

-
- + . Practical Approaches for Burn
 - o Rehabilitation in Saskatchewan

Objectives



Outline

Outline the typical clinical course in Saskatchewan for therapy after a thermal injury.



Review

Briefly review skin anatomy, classification of a thermal injury and estimating surface area.



Describe

Describe evidence based and practical OT and PT approaches for the acute and rehabilitation phases, including details on positioning/splinting, wound healing, scar management and restoring function.



Identify

Identify opportunities for further collaboration and learning to improve burn rehabilitation after injury.

Saskatchewan Thermal Injury Pathways



Assessed and transferred to Burn unit if larger TBSA burn (location and clinician dependent)



University of Alberta Burn Unit



Transitions to Regina General, St Paul's Hospital (adults) or JPCH (peds) in Saskatoon



Transition to inpatient rehab units, local hospital or home with support



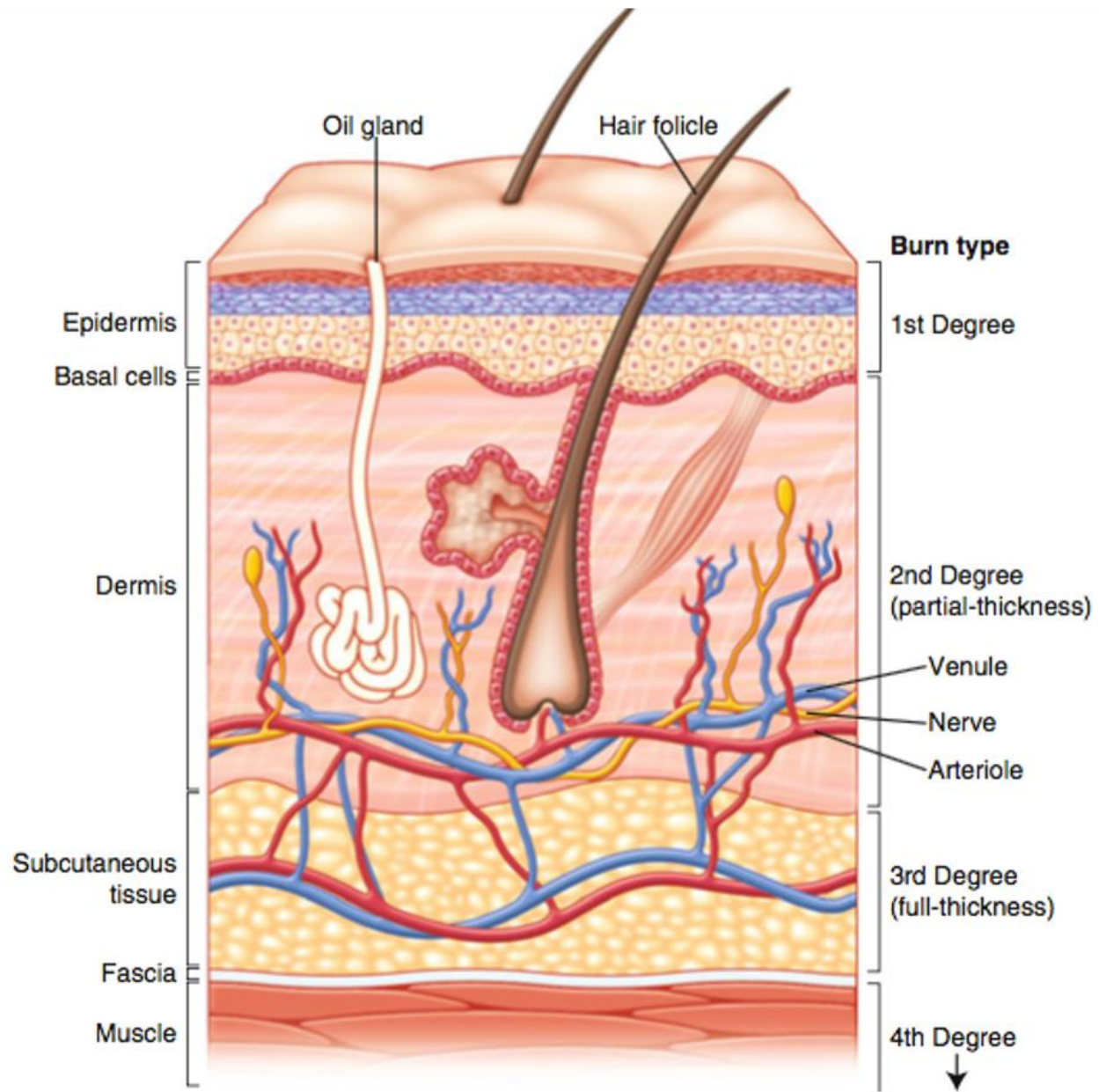
Outpatient services for scar management etc. provided through Wascana or Kinetik.

May also be treated in combination with local therapists.



Skin Anatomy Review





Picture: Greenhalgh, 2016, Page 97

- +
 - # Burn Assessment

Classifying Injury, Total Body Surface Area, Cutaneous Functional Units, Types of Grafts

Classification of Injury

Superficial (First Degree) Pink/red, like a sunburn, Epidermis injured, Painful, Heals 2-3 days

Superficial Partial Thickness (Second (2A) Degree) Image: Greenhalgh, 2016, Fig 8.6



- Epidermis and Papillary Dermis injured
- Bright Pink, Blisters present initially

- Painful
- Heals Spontaneous, 2 weeks
- Minimal scarring expected

Deep Partial Thickness (Second (2B) Degree) Image: Ure & Schetzsel, 2015



- Epidermis, Papillary and Reticular Dermis injured
- Mix of red and waxy white
- Significant Edema

- Painful, weeping surface
- Heals Spontaneous, 2-3 wks
- Expect some scarring

Full Thickness (Third Degree) Image: Greenhalgh, 2016, Fig 8.7



- Epidermis, Dermis and Subcutaneous tissue injured
- Dry, leathery and white appearance, May have eschar

- No pain, receptors damaged
- Often requires grafting to heal
- Expect scarring

Subdermal (Fourth Degree) Image: Ure & Schetzsel, 2015



- Through subcutaneous tissue to muscle or bone
- Likely neurological and muscular damage also
- No pain at site, since nerves damaged
- Need surgical support to heal

Thermal Injury and Types of Healing

- Superficial
 - Heals through re-epithelialization
- Partial Thickness
 - Heals with re-epithelialization and minimal contraction
 - Large surface areas of deep partial thickness may need grafting

