both members and nonmembers of the ABA.

Physical Therapy / Occupational Therapy (PT/OT)
This SIG provides opportunities for professional exchange of ideas, with colleagues on new treatment methods, research activity and clinical problem solving. Another focus is to encourage burn therapist involvement in the ABA. We have recently instituted a three year plan with two Co-Chairs to ensure continuity and consistency.

2013 Chair: Trudy Boulter, OTR/CHT
2013 Co-Chair: David Lorello, PT, DPT
2013 Co-Chair: Lynne Benavides, OTR/L, CHT
Additional 2013 Committees with Therapist Membership

**Aftercare Reintegration Committee**  
Dana Y. Nakamura, OTR/L, CLT, CLMC

**Archives Committee**  
Reginald L. Richard, PT, MS

**Awards Committee**  
Ingrid S. Parry, MS, PT

**Bylaws Committee**  
Michael A. Serghiou, OTR, MBA

**Ethical Issues Committee**  
Patricia A. Sharp, OTR/L

**International Outreach Committee**  
Beth A. Costa, OTR/L

**Nominating Committee**  
Ingrid S. Parry, MS, PT

**Program Committee**  
Ingrid S. Parry, MS, PT; Michael A. Serghiou, OTR, MBA

**Rehabilitation Committee**  
Bernadette Nedelec, PhD, BSc, OT, Chair  
Jennifer C. Arndt, OT  
Lisa Forbes, MSc, OT Reg(MB)  
Lesley Palmgren, PT  
Ingrid S. Parry, MS, PT  
Melinda Shetler, OTR/L  
Shu-Chuan Chen Hsu, OTR/CHT  
David J. Lorello, DPT

**Research Committee**  
Lan Van-Buendia, MS, OTR/L

**Strategic Budgeting Committee**  
Ingrid S. Parry, MS, PT

**Committee on Technology**  
Jonathan Niszczak, MS, OTR/L
Lisa Forbes, MSc, OT Reg(MB) has been an Occupational Therapist for 14 years serving her entire career working in burns, plastic and reconstructive rehabilitation for both adults and pediatrics. Lisa first earned the title of Clinical Specialist in Pediatrics at the Winnipeg Children’s Hospital in 2001 and has now served the last 10 years as Clinical Specialist in Burn Care at the Health Sciences Centre. Notwithstanding her full time burn responsibilities, Lisa has also passionately served as Director of the Firefighters Burn Camp Mamawi and on the planning committee for both the Mamingwey Burn Survivor Conference and the Canadian Burn Survivor Conference over 12 years. Lisa has been an active member of both of the American Burn Association and Manitoba Society of Occupational Therapists throughout her entire career and is the recipient of the 2012 Manitoba Outstanding Occupational Therapist Award.

Lisa, like Barb Knothe, is a dedicated clinician, a thoughtful researcher and a powerful educator. She is devoted to the whole patient. She not only provides her patients with skills for physical rehabilitation to return to their life role, but is also devoted to providing them with the critical psychological tools for coping and adjustment to these life role challenges. She does not shy away from difficult conversations, yet approaches her patients with compassion conviction and understanding. Her dedication to her patients extends far beyond the hospital walls with her extensive and longstanding involvement in burn camps and other burn survivor organizations.

As a researcher, Lisa’s work demonstrates this same consideration for the opinions and perspectives of the burn patient. Lisa has served on multiple ABA committees, symposia and workshop panels and has been a consistent, active participant in the organization every year since 2001. Moreover, she has been an energetic, contributing member of the Canadian SIG, Burn Camp SIG and the ABA / Phoenix Society Joint Aftercare and Reintegration Committee. The breadth of perspective in her research is further complemented by her detailed, objective, and systematic approach to investigation. She is an eloquent, candid and passionate speaker and incorporates humor which lightens the mood of her students and survivors, whether in a group or individual
setting and allows for greater ease of learning overall. She openly discusses sensitive or controversial issues in a professional way and can always be counted on to follow through by bringing vigor and passion to all her endeavors.

Lisa’s devoted work from bedside to professional conferences, publications and hands-on participation in burn camps and survivor activities, clearly makes her an ideal candidate worthy as the first Canadian recipient of this award. Lisa’s sense for incorporating practical clinical skills with academic research exemplify her character and solidify her recognition as a high caliber burn rehabilitation therapist.
Correlative Session Presentations

Friday, April 26, 2013

132: Results of a Prospective Randomized Controlled Trial of Early Ambulation for Patients with Lower Extremity Grafts

Friday, Apr 26, 2013, 10:45 AM -11:00 AM
M. D. Peck, MD, ScD, FACS, D. J. Lorello, PT, DPT, M. Albrecht, RN, K. J. Richey, RN, BSN, M. A. Pressman, PhD
Arizona Burn Center, Phoenix, AZ

134: Three Dimensional Analysis of the Latest Commercially Available Video Games for Burn Rehabilitation: Keeping Up with Technology

Friday, Apr 26, 2013, 11:15 AM -11:30 AM
I. S. Parry, MS, PT, J. Kawada, BS, C. Carbullido, BS, S. Sen, MD, D. G. Greenhalgh, MD, FACS, T. L. Palmieri, MD, FACS, FCCM
Shriners Hospitals for Children, Sacramento, CA

135: Challenging Standard Goniometric Measurement for Patients with Burn Injuries: A Suggested Paradigm Shift To Move Beyond Practice as Usual

Friday, Apr 26, 2013, 11:30 AM -11:45 AM
R. L. Richard, PT, MS, P. McGlinchey, DPT, I. S. Parry, MS, PT
U.S. Army Institute of Surgical Research, Fort Sam Houston, TX; Shriners Hospitals for Children, Sacramento, CA

136: Overhead Lift Systems Reduce Back Injuries Amongst Burn Care Providers

Friday, Apr 26, 2013, 11:45 AM -12:00 PM
W. R. Anyan III, MPT, I. Faraklas, RN, BSN, S. E. Morris, MD, FACS, A. Cochran, MD, FACS
University of Utah, Salt Lake City, UT

Poster Presentations

Wednesday, April 24, 2013

168: Occupational Therapy Intervention For The Mouth Following Traumatic Facial Burns
J. Gilchrist, OTR/L, MOT, B. M. Potenza, MD, FACS, FCCM, M. Tenenhaus, MD, FACS
University of California, San Diego, CA

169: Controlling Burn Scars of the Nose/Nares using Silicone Gauge Earring Plugs
K. L. Ause-Ellias, MPT, R. A. Shon, OTR/L, MOT, T. Perry, MD, FACS, R. M. Johnson, MD, FACS, M. Shapiro, RN, MSN
Miami Valley Hospital, Dayton, OH

170: Innovative Use of Thermoplastics: Face and Neck Burns Throughout Phases of Recovery
M. Sher, PT, H. Hunter, PT, R. W. Yurt, MD, FACS
New York Presbyterian / Weill Cornell Medical Center, New York, NY
171: A Comprehensive Guide for Using Interactive Video Games as a Tool to Achieve Burn Rehabilitation Goals
C. Carbullido, BS, I. S. Parry, MS, PT, J. Kawada, BS, S. Sen, MD, D. G. Greenhalgh, MD, FACS, T. L. Palmieri, MD, FACS, FCCM
Shriners Hospitals for Children, Sacramento, CA

173: Burn Wound Depth Related to Burn Scar Contracture: A Current Analysis of Old Information
R. L. Richard, PT, MS, J. Jones, BS, K. K. Chung, MD, E. M. Renz, MD
U.S. Army Institute of Surgical Research, Fort Sam Houston, TX

174: The Real Truth: Perceptions of Pressure Garments
J. A. Conway, OTR/L, K. A. Hannigan, RN, K. Prelack, PhD, RD
Shriners Hospitals for Children, Boston, MA

Thursday, April 25, 2013

208: Five Year Experience with Burns from Glass Fireplace Doors in the Pediatric Population
M. Baryza, PT, MS, M. Hinson, RN, C. M. Ryan, MD, FACS
Shriners Hospitals for Children, Boston, MA

217: Drawbacks and Difficulties Utilizing Virtual Reality for Pain Control in the Burn Population
H. Martin, OTR, CHT, PhD, S. Dissanaike, MD, A. Axelrod, OTR/L
University Medical Center, Lubbock, TX

218: Treating Neuropathic Pain in Burn Survivors: A New Approach
V. Calva, BSc, OT, A. Carter, BSc, OT, M. A. Couture, BSc, OT, E. Godbout, BSc, OT, C. Poulin, BSc, OT, B. Nedelec, PhD
Villa Medica Rehabilitation Hospital, Montreal, QC, Canada; McGill University, Montreal, QC, Canada

223: Pilot Study to Assess the Therapeutic Benefits of a Wilderness Rafting Adventure for Adult Burn Survivors
H. D. Christians, MOT, M. Reimann, MBA, N. A. Kemalyan, MD, FACS
Legacy Emanuel Hospital, Portland, OR; LEAP (Life Expanding Adventure Program), Portland, OR

240: Therapy Staffing and Staff Allocated to Conducting Original Research at Verified Burn Centers
D. O. Murray, MSPT, M. A. Pressman, PhD, K. N. Foster, MD, MBA, FACS
Arizona Burn Center, Phoenix, AZ

241: The Effects of Skin Cell Isolation Grafting on Therapy Intervention and Outcomes
P. A. Malie, OTR/L, MOT
UPMC Mercy Hospital of Pittsburgh, Pittsburgh, PA

242: Burn Therapist Contributions to the ABA & JBCR: An Anniversary Review
R. L. Richard, PT, MS
U.S. Army Institute of Surgical Research, Fort Sam Houston, TX
243: Use of a Full-Time Physical Therapist Dedicated Specifically to Outpatient Burn Clinic
D. O. Murray, MSPT, K. J. Richey, RN, BSN, M. A. Pressman, PhD, M. D. Peck, MD, ScD, FACS
Arizona Burn Center, Phoenix, AZ

244: Reliability of a Video Analysis Software System To Assess Dorsal Hand Skin Movement
R. L. Richard, PT, MS, M. Lester, DPT, W. S. Dewey, PT, V. L. Narvaiz, BA, J. Jones, BS
U.S. Army Institute of Surgical Research, Fort Sam Houston, TX

245: SPMP: An Innovative Padding System for Effective Pressure Therapy on Burn Scars
C. Li-Tsang, PhD, W. Y. Pao, BSc, OT
Department of Rehabilitation Sciences, The Hong Kong Polytechnic University, Hong Kong, China
The **BurnTherapist.com** web site – is the first site dedicated to the work and endeavors of Burn Occupational & Physical Therapists in an effort to develop outcome based research and clinical improvements for all burn survivors. We are committed to fostering collaborative networking relationships among burn therapists as well as developing clinical research, treatment innovations and improvement in service delivery and care at local, national and international levels.

