Current Rehabilitation Updates in Managing Facial and Neck Scar Hypertrophy

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Introduction
The management of burn scar hypertrophy involving the face and neck often poses unique challenges for the burn rehabilitation specialist. The physical complexity of creating and manufacturing a well-fitting orthotic is a daunting task. Moreover, the psychosocial and societal difficulties experienced by the burn survivor can severely impact long term functional outcomes. Fortunately, new advanced thermoplastic materials have emerged which can support the burn specialist in achieving functional and cosmetic goals. Specifically, these thermoplastic materials aid in patient comfort, provide for excellent contouring to body surfaces and indirectly support the psychosocial recovery of the patient.

Methods
A review of the burn rehabilitation specific literature coupled with a review of current treatment guidelines among burn therapists from North America was performed. Additionally, new technologies and materials were highlighted to assess current methodologies to improve patient outcomes.

Traditional Mold Fabrication Process
- Requires direct contact with the skin / difficult with wounds present
- Nearly impossible in children w/o sedation
- "claustrophobic" feeling during process
- Must be done in supine or reclined
- Patient must maintain consistent relaxed facial posture for intact mold

Computer Scanning Mold Fabrication Process
- No direct contact with the skin / can use with wounds
- Does not require sedation, allows for slight motion
- Can be done in any position
- Can start / stop the process at anytime to allow for movement
- Real time data capture to see mold in 3D prior to fabrication

Literature Review
- OVID literature search - 29 published journal articles
- Majority in Burn Specific Literature: 18 JBCR and 3 Burns
- Other Medical Scientific Journals: 1 British Journal of Plastic Surgery; 1 J of Prosthetics & Orthotics; 1 Journal of Prosthetics and Dentistry; 1 American Journal of Occupational Therapy; 1 Annals of Plastic Surgery; 1 J of Maxillofacial Prosthetic Technology
- Engineering Journals: 1 J. Engineering Manufacture & 1 Rapid Prototyping Journal
- Range of peer reviewed publications1979 – 2011

- Historically the use of high temperature thermoplastics is the primary choice in facial and neck orthotics
- Highly labor intensive manual process – requires a significant amount of technical proficiency and training
- Skill not routinely taught in all burn facilities
- Limitations include difficulty with manufacture and fitting process

- 1995 – First reported case of CAD / Scanning is documented in burns
- 1996 – First reported use of STS material for facemask fabrication (traditional technique)
- Scanning improves the speed and implementation of the positive mold process
- Less invasive technique but still requires high degree of skill to fabricate and fit device
- High and low temperature thermoplastics bonded with silicone improve the contact of orthotic, decrease vascularity and improve overall comfort
- Silicone layer increases overall orthotic comfort and fit
- Maintains transparency
- Provides the combined therapeutic effects of silicone and pressure in one application
- Aids the therapist in visualizing TERT and LLPS during orthotic creation and molding

Results
Current evidence supports the use of advanced materials and tools to assist burn therapists in designing and manufacturing facial and neck scar management appliances. In particular, high and low temperature thermoplastics with a silicone bonded membrane have shown significant clinical advantages over traditional materials and have demonstrated positive clinical results supporting their use in daily practice. Critical factors of these materials include: a) improved scar aesthetics (scar hydration, pliability and decreased height) utilizing silicone and pressure, b) improved contact and drape over irregular surfaces and c) evidence of increased tissue perfusion with wear and a sustained perfusion effect upon removal.

Technological Assessment to Better Study Outcomes
- Decreases in Scar Vascularity and Tissue Perfusion: JBCR 28(3)2004 & JBCR 31(2)
- LDI imaging directly thru thermoplastics and thermoplastics lined with silicone
- Use of combination therapy (silicone lined thermoplastics) demonstrates improved contact with skin surfaces versus uncoated thermoplastics
- Masks with silicone consistently diminish perfusion compared to non-silicone masks
- Measured blood perfusion decreases with the addition of silicone to transparent face masks and this effect persists over time after device removal

Enhanced Thermoplastic Materials Improve Outcomes

Silicone Bonded High Temperature Thermoplastics
- Provide increased contact to the skin / scar
- Silicone layer increases overall comfort and fit
- Maintains transparency
- Provides the combined therapeutic effects of silicone and pressure in one application
- Improved compliance with patient comfort
- Same molding and fitting characteristics as conventional thermoplastics

Silicone Bonded Low Temperature Thermoplastics
- Easy to modify multiple times to support increased ROM and scar stretch
- Silicone layer increases overall orthotic comfort and fit
- Direct wear on skin improves scar hydration and decreases itching
- Provides the combined therapeutic effects of silicone and pressure in one application
- Aides the therapist in visualizing TERT and LLPS during orthotic creation and molding

Discussion
Engineered silicone bonded high and low temperature thermoplastic materials have improved current practice and outcomes for burn rehabilitation specialists. The use of these materials in practice has shown to support patient care and has also improved the design and methodology of traditional burn rehabilitation devices. Coupled with less invasive computerized tools, burn rehabilitation research is further demonstrating improved outcomes and clinical successes.

In Summary
- Use of high and low temperature silicone impregnated thermoplastics with graduated pressure therapy are the optimal combination for burn rehabilitation scar management devices involving the face and neck
- Scanners have been shown to improve the speed, application, delivery and implementation of facial and neck orthotics
- A high degree of clinical burn expertise is still required to create and manage a well fitting facial orthotic
- Further research is warranted to assess these high tech materials and systems to provide long term effective burn rehabilitation solutions.