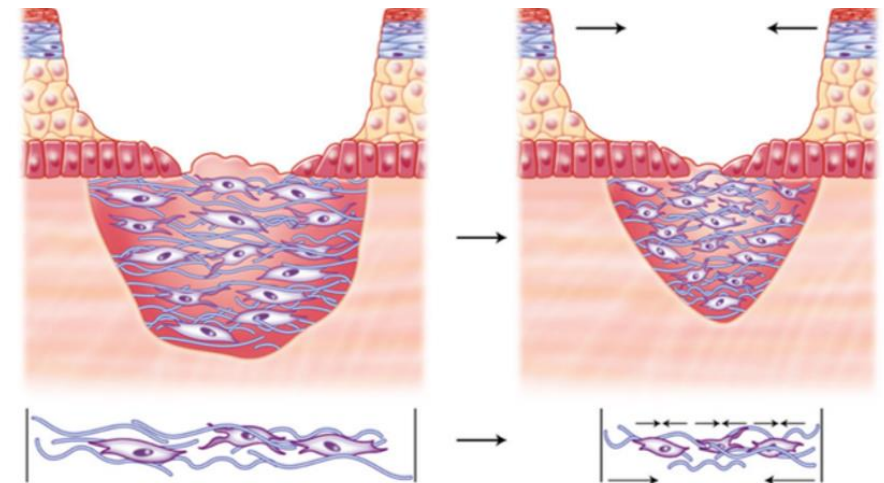
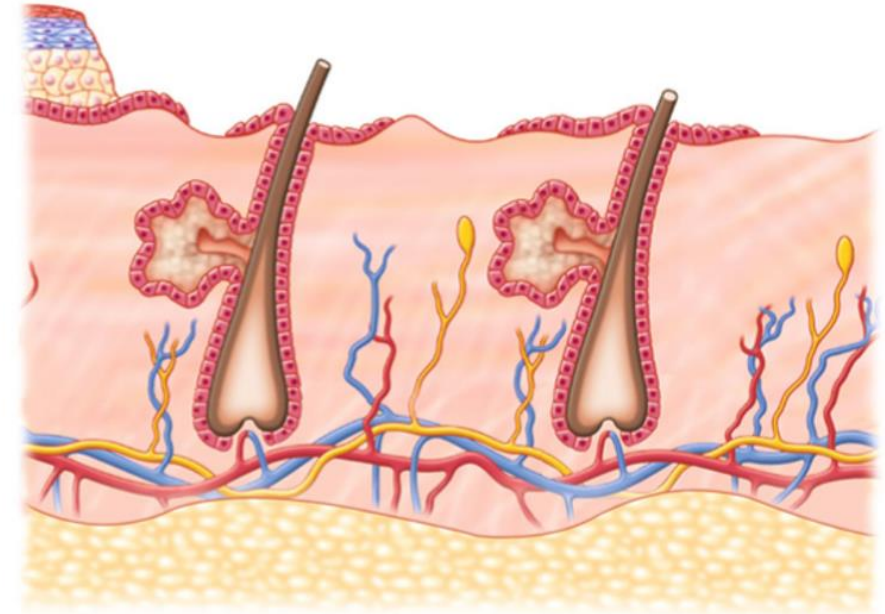


Fig. 8.14 Contraction occurs as myofibroblasts lay down collagen, "grab" it, and then contract like muscle cells

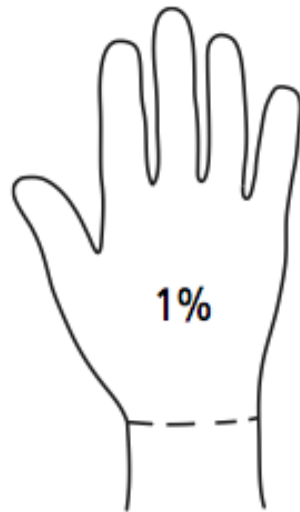
- (O'Sullivan & Schmitz, 2009; Images: Greenhalgh, 2016)

Thermal Injury and Types of Healing

- Full Thickness
 - Heals by contraction and scar formation
 - Some extent of re-epithelialization from edges
 - Usually needs grafting, or flaps
- Subdermal Injuries
 - Wound filled with granulation tissue initially
 - Tissue not viable for re-epithelialization
 - Wound filled with scar tissue primarily made of collagen
 - Extent of injury indicates need for grafting, or flaps
- (O'Sullivan & Schmitz, 2009)

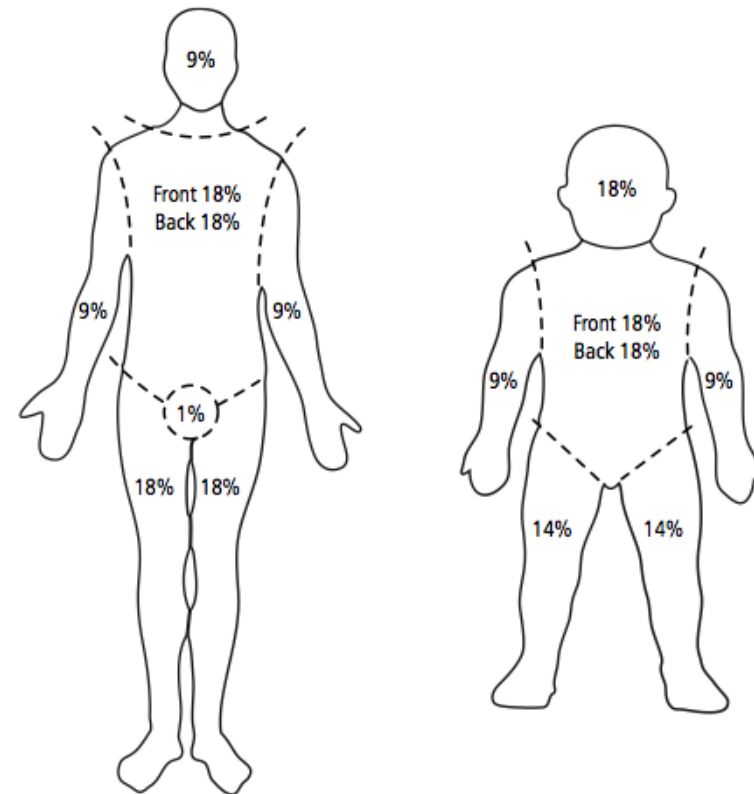
-
- +
 -
 - Total Body Surface Area and Cutaneous Functional Units

Palm Estimation and Rule of Nines (van Hasselt, 2008)



in small burns estimate the extent of the burn with the palmar surface of the patients hand (from the fingertips to the wrist), it is approximately 1% of the TBSA