We also highlight the achievements of Burn Occupational & Physical Therapists as part of the American Burn Association's Occupational & Physical Therapist Special Interest Group through the yearly **Barbara Knothe Burn Therapist Achievement Award**. We are a resource for therapist driven research and collaboration to provide the best treatment outcomes for the patients that we serve.

**Burn Clinical Pearls (formerly Splinting Quarterly)**

Each Quarter (January, April, July & October) we will highlight a splinting endeavor that has been created to work with a challenging surgical intervention or as a result of a unique patient need or request. New designs as well as modifications to an existing, established design are welcomed. Post-operative splints as well as adaptive device splints, casting and any other type of ADL modification gladly are welcome. We will also be archiving all of the submissions so that we can maintain a resource of burn splinting knowledge. Contribute to the accumulated knowledge and submit your splint design to today!

Go to the web site [www.burntherapist.com](http://www.burntherapist.com) and get involved!
Trudy Boulter, OTR/CHT is a Certified Hand Therapist and Advanced Practitioner specializing in Upper Extremity trauma, burn injuries and congenital differences. In addition to specialized clinical care at Children’s Hospital Colorado, she is the Director of Children’s Hospital Colorado Burn Camps Program, a specialized program to meet the emotional and physical challenges children often experience following a traumatic burn injury. Trudy is an active member of the American Burn Association, the American Camping Association and The American Society of Hand Therapists. She serves on the board for the International Association of Burn Camps and is currently the chair for the Occupational and Physical Therapy Special Interest Group.

Outside of work, Trudy enjoys her family, friends, skiing, biking, running, traveling….all things fun!

David Lorello, PT, DPT is a physical therapist who has been a member of the burn rehab team at the Arizona Burn Center since 2005. He has spoken about the rehabilitative needs of the burn survivor at multiple conferences including the Combined Sections Meeting of the American Physical Therapy Association (2009 – 2012), the Western Region Burn Conference (2009), the American Burn Association (2007) and the Arizona Burn Symposium (2006-2011). In the fall of 2012, David joined the faculty of the Program in Physical Therapy at Midwestern University in Arizona. David has been serving as a Co-Chair for the OT/PT Special Interest Group since 2011, and serves on the Rehabilitation Committee.

Lynne Benavides, OTR/L, CHT has been practicing for 23 years and has been a CHT for the past 11 years. She has been with Rhode Island Hospital throughout career and has been involved in burn care from her first days there. Lynne has worked in areas of acute care and outpatient therapy and has been involved in 2 international outreach missions for burn care. She has presented at the Northeast Regional Burn Conference and most recently at the New England Hand Society’s annual meeting. IN her free time she enjoys watching her children swim and compete and lives by her moto “Misery is optional”. Lynne has been serving as a Co-Chair for the OT/PT Special Interest Group since 2011 and is very pleased to be able to be part of this committee for the ABA!
Doug Baron, BSc PT grew up in Calgary and attended the University of Alberta in Edmonton. In 1992 he graduated with a Bachelor of Science in Physical Therapy (honors) and started to work for the Calgary Health Region as a rotating therapist treating a broad spectrum of clients. He never really had developed an interest in wound care until he started working as an outpatient therapist on a service that treated both hand injuries and burns. In 2004 he completed the Canadian Association of Wound Care’s S1 and S2 course in Halifax and then in 2006 accepted a position at the Alberta children’s Hospital as a burn therapist and team leader for outpatient musculoskeletal physiotherapy. One year later he completed the International Interdisciplinary Wound Care Course from the University of Toronto. Since then he has been working mostly with burn injuries in children and consulting with other chronic and traumatic wounds. In 2008 he presented at the World Union of Wound Healing Society’s conference in Toronto. In 2010 he presented on Physiotherapy in Burns and Wounds in St John’s, Nfld and in 2011 to the OT/PT Special Interest Group at the American Burn Association (ABA) conference in Chicago. Also in 2011, he joined a surgical burns reconstruction mission team to Lima, Peru and was fortunate enough to share his experience with the Pediatric Special Interest Group at the ABA last April in Seattle. In 2012, he was fortunate enough to return to Chancay, Peru with another surgical team.

Outside of work Doug enjoys many outdoor activities including spending time with family, golf, cycling and hockey. He has been a pilot on a tandem bicycle for a visually impaired athlete and competed at the World Para-Cycling Track Championships in Italy (2011).

Nora Barrett, MS, OTR/L, CHT is a burn therapist at MedStar Washington Hospital Center and Clinic Coordinator of the Outpatient Center for Orthopaedic Rehab at MedStar National Rehabilitation Hospital in Washington, DC. She graduated from Washington University in St. Louis, MO in 1997, working in rehab (Spaulding Rehabilitation Hospital, Boston, MA), acute care (Brigham & Women’s Hospital, Boston, MA), and outpatient settings (National Rehab Hospital Regional Rehab, Washington, DC and Curtis National Hand Center, Lutherville, MD), and has focused her clinical practice in hand therapy and burn injury/wounds since 2004. In 2006 she completed the Advanced Certification in Hand & Upper Quarter Rehab at Drexel University in Philadelphia, PA. She is a member of the American Burn Association and serves on the Education Division for the American Society of Hand Therapists. She enjoys lecturing at universities in the northeast region and presenting topics in burn and UE injuries at conferences across the country. Nora loves to travel, root on the Chicago Cubs and Indiana Hoosiers, run half marathons, listens to live music, and spend any free time outdoors!

Christine McQuaid-Bice, MSOT, BSM is an Occupational Therapist with Maricopa Integrated Health Systems, where she works in both the Arizona Burn Center and the Orthopedic Hand Clinic. Christi has over seventeen years of Burn and Rehabilitation experience. She has been a member of the American Burn Association for 6 years. Christi completed her COTA studies in 1995 and returned to school in 2011 to complete her Master’s Degree in Occupational Therapy. She is a proven innovator with a comprehensive understanding of how to solve multidisciplinary challenges, as demonstrated through her presentations and publications at multiple burn conferences. Christi has also presented at statewide burn conferences for CME approved educational material to burn professionals regarding the role of occupational therapy, with an emphasis on promoting improved burn management after discharge from the burn center setting.
Lisa Forbes, MSc, OT Reg(MB) graduated from the University of Manitoba with a Bachelor of Medical Rehabilitation (Occupational Therapy) in 1992, and completed her Master of Science (Rehabilitation) in 2008. She has worked at the Winnipeg Health Sciences Centre for 20 years, mostly in pediatric and adult burn care. Presently she is the Clinical Specialist for Burns Occupational Therapy where her duties include direct patient care, research, program development evaluation, and staff education/mentoring.

Lisa has completed research in the areas of burn scar assessment, sexuality and burn support program evaluation. She has presented several papers and posters at professional conferences, and has published four peer reviewed papers and 1 book chapter. Lisa is a member of two ABA committees, the Rehabilitation Committee and the Barbara Knothe Memorial Burn Therapist Achievement Committee. She is on the organizing committees for the Manitoba Firefighters’ Burn Camp and the adult Burn Survivor Conference.

Beth Franzen, OTR is an Occupational Therapist and work at the Burn Center at Regions Hospital in St. Paul, MN. It’s been my work home for the past 27 years. There are many parts of my work that keep me interested and challenged and are the reason why I continue to work and grow in this position. Patient care is the primary focus and each patient is motivated in a different way. Working with people of varying ages, backgrounds and personalities is stimulating and challenging as we all know. Selling exercise to a person with a burn injury takes some skill! Fabricating splints, face and neck splints, adapting items for ADL’s, keeps the creative juices flowing and is a fun part of the treatment for me. Additional responsibilities e.g. administration, teaching, presenting at conferences, research and mission work through Physicians for Peace provide opportunities to learn and broaden my perspective. We have a great team at Regions Hospital and that is the most important reason I continue to enjoy my work.

Karen Hulin Poli, OT, CHT is an occupational therapist specializing in the treatment of burns and upper extremity injuries/conditions. She has 20 years of experience working with both adults and children. As a member of the burn team at the Alberta Children’s Hospital, she provides therapy across the continuum of care. Karen is a member of American Burn Association and the Canadian Society of Hand Therapists.

When not working at the hospital, Karen volunteers with her dog at the hospital in a pet visitation program. Karen also keeps herself busy by spending time with her family, practicing yoga and participating in various other athletic pursuits.
Scar Wars Episode VII

No J.J. Abrams, but some really cool burn therapists will have practical information you can use!