Rule of nines



Cutaneous Functional Units

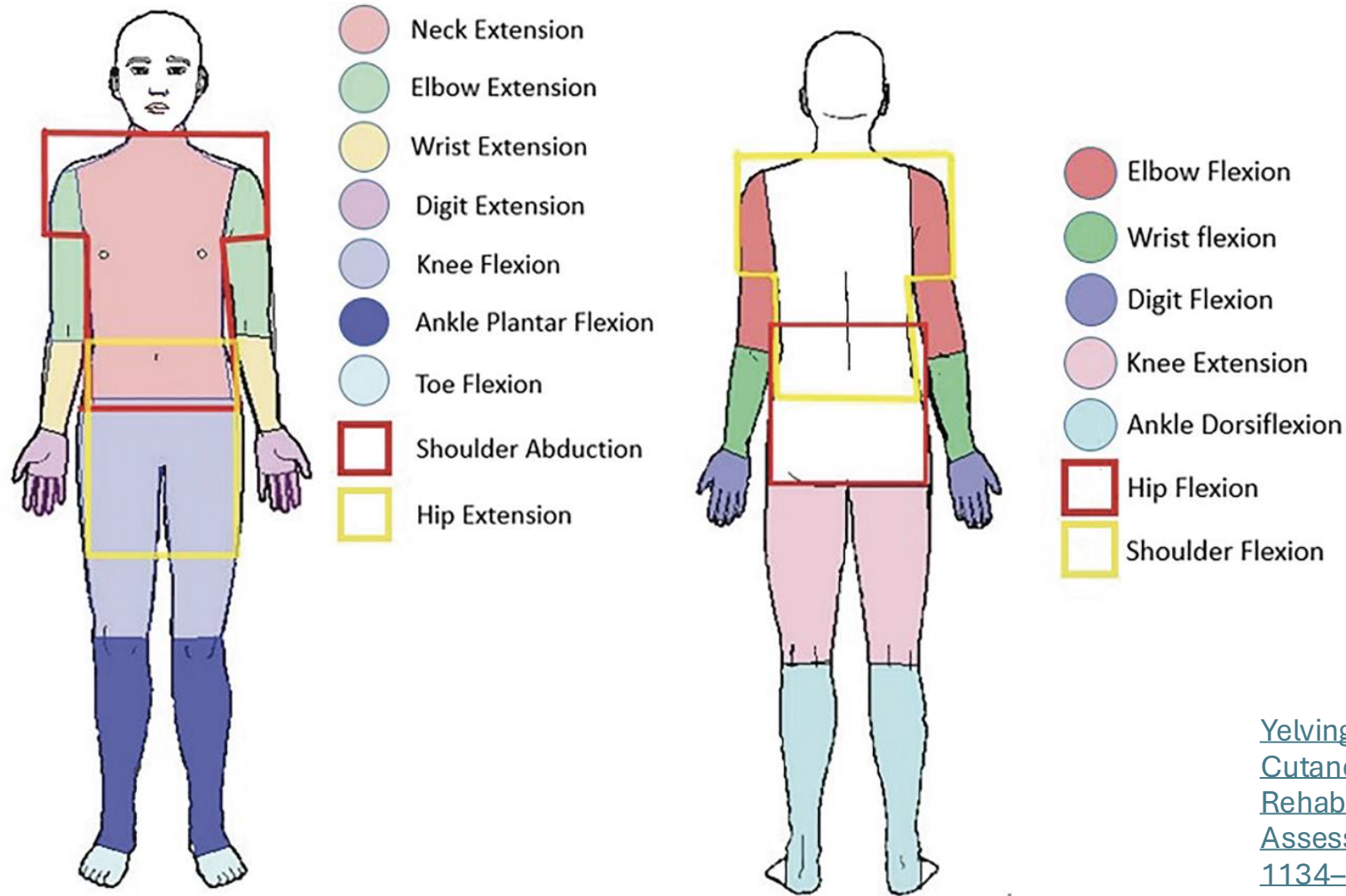


Figure 3. Educational tool for CFU distribution.

[Yelvington, M. L., & Parry, I. \(2023\). Integration of Cutaneous Functional Units Principles in Burn Rehabilitation: A Diffusion of Innovations Assessment. Journal of Burn Care & Research, 44\(5\), 1134–1139. https://doi.org/10.1093/jbcr/irad007](https://doi.org/10.1093/jbcr/irad007)

Cutaneous Functional Units

- Cutaneous Functional Unit = Fields of skin associated with motions at certain joints (Parry et al., 2019)
- A metric that indicates the location of the burn, which may be a better predictor of overall function as opposed to TBSA (Parry et al., 2025)
- Considers the cutaneouskinematics of skin and scar.

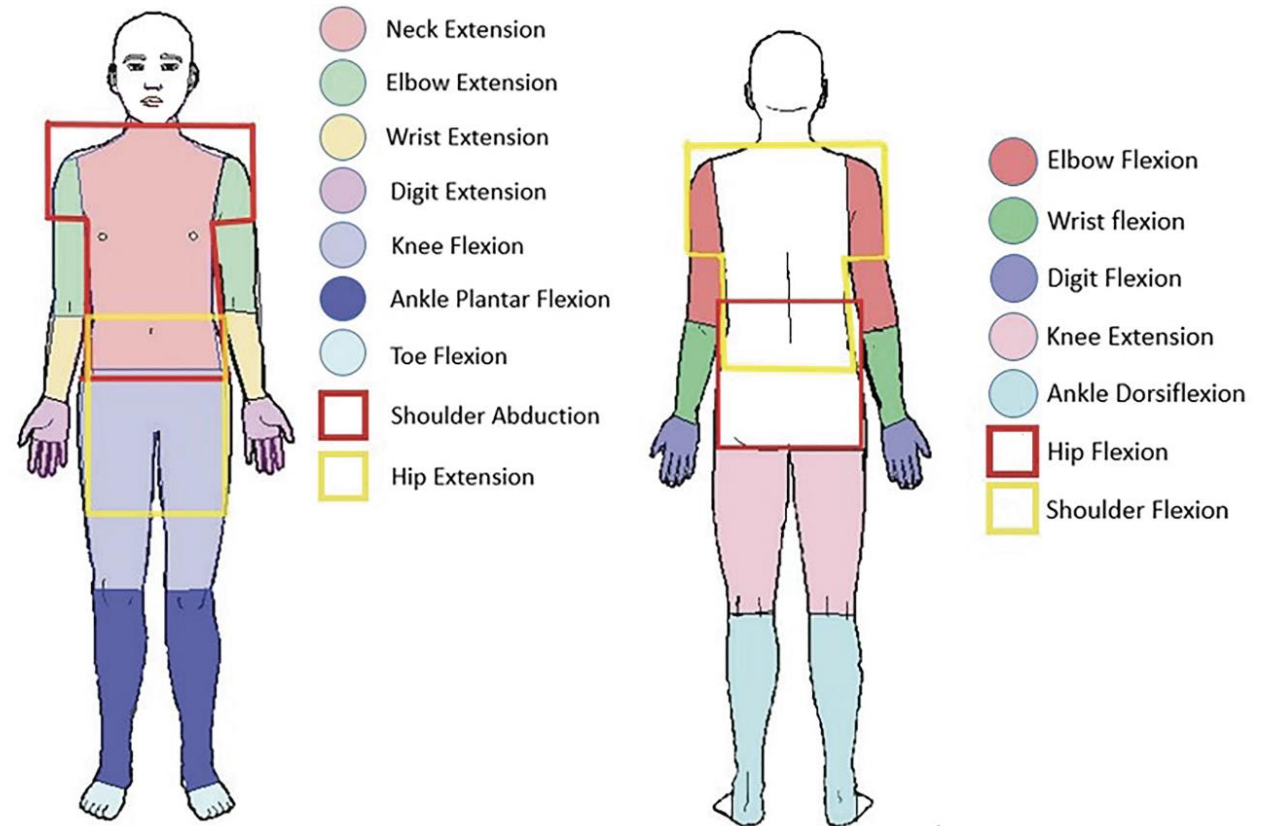


Figure 3. Educational tool for CFU distribution.

Cutaneous Functional Units

- With movement at a joint, there is a “serial recruitment of pools of skin” beyond surrounding the joint.
- Uninjured Skin stretches to 50% normal length with motion
 - After burn injury- immature scar only lengthens 15% and mature scar 4%
- Consider the CFU when planning positioning to get length through entire area mapped out, and ROM.

Goniometric Measurement of Burn Scar Contracture: A Shift in Paradigm Challenging the Standard (Parry et al, 2019)

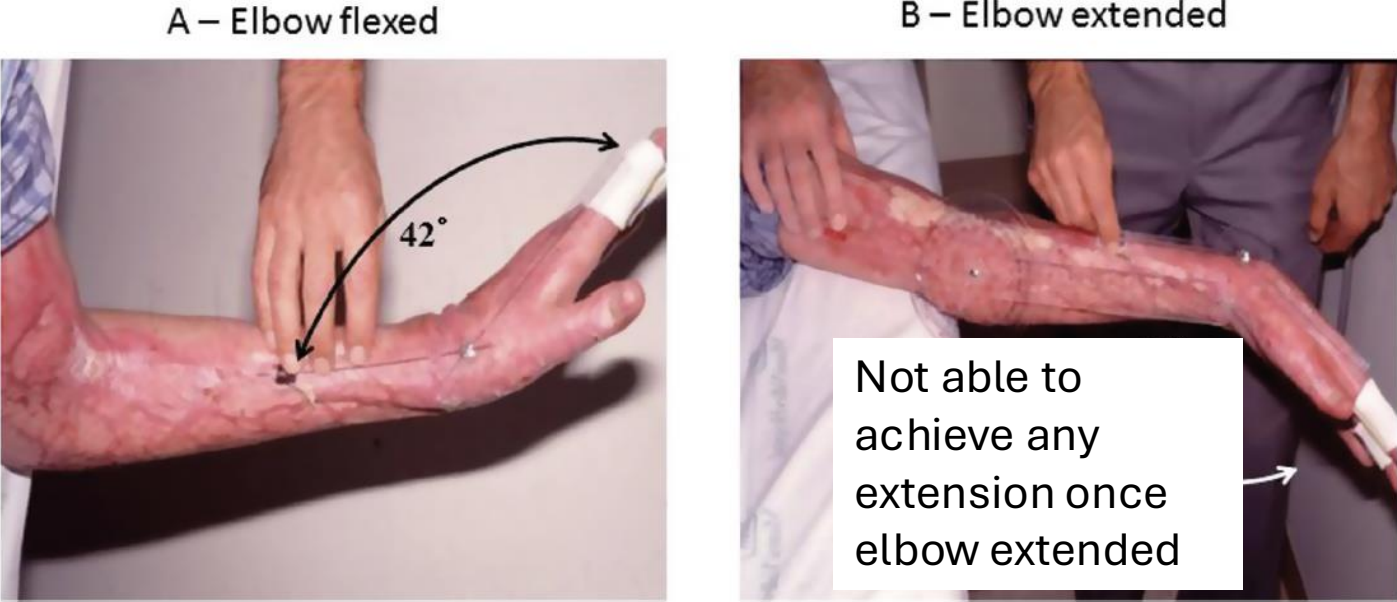
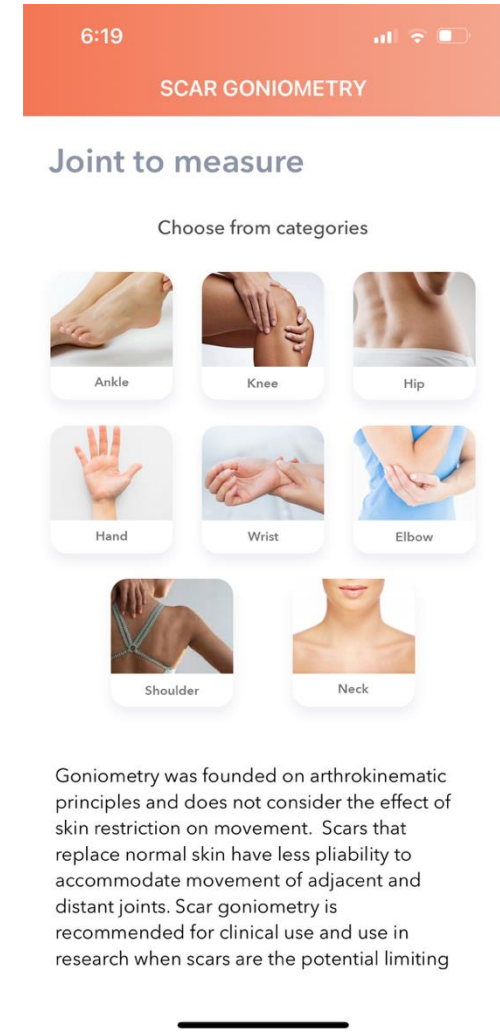
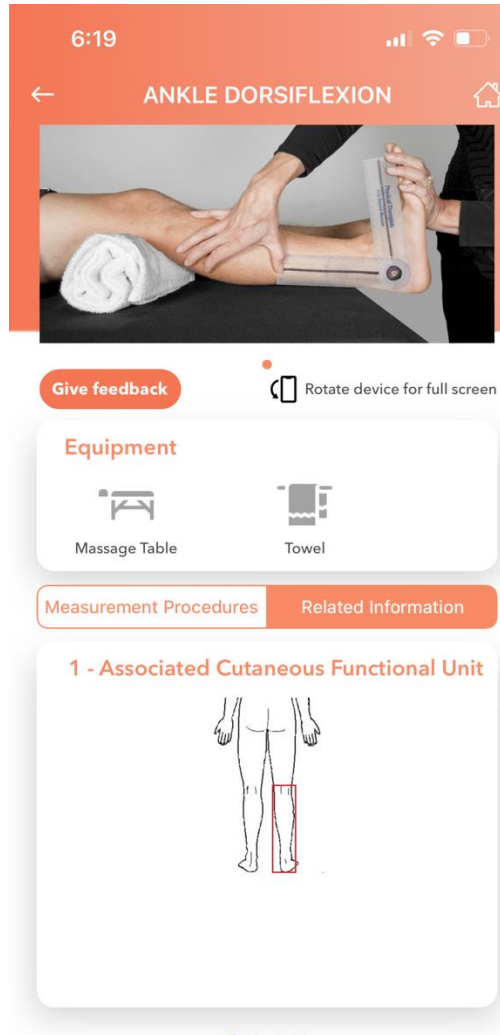
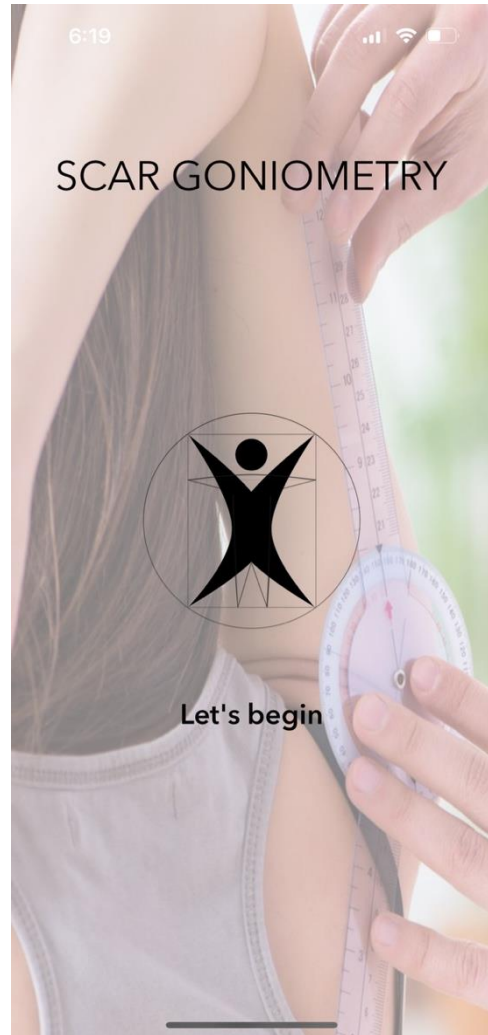