**Occupational and Physical Therapy**

**Special Interest Group Meeting**

**Palm Springs, CA  April 23, 2013**

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**Lecture: Pathophysiology of Burn Scar**

*David J. Lorello, PT, DPT*

*Arizona Burn Center, Phoenix, AZ*

*Midwestern University, Phoenix, AZ*

Learners will be able to:

- Understand the phases of wound healing
- Learn the cellular mechanisms involved during each phase of wound healing
- Understand the possible processes during each phase of wound healing associated with abnormal scarring

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**Lecture: Burn Scar Assessment**

*Lisa Forbes, MSc, OT Reg(MB)*

*Winnipeg Health Sciences Centre*

Learners will be able to:

- Discuss the importance of using a burn scar outcome measure (BSOM)
- Identify relevant properties of burn scar
- Understand important issues related to burn scar assessment (ex. scar relocation, clinimetric properties of scar scales)
- Identify available burn scar BSOMs, including general advantages and disadvantages
- Understand the difference between low technology (subjective) and high technology (objective) BSOMs
Breakout Session: Option 1

Low Tech Scar Management Options for Facial Scars

Karen Hulin Poli, OT, CHT; Doug Baron, BSc PT
Alberta Children’s Hospital

Learners will be able to:
- Identify the mechanism of action of topical silicone products
- Discuss the pros and cons of various scar management products with others in the breakout session
- Observe the use of various scar management products on the head and face via case study examples

Breakout Session: Option 2

Maximizing the Effectiveness of the TFO in Scar and Contracture Management

Beth Franzen, OTR/L; Lisa Rindal Kittleson, OTR/L
Regions Hospital Burn Center

Learners will be able to:
- List advantages and disadvantages of the transparent plastic face mask/orthosis (TFO)
- Identify areas of facial contracture
- Gain a basic understanding of how the face mask can prevent and treat contracture and hypertrophic scar
- View a demo of revising a face mask and apply the technique to a patient you are seeing

Breakout Session: Option 3

Treatment of the Adult and Pediatric Hand Web-space Contracture

Nora Barrett, MS OTR/L, CHT; Christi Bice, MS, OTR
MedStar Washington Hospital Center; Arizona Burn Center

Learners will be able to:
- Identify hand burns at-risk for webspace contracture and syndactyly
- Apply appropriate interventions given clinical presentation and timeline
- Determine appropriateness of selected method; problem solve higher level intervention along a continuum with various materials;
- Recognize scar characteristics and functional limitations when surgical intervention is recommended
Pathophysiology of Burn Scar

By David J Lorello, DPT
Pathophysiology of Burn Scar
David J Lorello, DPT

OT/PT Special Interest Group Meeting
April 23, 2013

Scar

• “Am I going to have a scar?”
• Reminder to the patient of the injury
• Let’s the world know that something has happened

Scar
A mark left on the skin after a surface injury or wound has healed
Scar

Wound Healing
Dynamic and highly regulated process of cellular and molecular mechanisms

Injury → Full Healing
May take years

Phases
Cascade of overlapping events that normally occurs in a predictable fashion
Phases of Healing - Simplified

• Inflammatory - platelets, fibrin, neutrophils, macrophages, mast cells
• Proliferative - fibroblasts, myofibroblasts, endothelial cells, keratinocytes
• Remodeling - collagen

The Players

• Platelets - small, irregularly shaped clear cell fragments which circulate in the blood and are involved in hemostasis
• Neutrophils - phagocytic cells that clean up debris and bacteria
• Monocytes - white blood cell that in response to inflammation will differentiate into macrophages
• Macrophages - responsible for phagocytosis of debris, secrete GF that stimulate angiogenesis
• Endothelial cells - cells that form the endothelium (lining of blood vessels)
• Fibroblasts - produce protein fibers (collagen, elastin) and extracellular matrix (ECM)
• Myofibroblasts - cell that is differentiated from a fibroblast. Contains an actin and myosin contractile system similar to what is found in smooth muscle
• Keratinocytes - predominant cell found in the epidermis
• Mast cells - specialized secretory cell that helps to promote fibroblast proliferation
• Cytokines and Growth Factors

Cytokines and Growth Factors

• Cytokines
  • Large group of proteins with immunoregulatory and hematopoietic effects
  • Produce alterations in the cells they bind to
  • Originally studied by Immunologists
Cytokines and Growth Factors

• Growth factors
  • Originally studied by Endocrinologists
  • Proteins that are able to effect cell reproduction, movement, and function
  • Distinctions between cytokines and growth factors is somewhat blurred
    • Cytokines are released in response to cellular stress
    • Growth factors are released in response to homeostatic control signals

Inflammatory Phase

• Begins at time of injury and can last 2-5 days
  • Clotting takes place in order to obtain hemostasis
  • Factors are released to rid wound of debris, bacteria and damaged tissue
  • Wound characterized by redness, warmth, pain, edema, decreased ROM

Inflammatory Phase

• 1st step dedicated to hemostasis
  • Clotting and vasoconstriction to reduce blood loss
  • Breaking down pre-existing tissue scaffolding
  • Clean-up of cellular, extracellular, pathogen debris
Inflammatory Phase

- Epidermal barrier is disrupted
  - Keratinocytes release IL-1 (1st signal to other cells of damage)
- Platelets are activated by injured collagen
  - Trigger vasoconstriction of the injured vessels
  - Clot is formed comprised of platelets and fibrin molecules

Inflammatory Phase

- Platelets secrete multiple cytokines and growth factors
  - EGF, PDGF, TGF-β, IL-1
    - Attracts neutrophils to the wound
    - Monocytes are transformed into macrophages

Inflammatory Phase

- Wound Space Hypoxia
  - Vasoconstriction causes decrease in O2
  - Hypoxia is a key signal that controls wound healing
    - Neutrophils, macrophages
    - Stimulates endothelial cells - angiogenesis
    - Causes a shift to anaerobic glycolysis = ↑ lactate production
      - wound becomes hyperlactic → acidotic
You need oxygen
Necrotic tissue will not allow the wound to move into the next phase of healing

Inflammatory Phase

- Neutrophils - 1° cell that cleanses the wound
  - Migrate into the wound within 24 hours of injury
  - Phagocytic cells that clean debris and bacteria
  - Hypoxic environment

- Macrophages - important throughout all phases of healing
  - Activates during the inflammatory phase initiate angiogenesis and granulation tissue formation during proliferation
  - Phagocytosis of debris - excrete lactic acid
  - Secrete collagenases - debridement in preparation for new collagen
  - Secrete GF’s
    - VEGF
    - TNF-β
    - IL-1
    - SDF-1

 promotes endothelial migration and proliferation
Proliferative Phase

- Begins around 3rd-5th day and can last up to 21 days
- Characterized by:
  - Angiogenesis
  - Granulation tissue formation
  - Collagen deposition
  - Epithelialization
  - Wound contraction

Proliferative Phase

- Fill in the tissue defect with shiny new tissue
- Restore the integrity of the skin
- Collagen synthesis - fibroplasia
- Angiogenesis
- Contraction

Proliferative Phase

- Macrophages release a host of GF and cytokines that attract fibroblasts to the wound
- Fibroblasts produce collagen and elastin molecules - building blocks of connective tissue
- Acts as a scaffolding that will support blood vessel growth by the endothelial cells
Proliferative Phase

- Elastin - forms a network of fibers that stretch and recoil
- Gives ECM of connective tissue its elasticity
- Decreases with age (skin tears)
- Collagen - predominant fiber in connective tissue
- Rope-like macromolecule that aggregates in long fibrils and resists stretching forces

Proliferative Phase

- 19 types of collagen have been discovered
- Numbered in the order of their discovery
- Type I - dermis, bone, tendon, fascia, sclera, IV disk
- Type II - hyaline and elastic cartilage
- Type III - smooth muscle, arteries, lung, uterus, kidney

Proliferative Phase

- Angiogenesis
  - Restoration of vascular integrity
  - Macrophages induce this process by releasing TNF-α, VEGF
  - New capillary buds arise from intact blood vessels
  - Endothelial cells proliferate and grow into the wound space
Proliferative Phase

- New capillary bed fills the wound space
- Supplies oxygen and nutrients to heal wound
- Capillary loops have the appearance of granules
  - Granulation tissue
  - Very fragile
  - Trauma may induce bleeding
    - Reinitiate the inflammatory process

Proliferative Phase

- Contraction
  - Fibroblasts release TGF-β-1
  - TGF-β induce myofibroblast differentiation
  - Myofibroblasts contain contractile structures
    - α-smooth muscle actin
    - Connect to the wound margin to pull the epidermal layer inward
    - Closes the wound

Proliferative Phase

- Re-epithelialization
  - Re-establishment of an intact epidermis over the newly formed tissue
  - Keratinocytes near the basal lamina migrate across the granulation tissue
  - Epithelial migration from intact hair follicles and sebaceous glands
Re-epithelialization

Remodeling Phase

- Occurs for 6 months - 3 years post injury
- Collagen becomes parallel and creates stronger bonds
- Most endothelial cells, macrophages, and myofibroblast undergo apoptosis

Remodeling Phase

- Scar
  - Essential and a hinderance
  - Begins as highly cellular and vascular ⇒ acellular and avascular
  - Changes to collagen
    - Basket weave ⇒ small parallel bundles
Remodeling Phase

- Intact skin
- Collagen (basket weave)
- Elastin fibers
- Ground substance
- Scar tissue
  - Collagen (bundles)
  - Ground substance

Remodeling Phase

- Collagen laid down during proliferation - Type III
- Type III collagen is lysed by tissue collagenases and replaced with Type I
- Type I is a stronger collagen fibril
- Collagen lysis
  - Collagenase produced during the inflammatory/proliferative phases cleave tropocollagen molecules aiding in reabsorption
  - Finely tuned balance between collagen synthesis and collagen lysis

Remodeling Phase

- Ratio of collagen breakdown to production determines type of scar
  - Breakdown ≥ rate of production = flat pliable scar
  - Breakdown ≤ rate of production = hypertrophic scar
Remodeling Phase

- Hypertrophic scar
  - Red, elevated, itchy
  - Confined to original area of injury

Remodeling Phase

- Keloid Scar
  - Type of hypertrophic scar
  - Extends outside the area of injury
  - Tumor-like appearance
Remodeling Phase

- Hypertrophic scarring
  - 32% - 72%
  - Possible causes include:
    - Sex
    - Females with ↑ risk
    - Age
    - Younger at ↑ risk
    - Prolonged healing time
    - SDF-1

Remodeling Phase

- Hypertrophic scarring
  - Possible causes include:
    - Infection
    - Increases in inflammatory response
    - Deeper burns
    - Reticular layer fibroblasts
    - Race

Maturation Phase

- Hypertrophic scarring
  - Possible causes include:
    - Thinner skin grafts
    - Skin flaps demonstrated a ↓ TGFβ-1
    - Location
    - Neck and UF
    - Increased tension
Tension?

- Presence of myofibroblasts should decrease after wound contraction
- Hypertrophic scars - myofibroblasts persist causing further hypertrophy
- Studies have shown that mechanical force can stimulate transformation of fibroblasts into myofibroblasts

Next?

- Knowing the risk factors can give you clues
- What do you do once you suspect hypertrophic scarring
  - Assessment
  - Treatment
### Growth factors and cytokines in wound healing

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References


Burn Scar Assessment

By Lisa Forbes, MSc, OT Reg(MB)
Burn Scar Assessment

Lisa Forbes, MSc, OT Reg(MB)
Why Should We Use a Burn Scar Outcome Measure?