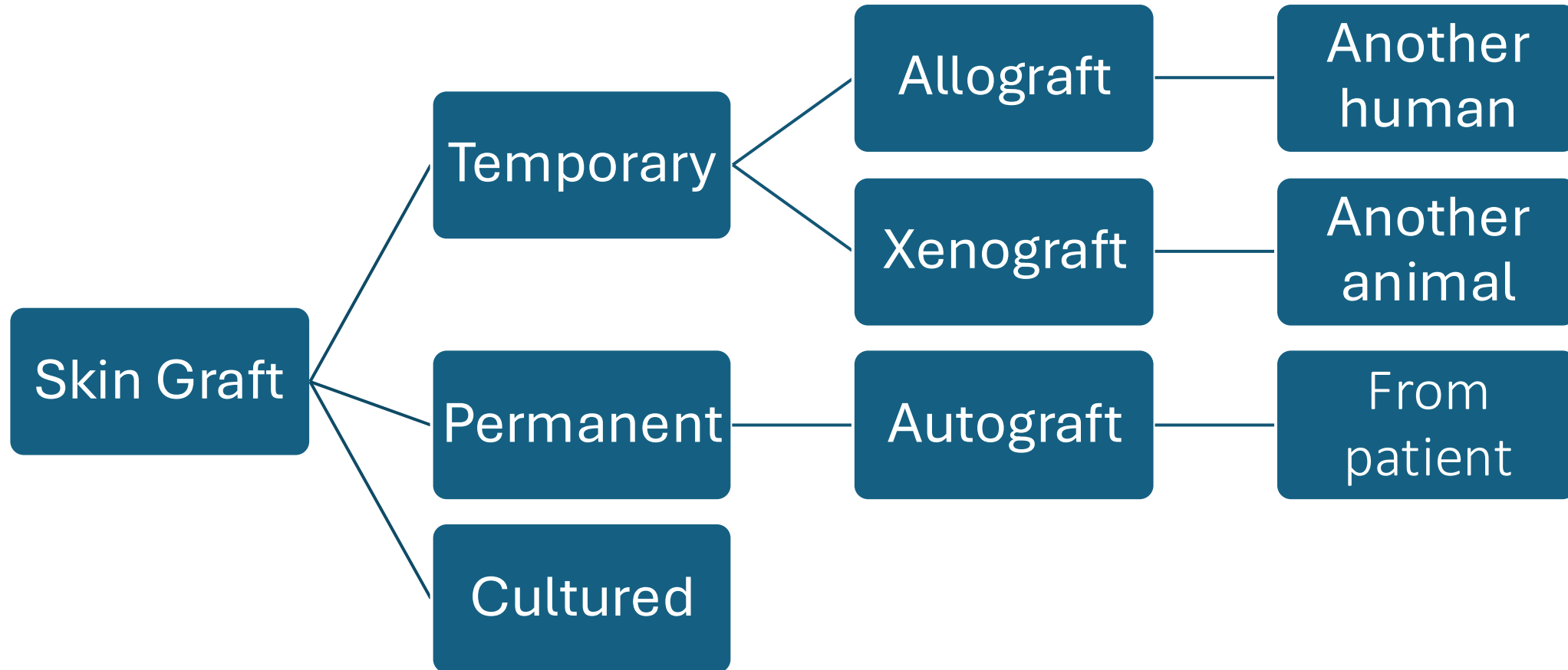
Figure 1. A visual example of the clinical difference of revised versus standard goniometric positions. A. Active wrist extension of 42° in the standard goniometric position (elbow flexed) compared with (B) active wrist extension of -33° in the revised goniometric position (elbow extended). Note that the patient is unable to fully extend the elbow in the revised position (B) due to an insufficient amount of pliable tissue to permit full ROM at either the wrist or the elbow.



-
- +
 -
 -

Skin Grafting

Skin Grafting



(O'Sullivan & Schmitz, 2009;
Doberstein, 2012)

Skin Grafting

Split Thickness Skin Graft

- Epidermis and superficial layer of dermis
- Most common
- Donor site will heal in 10-14 days, can be re-harvested
- No scarring to donor site
- Thin graft, easier to re-vascularize

• (O'Sullivan & Schmitz, 2009)

Full Thickness Skin Graft

- Epidermis and full dermis
- Less common
- Donor site requires primary closure, or grafting to heal
- Scarred donor site
- Relatively thick graft, slower re-vascularization
- Excellent cosmetic result

Split Thickness Skin Grafts

- Meshed Graft– lattice-like look, 1:3 area coverage
- MEEK Graft – islands of graft tissue, 1:9 area coverage



Photo: Ure & Schetzle, 2015

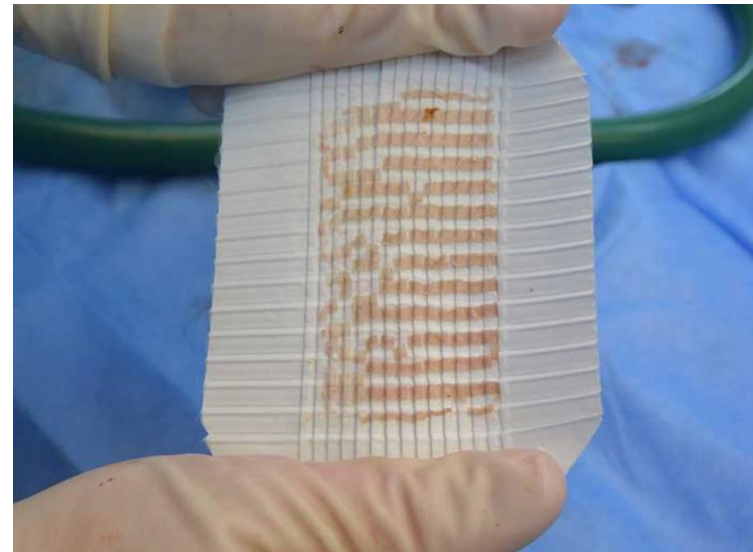


Photo: <https://basicsofburncare.org/mEEK-technique/>

Split Thickness Skin Grafts

- Sheet Graft– Used in visible areas so no remaining texture after heals. Less risk of contracture since less scarring while healing.

- (Photo: Greenhalgh, 2023)



Figure 8. A dorsal hand burn can be covered with a single 6-inch-wide graft. The lack of any seam makes the graft look like normal skin.



(a)

Figure 9. Cont.

Full Thickness Skin Graft

- Careful selection of the donor site
 - Often use the inguinal region, so scar will be covered
 - Try to match pigmentation of the skin
 - Try to limit hair transplantation as well
- Often used for the face or hand
- Less of a risk of contractures

• (Greenhalgh, 2016, Pg 129)



Fig. 9.10 This palm burn was covered with a full-thickness skin graft. The mobility is excellent but there is obvious hyperpigmentation

Skin Grafts- Vascular Anastomosis

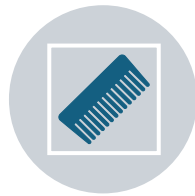
- Movement of blood vessels from the recipient site to the graft
- Begins within 12 hours
- New capillaries form by 24 hours
- Elevate limbs
 - prevent dependent flow of blood rupturing new capillaries, use compression to control blood flow
- Prevent shearing of the graft

- (Doberstein, 2012)

STSG Long term considerations (Wax, 2015)



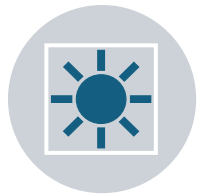
No active sweat or sebaceous glands initially



Hair rarely grows



Skin will be dry



Sensitive to sunlight



May have decreased light touch sensation, and hot/cold

Heterotopic Ossification (O'Sullivan & Schmitz, 2009)

Relatively high incidence in thermal injury

- Only 1-3% of thermal injury patients progress to have clinically problematic HO
- Most common in the elbow, then hip and shoulder
- Risk Factors:
 - >20% TBSA
 - Sepsis
 - Prolonged bedrest/immobilization
 - Trauma
 - Full Thickness injury



Heterotopic Ossification (Ure & Schetzle, 2015)

- Symptoms (occurs later in recovery)
 - Decreased ROM
 - Localized Pain
- Diagnosis
 - Symptom based or through imaging (X-ray, CT or Bone Scan)
- Treatment
 - ROM as tolerated
 - Surgery if nerve entrapment or severe decrease in function

Types of Abnormal Scarring

- Keloid Scar
 - Large, firm scar
 - Overflows boundary of original injury site
 - More common with darker pigmented skin



Picture from
<https://www.healthline.com/health/keloids#picture>



(Photo: Block, 2014)

- Hypertrophic Scar
 - Red, Raised, Rigid
 - Stays within boundary of original injury site



Practical Approaches to Rehabilitation for Thermal Injury

Acute and Rehabilitation Phases



Infection Control Guidelines

- Gloves worn at all times
 - Sterile Gloves for open wounds and during dressing changes (Frownfelter & Dean, 2022)
 - Gowns and mask worn if >10% TBSA or at dressing changes
- Hat (hair covering, including bangs!) at dressing changes

- +
-
-

Acute Therapy Priorities

On Admission....