- A burn scar outcome measure (BSOM) is needed clinically and for research to:
  - Determine scar maturation
  - Monitor the effectiveness of burn scar treatments
  - Compare burn scar treatment methods
  - Document changes in scar over time
  (Engrav et al, 2007; Forbes-Duchart et al, 2009; Nedelec et al, 2008(1); Richard et al, 2009; Tyack et al, 2012)

- 95% of therapists believe that using a BSOM is important:
  - To measure efficacy of scar treatment (95%)
  - To make scar treatment decisions (87%)
  - To assess burn scar maturity (83%)
  - To enable patients to see their progress (77%)
  - For formal research (63%)
  - To assess joint function (40%)
  (Forbes-Duchart et al, 2009)

- To define and understand the pathology of hypertrophic scar, we must first find a clinically meaningful and objective way to measure it.

Are Burn Therapists Using a BSOM?

(Forbes-Duchart et al, 2009)

- 38% reported using a BSOM
  - 75% use the Vancouver Scar Scale (VSS) or a modified version of the VSS
    - Only 27% using the VSS are fully satisfied
    - Those not satisfied feel the VSS is too subjective

- 62% do not use a BSOM
  - Reasons:
    - Not familiar with what is available (45%)
    - Have not found one that is clinically practical (32%)
    - Believe they need more training to use existing OMs (28%)
    - Have not found one with established reliability (20%) or validity (15%)
    - Do not think using a BSOM is necessary (5%)
  - 83% use written subjective descriptors
What Should We Measure?

- The definition of normal scar vs hypertrophic scar has not been well defined.
  - The majority of scar scales, such as the VSS, compare scar with normal skin
    - When making decisions about which scars should be treated (with the hope that they do not progress to hypertrophic scar), or when evaluating which treatments prevent or reduce the progression of scars to hypertrophic scar, this distinction is inadequate (Nedelec et al, 2008(1))
  - Definitions:
    - Hypertrophic scar:
      - Oliveira et al (2005): A scar that received ≥3 on the pliability subscale, ≥3 on the vascularity subscale, and ≥2 on the height subscale; or ≥7 when the pliability, vascularity, and height subscales were totaled on the VSS
      - Nedelec et al 2008(1) reported that with this definition, hypertrophic scar would be excluded and uses ≥2 on any subscales based on the observation that donor sites (“normal” scar) are rarely rated >1 on any of the subscales
    - Active scar:
      - VSS score >5 (each subscore must be >1) (Li-Tsang et al, 2010)

- It is difficult to judge when a hypertrophic scar is actually mature
  - Scar maturation is unpredictable, a wide individual variation exists, and most clinical judgments are subjective, depending largely on the experience of the clinician (Leung et al, 1984)
  - Determination of scar maturation relies very much on the clinical observation of scar properties and has generally been associated with a progressively flatter, softer and paler scar (Fong et al, 1997)
  - Is scar improving with treatment?
    - Can “test” maturity by having the patient discontinue pressure therapy and determining if scar worsens. If scar does not worsen without treatment, it is likely mature

- Many properties of burn scar have been described:
  - It is often difficult to record and measure scar properties (Fong et al, 1997; Powers et al, 1999)
  - Descriptive terminology has been inconsistent (McOwan et al, 2001)

**Colour**

- The degree of **redness** in a scar may correspond with the vascularity of a scar, as hypertrophic scars are associated with an increased microcirculatory blood flow and have been found to be extensively vascularized with abnormally large vessels (Baur et al, 1976; Clark et al, 1996; Davey et al, 1999; Kischer et al, 1975; Leung et al, 1989; Oliveira et al, 2005)
  - Scar maturation has been associated with fewer and smaller capillaries and, as erythema diminishes, the scar becomes progressively paler. A scar without redness is not likely to develop further hypertrophy (Baur et al, 1976;
Changes in pigmentation are often seen after partial-thickness burn injuries (Grover & Morgan, 1996; Kahn et al., 1991; Sullivan et al., 1990).

- Pigmentation reflects the presence of melanin, oxyhemoglobin, bile, and carotene in the scar (Tyack et al., 1997)
- A scar with hypopigmentation may occasionally show some improvement in colour with time, but more often remains permanently pale (Grover & Morgan, 1996; Kahn et al., 1991), while highly variable patterns of pigmentation can occur in hypertrophic and non-hypertrophic scars (Oliveira et al., 2005).
- It has been suggested that pigmentation may not be a useful property to define or classify hypertrophic scars or measure the progress of maturation (Cheng et al., 2001; Deitch et al., 1983; Masters et al., 2005; Oliveira et al., 2005).

**Pliability**

- One of the most important aspects of scars, but is also one of the most difficult to define and measure (Powers et al., 1999).
  - Definitions are frequently not provided, making it difficult to determine whether researchers are discussing the same construct (McOwan et al., 2001)
- Pliability is related to contracture, elasticity, stiffness and extensibility of the scar (Clark et al., 1987; Leung et al., 1984; Sullivan et al., 1990)
  - Texture and surface irregularity have also been described (Beausang et al., 1998; Crowe et al., 1998; van der Wal et al., 2012; Yeong et al., 1997)
- Scars often become stiff due to an increase of collagen synthesis and possibly also by the lack of elastin in the dermal layer. This may cause functional impairment, especially when scars are located on or around joints (van der Wal et al., 2012)
- Several authors have reported elasticity to be an indicator of scar maturation (Bartell et al., 1988; Clark et al., 1987; Fong et al., 1997; Leung et al., 1984)

**Size**

- Various terms have been used to describe the size of scars:
  - Volume (Nedelec et al., 2000; Powers et al., 1999)
  - Width (Siana et al., 1992)
  - Length (Siana et al., 1992)
  - Thickness (Fong et al., 1997; Katz et al., 1983)
  - Depth (Hambleton et al., 1992)
  - Height/elevation (Crowe et al., 1998; Sawada & Sone, 1992; Sullivan et al., 1990)
  - Surface Area (van der Wal et al., 2012)
- Some authors distinguish between the aspects of size that they are measuring, while others measure size as a single entity, compounding the difficulty of comparing results (McOwan et al., 2001)
- Determination of the size of the scar is difficult because the margins of a scar are often irregular or may even be below the skin’s surface, and the scar may be on a rounded surface such as the neck (McOwan et al., 2001; Powers et al., 1999)
Changes in the size of a scar may reflect the maturity of a scar, as scar tissue tends to go through a period of collagen overgrowth before maturing and becoming paler and flatter (Baur et al, 1976; Cheng et al, 2001; Fong et al, 1997; Katz et al, 1983; Tredget et al, 1997)

**Transepidermal Water Loss (TWL)**
- The relationship between TWL and scar maturity is not yet fully understood, but its potential as an indicator of wound healing has been investigated (Rodrigues & Roberto, 2006)
- TWL often increases with scarring due to the damaged stratum corneum and its role in barrier function (McOwan et al, 2001)

**Transcutaneous Oxygen Tension (tcpO2)**
- Low levels of tcpO2 in immature scars resulted from low oxygen diffusion through scar tissue. As maturation of the scar proceeded, thickened capillary walls began to thin, densely cemented masses of collagen fibres became less cohesive, and the tcpO2 rose toward normal levels. This rise in oxygen tension correlated well with clinical observation of decreasing scar mass and with ultrasound measurements confirming reduction in scar thickness, supporting tcpO2 as an indicator of scar maturity (Berry et al, 1985)

**Temperature**
- Scar temperature is dependent on the vascularity of the scar and the degree of metabolic activity occurring in it, and may provide information regarding the maturity of the scar (McOwan et al., 2001)
- However, Berry et al (1985) found no change in relative scar temperature with increasing maturity

**Skin Breakdown**
- Skin breakdown with open areas is usually the result of blisters, a common and recurrent problem following wound closure.
  - Scar epithelium is initially thin, fragile and intolerant of friction.
  - This may affect scar treatment and maturity, as areas of healed partial-thickness burn with unstable scar epithelium and newly healed grafts will not tolerate the pressure/shear applied by most pressure appliances, therefore delaying pressure treatment (Carr-Collins, 1992; Johnson, 1984; Leung & Ng, 1980)

**Subjective Factors**
- Scar properties related to the patient's opinions are important and include itching, pain, and appearance (Bombaro et al, 2003; McOwan et al, 2001; Sullivan et al, 1990)
- **Itching** may be caused by the release of histamines by mast cells (Tredget et al., 1997) and is often associated with hypertrophic scarring (Ward et al, 2004; Oliveira et al, 2005; Tredget et al, 1998)
  - Cheng et al (2001) found that itching did not correlate with the maturity of the scar, but was related to the type and depth of the skin injury
Subjective symptoms may be difficult to measure, as they can be influenced by anxiety and medications (Taal et al, 1999) but may be as or more important to the final scar outcome than the quantitative objective aspects of scars, as even patients with relatively minimal scarring may be unable to function (Powers et al, 1999).

- Most scar rating scales include vascularity, pliability, height and pigmentation as important properties of scar measurement, but there is little consensus about what other properties were important (Tyack et al, 2012).

- Burn therapists believe that the following scar properties should be included in a BSOM:
  - Pliability (96%)
  - Vascularity (92%)
  - Height (88%)
  - Appearance (75%)
  - Skin breakdown (74%)
  - Itch (73%)
  - Surface texture (71%)
  - Pigmentation (69%)
  - Pain (68%)
  (Forbes-Duchart et al, 2009)

- Burn survivors report that scar characteristics that were most visible and obvious to the public were the most important to them (Forbes-Duchart, 2008)
  - Colour, specifically redness, was the scar characteristic that participants felt the strongest about. They talked about people noticing the dark red or purple colour immediately, and feeling uncomfortable with their appearance. Participants felt relieved as time passed and the colour started to fade.
  - Height and surface irregularity were very important scar characteristics.
  - Participants all agreed that burn scar itch was one of the biggest challenges in their recovery, and was an important scar characteristic.
  - Participants all reported their scarred skin being more prone to blisters and skin breakdown and shared the frustration of small areas on their body taking months to heal.
  - Participants all described some type of sensory changes to their burn scars (hypersensitivity, numbness).