If qualify to go to a burn unit, should be transported directly there



Therapy usually assesses within first 1-2 days, and positioning/splinting should start as early as Day 1 (O'Sullivan & Schmitz, 2009)



Do not wait around for a referral. Try and find out when the first dressing change will be and try and attend.

Goals of Acute Phase

Edema management



Preservation of ROM and skin mobility



Protection of vulnerable structures



Assess CardioResp Status/General Mobility



Education to survivor and caregivers

1. Edema management

- Edema typically peaks around 36-48 hours post burn (Osterman et al., 2022)
- Wounds that take longer than 2-3 weeks to heal, even if not deep, are more likely to scar.
- In acute care done through:
 - Elevation
 - AROM
 - Compression to areas with no open wounds or fresh grafting.
 - Participation in ADL's/therapy

2. Preservation of ROM and skin mobility

- This is done by:
 - Positioning
 - Splinting
 - Range of motion active > passive
 - Participation in therapy/daily care
- Consider the depth of the burns, stages of healing.
- Burns over a joint or closely adjacent require more diligence to maintain ROM
- Consider the CFU chart- what functional motions may be affected.
- Assess with dressings down, coordinate with nurses for dressing changes.

Positioning/splinting

Maintains ROM, prevents contractures & protects skin grafts or vulnerable structures.

Wearing schedule depends on the patient (alert vs sedated)

If already showing signs of contracture may have them wear more often.

Consider patient comfort, they need to tolerate the position.

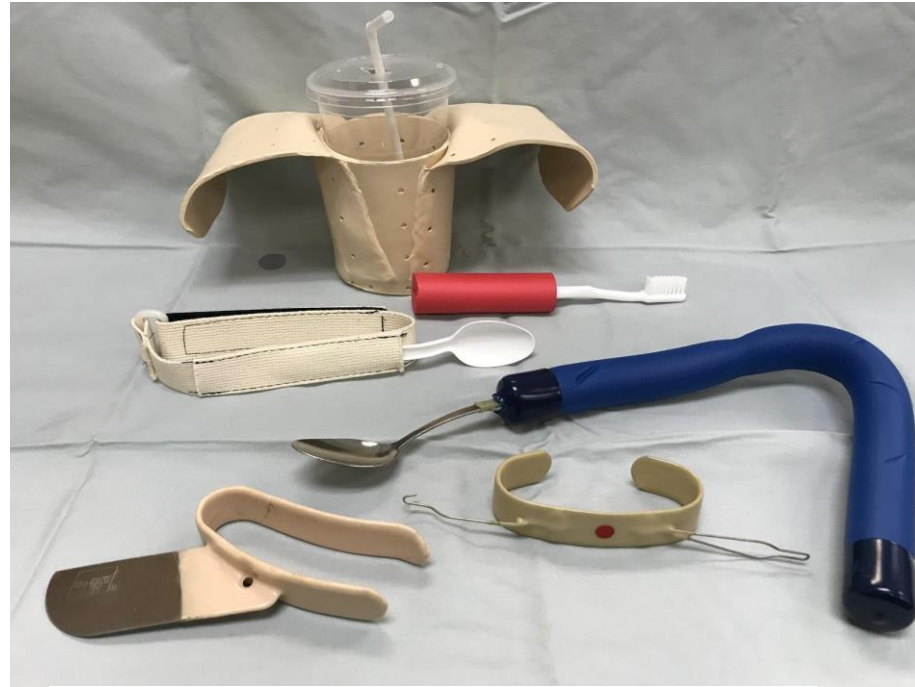
Need to communicate the wearing schedule well (to nursing and patient)

Make them easy to apply

Anti-Contracture Positioning

Injury Location	Common Contracture	Positioning/ Splint Strategy
Anterior Neck	Neck Flexion	No Pillows, neck extension splint or collar.
Axilla	Adduction and Internal rotation	Abduction, external rotation & Supination. Airplane splint or wedges. Lay with hand behind head in bed, or T lying.
Anterior Elbow	Flexion and Pronation	Elbow Extension splint, positioning into supination
Dorsal Wrist	Wrist Extension	Wrist splint positioned in neutral
Volar Wrist	Wrist Flexion	Wrist cockup splint
Dorsal Hand	Claw deformity	Position of safety or function. MCP's 70-90° flexion, IP's in full extension, thumb web space open and in slight opposition.
Volar Hand	Palm Contracture	Palm extension splint.
Foot	Plantar Flexion	Splint ankle at 90°, monitor for signs of heel breakdown
Face	Microstomia	Static splint to increase mouth opening. Facial exercises.
Hip/Groin	Adduction, Flexion	Place in abduction in supine in bed, Encourage extension in side-lying
Knee	Flexion	Flatten end of bed, prop heel to get full extension





Pic:
<https://www.isotoner.com/collections/therapeutic-compression-gloves>

Acute ROM Guidelines

Initial assessment of ROM

- **Contraindications to ROM**
 - Fractures/dislocations
 - Critically ill, unstable patient
 - Exposed tendons/joints, Need to Clear with Surgeon to start ROM

• **Precautions/Special Considerations with Hand Injuries**

- Use Tendon Glide Exercises for ROM
- Limit PIP and DIP flex 30-40 degrees with burns over dorsum on hand
- Await Dr's orders for ROM with tendon or joint exposed

- (Doberstein, 2012)