- The observers’ general opinion on scars is highly influenced by vascularization, pigmentation, thickness, relief, and contraction or expansion of the surface area. The patients’ opinion was predominantly influenced by pruritus and thickness (Draaijers, Tempelman, Botman, Tuinebreijer, et al, 2004; van de Kar et al, 2005).

- Martin et al (2003) examined the correlation between patients’ subjective and therapists’ objective evaluation of burn scar. They reported that agreement increased over time, but that the patient’s impression of what others think of the scar continued to be poorly correlated to the VSS rating, suggesting that the patient experiences poor acceptance despite objective scar improvement.
Subjective feelings of appearance are related to many factors including body image, pre-injury psychiatric status and defense mechanisms such as denial (Powers et al, 1999)

What Area of the Scar Do We Measure and Are We Measuring the Same Area Each Time?

• Scar relocation:
  o The ability to accurately relocate a scar for study over time (Masters et al, 2005; Richard, 2005)
  o Important to determine results of different treatments and outcome, particularly because burn scar maturation takes 12 to 24 months
  o Reliability of a scar assessment tool is dependent on testing exactly the same area of scar each time (Cleary et al, 2007; Masters et al, 2005)
    ▪ Even slight movement from the original site can have a dramatic impact on the evaluation outcomes since height, pliability, and color can vary markedly by location (Nedelec et al, 2008(1))
    ▪ If less than 100% accuracy of relocation is achieved then reliability and validity estimates will be affected (Tyack et al, 2012)
  o Few scar assessment studies provide descriptions of how scars were relocated:
    ▪ Mapping with translucent paper/film (Cheng et al, 2001; Cleary et al, 2007; Fong et al, 1997)
    ▪ Photographs (Katz et al, 1983)
    ▪ Photography, included an anatomical area in the photograph, and tested area marked with a white plastic arrow (Masters et al, 2005)
    ▪ Combination of transparent film, tracing notable landmarks and photographs (Nedelec 2008(1))
• Related to scar relocation is the difficult decision of what scar area to measure, as an area of burn injury is generally composed of varying burn depths
  o Some studies focus on specific changes in an entire area of scar, while others isolate an area of scar for serial evaluation (Richard, 2005; Tyack et al, 2012)

• Much variation exists in the features of the scar site chosen, including perceived worst or best or most hypertrophic areas of scarring, a site adjacent to normal skin, describing the scar as hypertrophic or keloid, and no specification (Tyack et al, 2012)

**Is Our Assessment Consistently Measuring What it Should and Will We See Changes?**

• An outcome measure is defined as a measurement tool (instrument, questionnaire, rating form, etc) used to document change in one or more patient characteristics over time (Cole et al, 1994)

• An outcome measure should be:
  o Reliable: measurement of the variable should be consistent (Portney & Watkins, 2000)
  o Valid: should measure what it intends to measure (Portney & Watkins, 2000)
  o Responsive: sensitive to change (Portney & Watkins, 2000)
  o Measuring an important outcome of the intervention and be easy to use and understand (Quinn & Wells, 1998)

• The lack of a gold standard for subjective scar assessment complicates the validation process of new scales and forces one to focus on the “content” and “construct” validity of new scales (Tyack et al, 2012; van der Wal et al, 2012)

**What Should We Use to Measure the Scar?**

• An ideal BSOM should:
  o Include both objective and subjective aspects of scars
  o Include the functional limitations imposed by the scar
  o Capture the changes in the scar and its effects over time
  o Be sensitive enough to identify true cases of hypertrophic while being specific enough to exclude truly normal scar cases
  o Allow early diagnosis of problems or complications arising from pressure therapy
  o Be painless and non-invasive
  o Be inexpensive, portable, easy to obtain
  o Consider the perspectives of both the health professional and the burned patient
• To date such an outcome measure does not exist (Draaijers, Tempelman, Botman, Tuinebreijer, et al, 2004; Engrav et al, 2007; Fong et al, 1997; Masters et al, 2005; Powers et al, 1999; Rodrigues & Roberto, 2006; van der Wal et al, 2012; Tyack et al, 2012)

• Several BSOMs have been described in the literature, and can be categorized as low-technology (subjective) or high-technology (objective)

**Low-Technology (Subjective) Burn Scar Outcome Measures**

- Low-technology BSOMs generally consist of therapist and/or patient-judged rating scales (subjective)
- They possess several advantages over objective tools such as being freely accessible, quick, and easy to use and apply in outpatient clinics (van der Wal et al, 2012)
- Therapist-rating scales depend on subjective assessment by the rater, and multiple factors may influence this assessment, including years of burn treatment experience.
  - Physicians with only a few months of burn experience drew a scar from a photograph of a patient with facial scars more accurately than a nurse with over 10 years of burn experience
  - Professionals with more years of burn experience may underestimate the extent of the scars
  - Staff members who work with disfigured patients develop coping skills that may influence their judgment about scar (Powers et al, 1999)

**Vancouver Scar Scale (VSS)** (Sullivan et al, 1990)

- The most widely used burn scar outcome measure
- Properties measured: pigmentation, vascularity, pliability and height
- Clinically practical
- Subjective rating system by a clinician (Powers et al, 1999)
- Patient’s opinion is not taken into account (Martin et al, 2003)
- Some issues with scoring (van der Wal, 2012)
  - A hypopigmented scarred area is considered worse in dark skin compared with pale skin
  - Some aspects of the scale suggest a nominal nature. This would mean that adding up the separate parameters will give a misleading total score

**Modifications to the VSS**

**Baryza and Baryza** (1995)

- Developed a Plexiglas tool to ease administration of the pigmentation, vascularity and height subtests

- Scoring and wording adjustments to the VSS
  - For example, they changed the height subscale to a four-point scale with equal increments, increasing sensitivity to change. They suggest that subscales not be totaled, as results may be misleading: the total score may be unchanged, even though there have been improvements in the quality of the scar ex. the height of the scar may be decreasing yet the scar may become hyperpigmented
  - Patient’s subjective reports of itch and pain are also included
  - Addressed the value of training the observers


- Developed a pictorial color scale to aid with vascularity rating

Numeric scales
(Beausang et al, 1998; Smith et al, 1988; Yeong et al, 1997; Crowe et al, 1998)

- Assess scar parameters such as irregularity, pliability, disfigurement, thickness, height and colour from a photograph
- A major limitation of these scales is the questionable validity of assessing three-dimensional components of scars (texture, height, and thickness) from a two-dimensional photograph.
  - The quality and reproducibility of photographs for scar assessment are highly variable and costly (McOwan et al., 2001)
  - Richard (1997) has reported that rating scars by photograph after the patient has left the clinic is time-inefficient, particularly if decisions about scar treatment are to be made
Photographic assessment scales can be useful to evaluate scars from a distance but must always be considered inferior to clinical assessment, because relevant three-dimensional information is missing (van der Wal et al, 2012)

Matching Assessment of Scars and Photographs (Masters et al, 2005)

- Modification of the scale developed by Yeong et al (1997)
- Developed a set of reference photographs for matching patients’ scars during assessment of surface, border height, thickness and colour
- Assessment is done on the patient; photographs are used for reference only
- Patient self-rating of itch, pain and appearance
- To aid in relocation of the site chosen, a digital photograph was taken of each scar with a small white plastic arrow placed at the chosen scar location. An anatomical landmark was included in the photograph to assist identification of the site at a later stage.
- A limitation is the use of negative values for parameters which are in the opposite range of the hypertrophic score. For example, although hypopigmentation would be a poor cosmetic outcome, it is rated with a negative score, yielding an “improved” final score (Oliveira et al, 2005; Richard, 1997; van der Wal et al, 2012)

Patient and Observer Scar Assessment Scale (POSAS) (Draaijers, Tempelman, Botman, Tuinebreijer, et al, 2004)

- Two numeric, 10-point scales
  - Patient scale: pain, itch, colour, pliability, thickness, relief
  - Clinician scale: vascularity, pigmentation, pliability, thickness, relief

(See Appendix 1 for the POSAS)

Tyack et al (2012) performed a systematic review of the quality of burn scar rating scales for clinical and research use:

- Only the POSAS received a high quality rating but only in the area of reliability for total scores and the subscale vascularity
- The VSS received indeterminate ratings for construct validity, reliability and responsiveness
- Where evidence was available, all other criteria for the POSAS, VSS and the remaining 17 scales received an indeterminate rating due to methodological issues, or a low quality rating. Poorly defined hypotheses limited the ability to give a high quality rating to data pertaining to construct validity, responsiveness and interpretability. No scale had empirical testing of content validity and no scale was of sufficient quality to consider criterion validity.
- The POSAS, with high quality reliability but indeterminate validity, was considered to be superior in performance based on existing evidence
- The VSS had the most thorough review of clinimetrics although available data received indeterminate quality
- No MVSS’s offered distinct advantages over the original VSS in terms of clinimetric
van der Wal et al (2012) performed a clinimetric overview of scar rating scales:

- Comparison of scales is complicated because of a large variety of chosen statistical tests to study their clinimetric properties
- None of the reviewed scales completely meet the entire array of basic clinimetric requirements
- Most scales require more than two observers to obtain reliable results, and this limits their feasibility in clinical practice

High Technology (Objective) Burn Scar Outcome Measures

- Many methods using highly technical equipment have been used for scar assessment with varying degrees of reliability and validity (Tyack et al, 2012)
- Most of these assessments are costly, time-consuming, highly technological, inconvenient to use and often non-portable, making them clinically impractical (Masters et al, 2005; Yeong et al, 1997)
  - Few have found their way from research applications into the clinical setting (McOwan et al, 2001)
  - It is difficult to obtain an overall scar assessment using objective instruments as multiple pieces of expensive equipment are needed, as most are capable of measuring only one of many scar features (Tyack et al, 2012; Van der Wal, 2012)
- Burn therapists desire a BSOM that is quick to administer, easy to use, non-invasive, inexpensive and portable (Forbes-Duchart et al, 2009)

See Appendix 2 for examples of hi-tech (objective) burn scar outcome measures

So What Should We Do???

- Tyack et al (2012) makes the following recommendations for clinicians or researchers wishing to use a non-invasive burn scar rating scale:
  - Consider the VSS or Baryza’s MVSS for longitudinal studies or measurement over time based on preliminary responsiveness data (obtained in her study by analyzing results of previous studies)
  - Consider the MAPS method for scar relocation for longitudinal studies/clinical use where re-assessment of the scar is likely to be required
  - Recommendation for choosing scar site:
    - Each study or clinic needs to consider their own specific needs but one suggestion is to measure a scar area 3x3 cm² from the perceived best and worst scar, adjacent to normal skin if available (Tyack et al, 2012)
    - Incorporating both strategies of isolating areas of scar for some characteristics and looking more globally at the scar for others (Richard, 2005)
  - Consider the POSAS for cross-sectional studies or when only one measurement of the scar is required, as it has not been tested for responsiveness or test–retest reliability.
Consider the POSAS (patient scale) to obtain the patient’s view of their scars, recognizing that there has been a lack of clinimetric testing. Consider conducting clinimetric testing prior to use.

Use a full description of the patient subjects, and the characteristics of raters used for research, to assist in advancing knowledge regarding the clinimetric properties of burn scar rating scales to assist in determining generalizability of results.

Consider assessing the patient’s overall view of their scar, or the change in their scar (for longitudinal research studies) as it is useful for determining the interpretability and responsiveness of the chosen scale (ex. POSAS)

Clinicians and researchers must consider which clinimetric properties are most relevant to their practice or research design and thus which properties need a high quality rating when choosing a burn scar rating scale.

- The POSAS may be most suitable for scar assessment as it includes a comprehensive list of frequently used scar features, incorporates the patients’ opinion, and has a superior internal consistency and reliability compared with the VSS
  - Also enables the rater to indicate a category for the direction of abnormality next to the score for the level of abnormality. In the data analysis, this allows for a selection based on the specific categories of pathology (van der Wal et al, 2012)

- Further research is required to:
  - Test the clinimetric properties of objective and patient scar rating scales
  - Determine appropriate scaling and use of total scores
  - Determine whether health professional’s ratings on a chosen burn scar rating scale correlate with data on the underlying molecular profile of scars and with objective scar assessments (Nedelec et al, 2008; Tyack et al, 2012)

- The following scar properties should likely be included in scar assessment as they are indicators of scar maturity and/or affected by scar management:
  - Pliability
  - Vascularity
  - Height
  - Itch
  - Appearance
  - Pain
• The inclusion of pigmentation is not recommended as it does not seem to provide useful information about scar maturity and effects of treatment (Cheng et al, 2001; Deitch et al, 1983; Engrave et al, 2007; Forbes-Duchart et al, 2007; Masters et al, 2005; Nedelec et al, 2000; Oliveira et al, 2005; Tyack et al, 1997)

• Scar temperature, transepidermal water loss and transcutaneous oxygen tension may be promising indicators of scar maturity (Berry et al, 1985; Rodrigues & Roberto, 2006), however:
  o Burn therapists report that they do not understand them enough to include them in a BSOM (Forbes-Duchart et al, 2009)
  o These properties require highly technological assessment methods making them impractical to include (Masters et al, 2005; McOwan et al, 2001; Tyack et al, 2012; Van der Wal, 2012; Yeong et al, 1997)

• Subjective burn scar rating scales are able to capture patient perceptions of scarring as well as pain and itch, therefore a role for subjective scales is likely to continue (Tyack et al, 2012)
  o The patients’ opinion on the scar is what motivates the clinician in his or her decision to follow a certain treatment strategy (van der Wal, 2012)

• The complex nature of appearance and how a burn survivor feels about their burn scars makes it unlikely that therapists and survivors will always agree on a “good outcome”
  o A therapist may perceive a good outcome based on a particular variable, yet the survivor may perceive a poor outcome because they value a different variable.
  o These two perspectives may never be aligned; however, the therapist can educate the client on how each variable relates to scar maturity and may be affected by scar treatments.
  o If the therapist takes the time to understand which variables are important to her/his client, then treatment decisions can be made using a client-centered approach, potentially leading to increased compliance. (Forbes-Duchart et al, 2009)
## Appendix 2

<table>
<thead>
<tr>
<th>Method</th>
<th>Measurement</th>
<th>References</th>
</tr>
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<tbody>
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<td>Colour</td>
<td>Oliveira et al, 2005</td>
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<tr>
<td>Ultrasound</td>
<td>Thickness</td>
<td>Cheng et al, 2001; Fong et al, 1997; Lau et al, 2005; Van den Kerckhove et al, 2005</td>
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<td>DermaScan C (high-frequency, high-resolution ultrasound scanner)</td>
<td>Thickness</td>
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</tr>
<tr>
<td>Elastometer</td>
<td>Pliability</td>
<td>Ahn et al, 1989</td>
</tr>
<tr>
<td>Extensometer</td>
<td>Pliability</td>
<td>Clark et al, 1987; Spann et al, 1996</td>
</tr>
<tr>
<td>Tonometer</td>
<td>Pliability</td>
<td>Katz et al, 1983; Lye et al, 2006</td>
</tr>
<tr>
<td>Pneumatonometer</td>
<td>Pliability</td>
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</tr>
<tr>
<td>Durameter/Durometer</td>
<td>Pliability</td>
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</tr>
<tr>
<td>Cutometer</td>
<td>Pliability</td>
<td>Fong et al, 1997; Nedelec et al, 2008; Rennekampff et al, 2006; van Zuijlen et al, 2001</td>
</tr>
<tr>
<td>Laser Doppler</td>
<td>Vascularity</td>
<td>Oliveira et al, 2005; Rodrigues &amp; Roberto, 2006</td>
</tr>
<tr>
<td>Biopsy</td>
<td>Thickness, vascularity, histological characteristics</td>
<td>Hambleton et al, 1992; Oliveira et al, 2005</td>
</tr>
<tr>
<td>Three-Dimensional Mould</td>
<td>Volume</td>
<td>Nedelec et al, 2000</td>
</tr>
<tr>
<td>Dermaspectrometer</td>
<td>Colour (vasculature and pigmentation)</td>
<td>Draaijers, Tempelman, Botman, Kreis et al., 2004; Oliveira et al, 2005</td>
</tr>
<tr>
<td>Chromameter</td>
<td>Colour (vasculature and pigmentation)</td>
<td>Draaijers, Tempelman, Botman, Kreis et al, 2004; Van den Kerckhove et al, 2005; Oliveira et al, 2005</td>
</tr>
<tr>
<td>Spectrocolorimeter</td>
<td>Colour (vasculature and pigmentation)</td>
<td>Li-Tsang et al, 2003</td>
</tr>
<tr>
<td>Infra-red Camera</td>
<td>Temperature (for vascularity and metabolic activity)</td>
<td>Berry et al, 1985</td>
</tr>
<tr>
<td>Three-dimensional Imaging</td>
<td>Colour, texture, volume, shape, size and pliability</td>
<td>Powers et al, 1999; Zhang et al, 2004</td>
</tr>
<tr>
<td>Oximetry</td>
<td>Transcutaneous oxygen tension</td>
<td>Berry et al, 1985</td>
</tr>
<tr>
<td>Planimetry (using photography, tracing or imaging)</td>
<td>Surface area</td>
<td>Oliveira et al, 2005</td>
</tr>
<tr>
<td>Mexameter®</td>
<td>Melanin, Erythema</td>
<td>Nedelec et al, 2008</td>
</tr>
</tbody>
</table>
References


Maximizing the Effectiveness of the TFO in Scar and Contracture Management

By Beth Franzen, OTR/L & Lisa Rindal Kittleson, OTR/L
Maximizing the Effectiveness of the TFO in Scar and Contracture Management

Regions Hospital Burn Center
Beth Franzen, OTR/L
Lisa Kindal Kittleson, OTR/L

Objectives
- List advantages and disadvantages of the transparent plastic face mask/orthosis (TFO)
- Identify areas of facial contracture
- Gain a basic understanding of how the face mask can prevent and treat contracture and hypertrophic scar
- View a demo of revising a face mask and apply the technique to a patient you are seeing.

Which patients receive a TFO?
When do patients start wearing their face masks?

- 5-7 days post skin graft when graft or burn is mostly healed
- Use thin, moist dressings over open areas e.g. Xeroform, vaseline gauze or unna boot

Taking the model of the face

- 'Therapist driven' alginate impression
- 3-D laser scanning process

Alginate method vs scanning

- Advantages of alginate method
  - Immediate fitting of TFO
  - Experience in making the TFO, can make new ones easily from same model
  - Plaster model which is easily revised

- Advantages of scanning
  - Easier for most patients to tolerate the scan
  - Less therapist time in taking model and fabricating mask
Frequent face mask revision

- Important to revise face masks throughout the course of scar maturation
- Revise to offer adequate compression to hypertrophic scars
- Revise to lengthen contracting tissue

How do you decide on the shape of the mask?

How do you strap the mask?
Straps—double Y method
Double Y with headband

- Use for better compression around eyes to prevent contractures of medial canthus or ectropion of lower lid

Alternate strapping designs

- Initial mask on a newer graft should lightly contact all areas. Do no harm – patient is getting used to wearing it. Flare edges.
- Touch the skin to see how pliable it is. This will determine how much you can carve the model and compress the skin. When skin is tight/contracting, make small changes.
- Anchor mask under mandible - define mandible.
Carving the model to compress hypertrophic scar

- Carve plaster model and heat plastic mask to compress scar tissue evenly.
- Carve beyond the margins of the scar
- Scar that lies over a bony structure requires less compression than scar that lies over soft tissue

Scar should appear blanched and "flat"; its margins should blend into surrounding unburned skin when patient is wearing mask.
- Blanched skin should return to pink color under mask after 10-15 minutes
- Continue to carve and revise mask until all scars are blanched.
How do you know if there is enough pressure?

- After patient has worn splint for a few hours, scars should be flat upon removal of their face mask. It will take practice and experience to evaluate this in a treatment session.
- No new open areas/pressure areas on scar
- Scars may begin to raise within a few minutes after removal; that indicates the scars are ‘active’ and require continuous pressure for the best outcome

Facial contractures

- If the skin is allowed to contract, the face will lose
  - it’s ability to express subtle emotion
  - the contours and features that make each person look like a unique individual
  - range of motion

How do you carve the model to prevent or correct contracture?