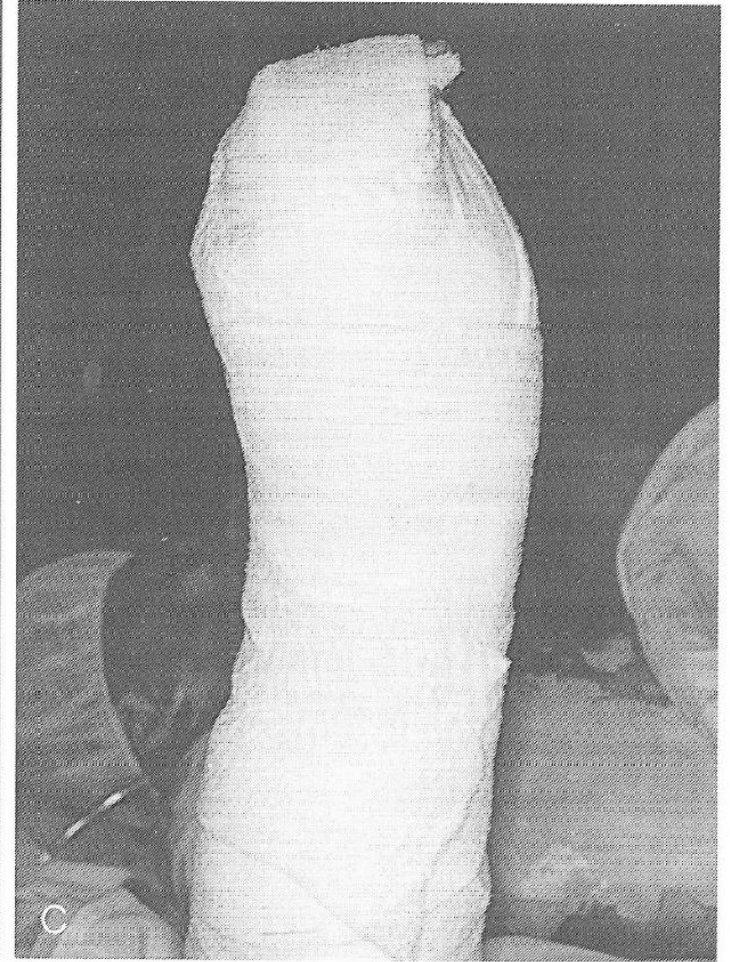
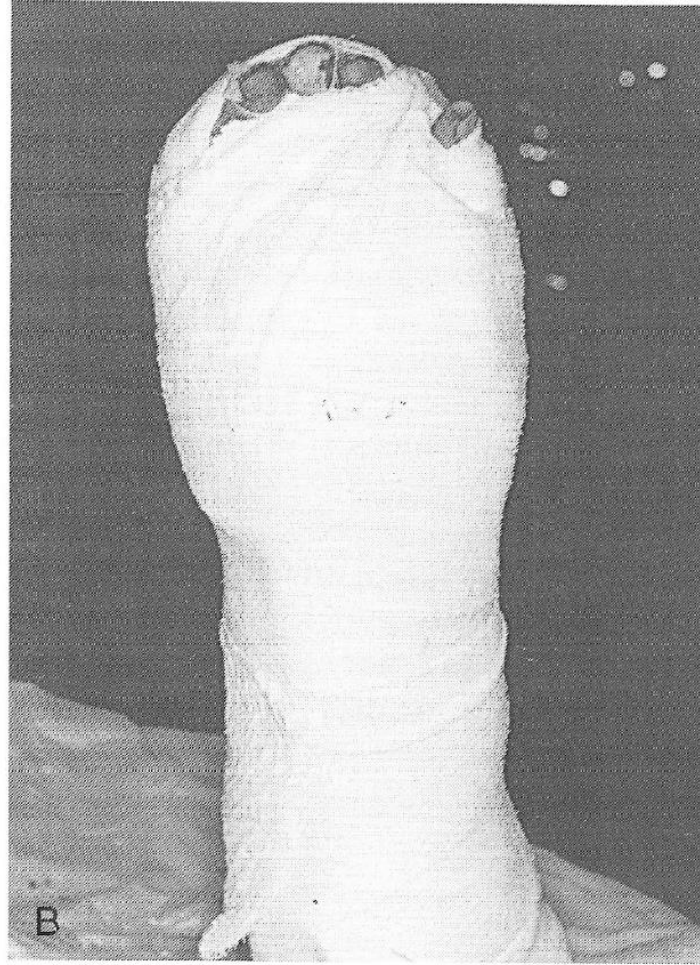
ROM Guidelines (Doberstein, 2012)

- Active and passive (?difference between active and passive)
- Hold 10 seconds, 3-4 reps
- Do with dressings off
- Within pain tolerance
- May need to use distraction techniques, or time with pain medications
- Ensure area stretching is moist and skin will not open
- Stretch to the point of blanching the tissues on tension

Consider what functional tasks the patient can do that will also increase ROM and Strength

Common Hand Bulky Dressing

- (Photo: Luce, 2000)





STRAIGHT



HOOK



TABLE TOP



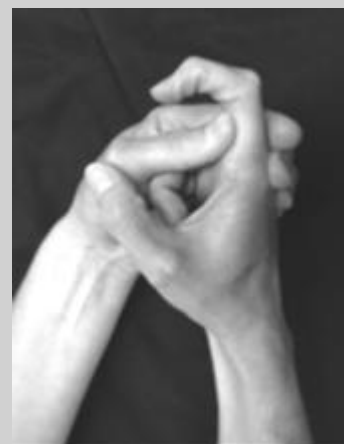
STRAIGHT FIST



FULLFIST



DIP Blocking



PIP Blocking

Acute Care – ROM and Skin Grafting

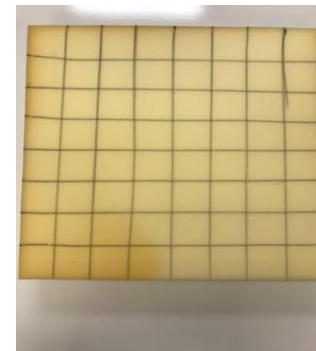
- **ROM after grafting**

- On Hold to grafted site after surgery until receive Dr's orders
- Do ROM for joints not involved in grafting
- Discontinue exercises of the donor site for 24-48 hours, due to pain
- ROM done with dressings down to grafted area
- While doing range note if skin grafts taken (will appear pink/red)
 - Areas not vascularized will be white

- (Doberstein, 2012, O'Sullivan, Schmitz & Funk, 2014)

3. Protect Vulnerable Structures

- Be mindful of positioning aids over bony prominences.
- Common pressure sites:
 - Occiput
 - Scapula
 - Elbows
 - Heels
 - Ischial tuberosity
 - coccyx



4. CR Status/General Mobility

- Any injury within a closed environment has some extent of inhalation injury
- Signs of inhalation injury
 - Facial burns, hair singed, harsh cough, hoarse voice, abnormal breath sounds, carbonaceous sputum, or hypoxemia
- Consider circumferential burns may limit chest expansion
- (O'Sullivan and Schmitz, 2014; Frownfelter and Dean, 2022)

4. CR Status/General Mobility

- Carbon Monoxide levels may complicate clinical situation in early phases
- Pulmonary edema common since fluid balance a challenge acutely, considering barrier function of skin lost (Frownfelter & Dean, 2022)
- Assess CR status, early mobility is key, as orders allow

4. CR Status/General Mobility

- General Mobility
 - Follow guidance of mobility orders and initiate discussions with team
 - May need to be creative to comply with grafting movement restrictions

- Example:

- Bilateral knee burns, and right ankle burn
 - Knee extension splint L
 - Knee extension and ankle boot R

- (Taylor, Manning & Quarles, 2013)



Practice Guidelines for Early Mobility after Lower Extremity Skin Grafts

- Fears around early mobility include:
 - Loss of graft due to hematomas forming
 - Shearing or lack of graft adherence
 - Tissue necrosis
- (Nedelec, 2012)
- However, risks of immobility include:
 - Decreased ROM
 - Decreased endurance
 - DVT or PE
 - Decreased independence with ADL's
 - Decreased quality of life
 - Longer hospital stays
 - Increased health care costs
- Review of the literature and consensus among clinicians created CPG's

Practice Guidelines for Early Mobility after Lower Extremity Graft

- Exclusions for mobility protocol:
 - Fractures, wounds >300cm², pre-injury immobility, not medically stable, over-riding psychological factors, grafting to the bottom of the foot
- Before mobilizing, and during:
 - Apply compression to graft site, double layer of tensor, figure 8 wrapped
 - If graft crosses a joint, use a brace to avoid joint movement
 - Monitor for orthostatic hypotension
 - Start with dangle and progress as tolerated

- (Nedelec, 2012)

5. Education

- Patients need to understand the goals of the splints as well as wearing regime.
- Consider other referrals needed
- Develop goals together
- Phoenix society has lots of great resources
 - [Phoenix Society | Burn Survivor Support & Recovery Resources](#)

- - +
 -

Rehabilitation Therapy Priorities

Goals of Rehab Phase

Reduce Contractures, and Improve Joint Mobility

Edema Management

Scar Management - Compression, serial casting, splinting

Exercise Programming

Scar Massage

Desensitization

Education

1. Reduce Contractures, and Improve Joint Mobility

- Survivors will enter the scar maturation phase
- Scar tissue will remain active for 6-24 months.
- How we help this :
 - Edema management
 - Splinting/ serial casting
 - Compression therapy
 - Exercise
 - Participation in ADL's

2. Edema Management

- Once wounds are closed and graft site stable can initiate compression.
- This is achieved through tubigrip, coban or tensors.
- Participation in care and ADL's will assist with this as well.
- Splints and positioning aids will be primarily used when resting.