- Carve the model and revise the mask to create skin length
- “Bottom out the tissue to the underlying bony structure”
Ectropion-lower eyelid

Fit of mask around the eyes

- Contact the lower lid and extend plastic toward the lower lashes, gently supporting the lower lid.
- Don’t put pressure on the eye

Medial canthus contracture
Fit of mask for contractures of medial canthus

- Plastic needs to contact the canthal ‘web’ and lengthen it
- Prevention is best, but this contracture can be corrected with a well-fitting face mask

Lateral canthus contracture

- Good contact along graft margin and beyond
- Plastic should lengthen the contracting tissue

Accentuate nasolabial fold “laugh lines”

- Helpful with microstomia by horizontally stretching the lips
- Have patients smile or say “eee” to mark the mask
Lower and upper lip eversion

Preventing or correcting lower lip eversion
- Plastic should contact to or slightly past the vermillion
- Lengthen tissue between chin and lower lip by carving a concave space under lip

Cervicomental angle
- Keep increasing ‘chin shelf’ – define angle of jaw by carving under mandible
- This is the first step in making a good-fitting face mask – ‘anchor the mandible’
If graft/burn extends above the top of the neck onto the mandible, need to use both a chin splint and a neck splint to define the mandible.

Increase overall skin length.
14 months post grafting

“Bottom out the tissue to the underlying bony structure”
For scars behind the ear

Things we’ve learned...

- Take a new model within 1-2 weeks if face edema subsides and fit of mask is poor.
- Use dressings and foam pads under straps over healing scalp donors.
- Fabricate more than one face mask to accommodate microstomia appliances/splints.
- Take new model and make new face mask every 6 months for a growing child to follow jaw development/growth.

Things we’ve learned...

- Fit patient with retainer if teeth are at risk of moving due to pressure from the mask. Dentist will fabricate.
- Revise mask frequently initially, then 1X/month or less frequently until scars are mature.
Demonstration of revising the mask
Low Tech Scar Management Options for Facial Scars

By Karen Hulin Poli, OT, CHT & Doug Baron, BSc PT
Low Tech Scar Management Options for Facial Scars

To Review:

1. Mechanism of Action of Silicone Products (Mustoe, 2008):
   - Occlusion / Hydration of Stratum Corneum
     - Decreases trans epidermal water loss
     - Magnitude of occlusion is critical
       - Silicone is semi-permeable (film dressings allow too much evaporation), other non silicone-based occlusive dressings work as well (ie hydrocolloid)
       - Too much will create maceration
     - Cytokine-mediated signalling from keratinocytes to dermal fibroblasts (in vitro and in vivo studies)(Gallant-Behm and Mustoe, 2010)
     - Increase in scar temperature (up to 1.7 °C) can significantly increase collagenase activity (Musgrave et al, 2002)
     - Enhanced by good patient education (So et al, 2003)

2. Mechanism is not mediated by (Mustoe, 2008):
   - Pressure
   - Changes in O₂ tension
   - Changes in blood flow
   - Silicone release into the scar

3. Pro’s of Silicone Gel Sheets (Mustoe, 2008):
   - Widely available
   - Soften scars
   - Reduce scar height
   - Decrease redness
- Decrease pain
- Decrease pruritis

4. **Con’s of Silicone Gel Sheets (Mustoe, 2008):**
   - Some body parts are not suitable including the face or near joints
   - Large areas
   - Unclothed areas during the daytime
   - Localized rashes, persistent pruritis, skin breakdown, maceration, foul smell, poor durability of the gel sheet (Rayatt, 2006)

5. **Pro’s of Topical Silicone Gel (Mustoe, 2008):**
   - Minimal side effects
   - Easy to apply (therefore increased patient compliance)
   - More comfortable on the face
   - *intimate contact with the skin surface contours*
   - Can put make-up on over top of gel

6. **Con’s of Topical Silicone Gel (Karagoz et al, 2009):**
   - Requires frequent application / drying time
   - Can be removed by friction from clothing or hand washing

**References**

Scar Management Products/Tools

There are numerous scar management products available. Products are chosen depending on factors such as: location of scar, age of patient, availability, therapist preference, patient preference and cost. This table is not intended to be a summary of all products available or a listing of products that are used only on the face. This table describes the products we have access to or recommend at our facility (Alberta Children’s Hospital, Calgary, Alberta, Canada). As part of the breakout session, we hope to generate discussion about how to best manage scars and learn about other products that you may use at your facility.

<table>
<thead>
<tr>
<th>PRODUCT/ TOOL</th>
<th>FORMAT</th>
<th>COMPOSITION</th>
<th>USE/APPLICATION</th>
<th>SIMILAR PRODUCTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Skin Scar Therapy/Scar Fade</td>
<td>Gel</td>
<td>Silicone</td>
<td>2X/day</td>
<td>Scarprin Dermatix</td>
</tr>
<tr>
<td>Oleeva – Clear, Fabric and Foam</td>
<td>Sheet</td>
<td>Silon (silicone)</td>
<td>23/24 hrs/day - can be washed and reused</td>
<td>Cica Care</td>
</tr>
<tr>
<td>Mepiform</td>
<td>Sheet</td>
<td>Silicone</td>
<td>Continuous wear - change every few days</td>
<td>Comfeel</td>
</tr>
<tr>
<td>Duoderm</td>
<td>Self adherent sheet</td>
<td>Hydrocolloid dressing</td>
<td>Continuous wear – up to 6 days</td>
<td></td>
</tr>
<tr>
<td>Otoform</td>
<td>Mouldable putty</td>
<td>Silicone</td>
<td>In conjunction with a garment, splint or tape to secure</td>
<td>Rolyan 50/50 elastomer putty</td>
</tr>
<tr>
<td>Tapes</td>
<td>Self adherent tape</td>
<td>Variable</td>
<td>Can be worn continuously for multiple days</td>
<td>Kinesio Tape 3M silicone tape Mepitac</td>
</tr>
<tr>
<td>Moisturizer</td>
<td>Cream/lotion</td>
<td>Fragrance free, non irritating formulation</td>
<td>Applied in conjunction with scar products or at least 2X/day if using alone</td>
<td>Cetaphil Glaxal Base Aveeno</td>
</tr>
<tr>
<td>Sunscreen</td>
<td>Lotion/spray</td>
<td>30 SPF or higher, fragrance free, non irritating formulation</td>
<td>When outside Day time hours</td>
<td>Sun protection clothing</td>
</tr>
<tr>
<td>Compression Therapy</td>
<td>-Custom or prefab garments -Tubigrip</td>
<td>-Nylon, lycra, spandex -cotton, elastic</td>
<td>23/24 hrs /day</td>
<td>-Bio Concepts, Jobst -Elastogrip/Surgigrip</td>
</tr>
<tr>
<td>Massage</td>
<td>Manual pressure over scar area</td>
<td>+/- moisturizer</td>
<td>Variable ~2X/ day</td>
<td></td>
</tr>
<tr>
<td>Splints</td>
<td>Custom or prefab</td>
<td>Thermoplastic – regular or silicone lined (Silon-LTS)</td>
<td>Variable</td>
<td>Collar for neck Face mask</td>
</tr>
</tbody>
</table>
CASE STUDY #1: DW

- 17 year old male

- August 5, 2011, he was under his vehicle working on the fuel line when an explosion occurred. He sustained a severe flame burn to his arms, face and scalp. 20% TBSA. His Dad was also burned while trying to pull DW out from under the vehicle. His face and scalp burns were as follows:
  - Superficial partial thickness on right side of his face and left frontal, parietal and temporal scalp area
  - Deep partial thickness on the left side of his face and neck including the tip of his nose and his left ear

- Multiple surgeries:
  - Escharotomies and skin grafting to both arms
  - Split thickness graft from the scalp to the left temple, cheek, ear and side of neck
  - Laser surgeries at 2, 4, 6 and 9 months post burn to assist with managing scar areas on face and arms

- Face, neck and scalp scar management included:
  - Thermoplastic splint to encompass head, left side of face and neck – wore for only a few weeks as it was not well tolerated
  - Compression garment (modified chin strap that extended on to left side of face) – wore for 3 months at night and around home. He would not go out with it on.
  - Silicone sheet products:
    - Oleeva Foam and Fabric under splint/chin strap
    - Oleeva Clear used when no longer using splint/chin strap – used for approximately 2 months
  - Silicone gel on face replaced Oleeva Clear – used until approximately 16 months post burn
  - Massage and lotion
  - Education re: sunscreen and head/face coverage
  - A/PROM and stretching exercises for neck/head

- Most of DWs active therapy ended 1 year post burn. He attended burn camp in August 2012 and found this to be a very rewarding experience.

- No future plans for surgery at this time. Dakota will be 18 in July and his care will be transferred to the adult burn team if needed.
3 DAYS POST BURN

SPLINT USED FOR PRESSURE AND TO SECURE SCAR MANAGEMENT PRODUCTS

16 MONTHS POST BURN
CASE STUDY #2: EA

- 17 month old male

- February 20, 2011 he pulled a pan of hot oil down on to himself and sustained burns to his upper extremities, scalp, forehead and right foot. 20% TBSA.
  - Full thickness burns to scalp and forehead

- Surgery 2 weeks post burn with debridement and skin grafting to upper extremities and foot. Scalp was left to see what would heal on its own as skin grafting in this area would leave bald spots. At 3 weeks post burn it was decided to graft almost the entire forehead and scalp. The forehead was grafted with the unburned skin from the occipital area of the scalp and the remainder of the scalp was grafted with donor skin from the thigh.

- Scalp and forehead scar management included:
  - Pressure garment – skull cap style hat
    - Custom version not well tolerated and discontinued after several weeks
    - Tubigrip version trialed and parents made various configurations of straps to secure. Also wore a base ball hat over cap for added security and pressure. Tubigrip cap was well tolerated and discharged at 19 months post burn.
  - Massage and lotion
  - Education re: sunscreen and head protection

- No future plans for ongoing treatment to head scars. We continue to follow him for his UE scars.
1 WEEK POST SKIN GRAFT

3 MONTHS POST SKIN GRAFT

CUSTOM PRESSURE GARMENT

19 MONTHS POST BURN
CASE STUDY #3: JT

- 10 year old male

- October 11, 2011 he was burning garbage with a gasoline fire and sustained a severe flame burn to his chest, arms, neck and lower face when his clothes caught on fire. 25% TBSA.
  - Full thickness burns to neck and chin

- Multiple surgeries:
  - Escharotomies and skin grafting to all burn areas
  - Split thickness graft from calf to neck area at 3 weeks post burn
  - Scar release and full thickness graft from abdomen to neck area at 7 months post burn secondary to significant contracture
  - Laser surgery to chest, arms hands and legs, 7 months post burn to manage hypertrophic scar

- Neck and face scar management included:
  - Cervical collar- to maintain space in neck and assist in holding scar product in place. Did not wear consistently after first grafting. He continues to wear it regularly now.
  - Compression garment (chin strap) - wore for only a few weeks as not well tolerated
  - Silicone sheet products – Oleeva Foam. Continues to wear under collar.
  - Massage and lotion
  - Education re: sunscreen
  - A/PROM and stretching exercises, posture retraining/education

- Neck ROM and mouth opening/closing are functional. Neck and face scars remain red and textured. He tends to sit and stand in a hunched position, therefore ongoing stretching and posture education required.

- Future surgery – laser surgery to neck and face scars (to be done in conjunction with other scar release procedures).
2 WEEKS POST BURN

AFTER FIRST GRAFT

2 MONTHS POST FIRST GRAFT

4 MONTHS POST FIRST GRAFT

13 MONTHS POST BURN
6 MONTHS POST SECOND GRAFT
CASE STUDY #4: TH

- 13 year old male

- August 31, 2012 he was in a trailer where there was a propane leak and subsequent explosion. He sustained flame burns to his right upper extremity, left shoulder and face in addition to an inhalation burn. 17% TBSA.
  - Superficial and deep partial thickness burns to face/ears

- Surgery 2 weeks post burn for debridement and skin grafting to upper extremities and debridement only of burns to face. Face burns did not require skin grafting.

- Face scar management included:
  - Scar gel
  - Massage and lotion
  - Education re: sunscreen and head/face coverage

- Healing well

- No plans for future surgery at this time. We continue to follow him for his UE scars and to monitor face scars
DOUG AND KAREN WOULD LIKE TO ACKNOWLEDGE...

OUR AMAZING PATIENTS AND THEIR FAMILIES FOR ALLOWING US TO SHARE THEIR STORIES AND PICTURES IN THIS PRESENTATION

THE CALGARY FIRE-FIGHTER BURN TREATMENT SOCIETY FOR THE FINANCIAL SUPPORT THAT IS ALLOWING US TO ATTEND THIS YEAR'S CONFERENCE

THANK YOU

BRAD UPHILL, MEDICAL PHOTOGRAPHER AT ACH FOR HIS PHOTO CONTRIBUTIONS TO OUR PRESENTATION

OUR SUPPORTIVE COLLEAGUES ON THE MSK TEAM AT ACH
Treatment of the Adult and Pediatric Hand Web-space Contracture

By Nora Barrett, MSOTR/L, CHT & Christi Bice, MS, OTR
Treatment of the Adult and Pediatric Hand Webspace

Ideas for Contracture Prevention and Treatment from the Acute Hand Burn to Formed Webspace Contractures

Nora Barrett, MSOTR/L, CHT
Christi Bice, MS, OTR

Learning Objectives

• Identify hand burns at-risk for webspace contracture and syndactyly
• Apply appropriate interventions given clinical presentation and timeline
• Determine appropriateness of selected method; problem solve higher level intervention along a continuum with various materials; recognize scar characteristics and functional limitations when surgical intervention recommended

Hand Function
Pediatric Considerations

• Mobility within webspaces allows:
  – ADL/Play- finger manipulation, prehensile development, exploration of environment, development of self help skills
  – Quadruped mobility- development of arches
  – Cosmesis- psychosocial development
Hand Functions
Adult Considerations

• Mobility with webspaces allows:
  – ADL- functional grasp, object conformity, power prehension, in-hand manipulation
  – Leisure- musical instruments, sport participation, bicycle gear shift
  – Work- typing, cylindrical/conforming grasp, holding large items
  – Cosmesis- wearing jewelry/rings, gloves, “relaxed hand” appearance

How do webspace contractures develop?

• Intricate anatomy/concave surface
• Volar/dorsal hand burn, ? Involving webspace
• Immobilization/edema/pain
• Delayed healing/significant depth
• Lack of exercise/use; poor compliance
• “Safe” or “Intrinsic plus” position orthotics
  – Promote intrinsic tightness
  – Place MCPs in closed-pack position/ADd
  – Contact/conformity with 1st webspace

Pertinent Anatomy

• Palmar Interossei (PI)
  “PAD”
  – 1st. ADducts IF (toward MF)
  – 2nd. ADducts RF (toward MF)
  – 3rd. ADducts SF (toward RF)
• Ulnar nerve
Pertinent Anatomy

• ADductor Pollicis (AP)
  – Thick, broad muscle
  – Originates from 3rd metacarpal
  – High propensity to tighten and contract
    • In setting of immobilization
    • Non-burn population
  • Ulnar nerve

Pertinent Counter-Anatomy

• Dorsal Interossei (DI)
  “DAB”
  – 1st: Abdacts IF (away from MF)
  – 2nd: Abdacts MF radially (toward IF)
  – 3rd: Abdacts MF ulnarly (toward RF)
  – 4th: Abdacts RF (away from MF)
• Ulnar nerve

Pertinent Counter-Anatomy

• ABductor Pollicis Brevis (APB)
  – Counters ADdutor Pollicis
  – Median nerve
• ABductor Digiti Minimi (ADM)
  – Counters SF ADd
  – Ulnar nerve
?Role of Lumbricals

- Originate FDP tendon mid-palm
  - Split innervation
- Pass volar to MCP on radial aspect of joint
  - Contribute to MCP flexion
- Insert dorsally into extensor mechanism
  - Contribute to PIP extension

Evaluation of Digital Motion within Webspaces (Adult)

- Normative ROM values for digital ABd/ADd
  - Finger ABd: 0 to 20-25
  - Finger ADd: 20-25 to 0
  - Thumb ABd: 0-50
- Tape measurements
  - Between digits, depth tip to web
- Tracing
- Functional grasp- hand around a can/bottle

Assessment Activities (Pediatric)

Peeling stickers allows assessment in age appropriate activities

(ideal attention in 3 to 10 year olds)
Note blanching at IP joints and 5th MCP "collapse" appearance at end-range flexion.
Assessment Activities (Pediatric)

Webspaces allow rotation during dynamic movements.

Assessment Activities (Pediatric)

Weight bearing allows assessment of how the webspace will impede normal weight bearing activities. In this case, it has a negative effect on the small finger.
Assessment Activities (Pediatric)

Note 2 digits moving as single unit due to 4th web space.

Assessment Activities (Pediatric)

Note the 2nd web space pulling the long finger. If left to its devices, the long finger will deviate.

At-risk Hand Burns

- Dorsal > volar hand and digital burns
- Deep partial thickness, full thickness burns
- Slow healing wounds
- Autograft border follows webspace contour
- Race
Coban

- Initial line of defense
- Can be used in initial phases post-burn or post-graft over light dressing
- Assists with edema management and webspace conforming
- Can be bulky
- Transition out of Coban once edema down and wound closing (glove tolerated)
Coban Wrapping

Natural transition from Coban into compression gloves
Custom measured and fabricated as spacers

Compression Gloves
Compression Gloves

Fabricated glove spacers apply even, comfortable pressure. (Cutting down gloves do not apply constant pressure)

Compression Gloves

Sample adult and pediatric webspacers

Compression Gloves

Web spacer fit to go over gloves
Silicone Gel

- Easily conforms into webspaces
- Comfortable
- Not as durable
- Allows mobility for daytime use
- Can be worn under pressure glove

Gel Mate
3-Point Products

Silicone Lined Compression Gloves
Plastazote Foam

- Can be easily customized for individual webspaces or dorsal hand with multiple webspaces
- Improved conformability when 1st webspace separate from digits
- Can be worn under pressure glove
- Allows digital mobility for daytime use
- Can reinforce with thermoplastic material

Individual Plastazote Strips

1st Webspace with Thermoplastic Reinforcer
Plastazote Under Compression Gloves

Hand Position to Determine Shaping

Plastazote Insert
Kinesiotape

- Cut/sized thin for narrow pressure or wide to increase width of contact
- Applied on light stretch, must allow hand to move
- Tape extends proximally half-way down hand
- Can be worn under gloves
- Can use in adjacent post-op released webspaces
  - i.e. K-tape applied to 2nd, 5th webspaces when 1st, 3rd post-op release

Elastomer/Otoform

- Used under garments for peds, with straps or under orthotics for adults when need limited pressure to effect skin
- Even contact to skin
- Even contacting glove to maintain even pressure (nothing bumpy)
- Soft, angled edges
- Applied thin: less is more
Thermoplastic Orthotics

- Rigid, conforming
- Does not allow functional use simultaneously
- Typically worn at night
- Can be used in conjunction with pressure gloves, gel and/or plastazote

Plaster Casting

- Superior conformability
- Serial static approach out of contracture
- Pre-operative release to lengthen tissue, minimize need for skin graft
- Role of removable cast spacer/conformer for night use
Webspace Casts

Serial, semi-permanent  Removable (night use)

Recommendation for Surgical Release

- Functionally limiting
- Cannot spread digits
- Webspace contracture assisting/blending into other scar bands
- Contracture border migrating distally
Distal Migration

Webspace Contracture Release

- Restart! Back to inserts/pressure, etc
Staged Release

The process took 5-6 weeks. Gains achieved in the first and third was at the cost of the second and fifth spaces (unable to intervene in any way during the healing process.).
Case One: Bilateral circumferential scald (2y, 4m)

Case study

2-20
Before and after release

Case Two: Bilateral circumferential ash contact in firepit (18 mo)  
Burn Week one
Integra placement

Week three

Pt was given an auto graft and placed in a wound vac for one week.
Special thanks to...

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