3. Scar Management - Compression

- Widely used intervention for management of scars.
- Contributes to a more linear, pliable and de-vascularized scar
(Osterman et al., 2022)
- Decreases blood flow to the scar which reduces collagen synthesis and fibroblast proliferation.
- Not needed for patients who heal within 2-3 weeks.
- Can become thick and raised as early as 8-12 weeks
- Typical pressure is around 25 mmHG
- Needs to be worn ideally 23 hours per day

Compression continued

- Purplish or pinkish color should reduce, and no longer blanch to touch.
- Maturity usually occurs in 6months- 2 years.
- If they are coming from Edmonton will have tubigrip garments
- Once mostly healed will measure for custom compression.
- In Saskatoon we order from Recovery Garments out of Toronto.
- May also use Gel inserts or Neoprene in addition to compression.
- Pictures from:
<https://recoverygarmentcentre.ca/en-CA/>



3. Scar Management - Silicone and Inserts

- Silicone widely used in burn scar management
- Burn Syndactyly another consideration in the hand
 - Add inserts to webspaces using silicone, velfoam, conformer
- Scar over concave surfaces meets less resistance than convex, allowing more migration of the scar.
- Burn injuries to the dorsal hand and fingers will often result in syndactyly in the webspaces as maturation occurs
- Adding inserts restricts contraction from migrating
- Photos from (Osterman et al., 2022) Fig 81.20 & 21



FIG. 81.20



3. Scar Management - Splints and Serial Casting

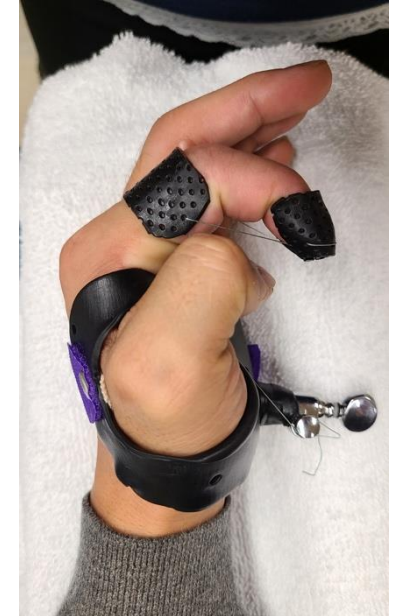
- Goals are a low load stretch over a long period of time.
- Can use a variety of static progressive or dynamic splints.
- Serial casting very effective as the client cannot remove it. Gives them a more continuous stretch.
 - Initially changed within a day or 2 but once you know its stable and they are tolerating can leave for up to 7 days.
 - Can be done over a small wound that is free of infection or dressed appropriately (Osterman et al., 2022).
 - Caution for areas of reduced sensation.
 - Remember to do ROM pre and post application.



FIG. 82.33

Hand extension serial casting for severe palmar contracture.

(Osterman et al., 2022, Fig 82.33)



Splinting

Can be used to gain range of motion.

Will make both static progressive and dynamic options.

Can be remolded and used in conjunction with range of motion.

4. Exercise Programming

- Consider components of Exercise Programming, including ROM, Strength and Endurance Training
- Range of Motion Exercises:
 - Range of motion "when it is white, it is tight", therefore you should observe blanching during ROM exercises.
 - Forceful PROM can lead to traumatic inflammation, which can make contractures worse. (Osterman et al., 2022)
 - Typically, will heat them up before stretching using heat packs, paraffin wax or fluidotherapy.

Strength and Endurance Training

- Deconditioning results from prolonged bedrest and catabolic state
 - (O'Sullivan, Schmitz & Funk, 2014)
- Hypermetabolic state can last up to 24-35 months after injury
 - (Holavanahalli et al, 2013)
- Patients with a thermal injury do have the potential to improve strength and endurance
 - (Grisbrook, 2012)

Rehabilitative Exercise Training Post-Burn Injury

(Palackic et al., 2021)

- Helps with
 - decreasing edema
 - preventing tendon adhesions
 - reduces joint stiffness and capsular shortening
 - reduces need release of burn scar contractures
- Rehab Exercise Training is an underutilized treatment strategy in burn survivors, yet safe and effective
- Consider effects of impaired thermoregulation (Skin grafts can't sweat!), but don't discourage exercises outdoors due to additional benefits

Practice Guidelines for Cardiovascular Fitness and Strengthening Exercise Prescription after Burn Injury (Nedelec et al 2016)

- Exercise programs can start as early as immediately post-discharge from acute care
- Involve both strength and cardiovascular exercises for adults and pediatrics
- Participants in studies were moderate to large TBSA burns (>40%)

Progressive Resistive Training	Aerobic Conditioning Program
Baseline evaluation	Baseline evaluation
Instruct in correct weight lifting technique Warm up with lever arm and bar or wooden dowel Attempt to lift a weight 4 times If successful, with correct technique, 1 min rest Lift progressively increased amount Continue until unable to perform 4 th repetition Final weight/load=3RM	Standardized treadmill exercise test (modified Bruce Protocol) Oxygen consumption and heart rate measured Begin to walk on treadmill 1.7 mph 0% grade 3-minute intervals - increase speed and incline VO _{2peak} =respiratory exchange ratio≥1.10 and peak volitional effort achieved
Resistance Exercises	Aerobic Exercises
Eight exercises: bench press, leg squats, shoulder press, leg press, biceps curl, leg curl, triceps curl, toe raises 1 st week: 50-60% 3RM 4-10 reps x 3 sets 2 nd -6 th week: 70-75% 3RM 4-10 reps x 3 sets 7 th -12 th week: 80-85% 3RM 8-12 reps x 3 sets 1 minute rest between sets	5 minutes warm up (<50% treadmill or cycle ergometer VO _{2peak}) 30 minutes (70-85% treadmill or cycle ergometer VO _{2peak}) 5 minutes cool down (<50% treadmill or cycle ergometer VO _{2peak})
30 minutes/3 non-consecutive days/week x 12 weeks	30 minutes/5 days/week x 12 weeks

mph = miles per hour; RM = repetition maximum; VO_{2peak} = peak oxygen consumption

5. Scar Massage

- Debate in the literature, yet Clinically it has been noted that massage helps with pliability and texture of the scar
 - (O'Sullivan & Schmitz, 2009; Holavanahalli et al., 2013)
- Preliminary evidence for scar massage to benefit pliability, decreased scar height, pain, and improved psychological outcomes (decreased depression levels)
 - (Ault et al., 2018)
- Assess Scar pliability, height, texture, pigmentation, response to body movements and patient's experience with itch/pain/sensitivity with the scar
 - (Ault et al., 2018)

5. Scar massage

- Once fully healed, great to incorporate
- Scar should blanch and can incorporate massage while on stretch
- Helps reduce sensitivity
- Makes skin pliable and softer
- Adjunct to compression garments

- Techniques:
 - Journal of Burn Care and Research, Jan 2016, experienced therapists from 6 countries created a video on the consensus of ten techniques for scar massage
 - <https://www.youtube.com/watch?v=oKszhYKy-9w>

6. Desensitization

- After a significant injury can have loss of specialized nerve functions (Osterman et al., 2022).
- Hypersensitivity or sensory loss can occur.
- Can be beneficial to include sensory testing in your assessment.
- Scar massage can help with hypersensitivity.
- Getting the patient touching and looking at their injury helps.

7. Education

- Wear and care of pressure garments & splints
- Skin care and protection- unscented lotion, no scratching, sunscreen
- A graft exposed to the sun too soon can darken
 - None to minimal sun for the first year, impact on sweat glands
 - Mitts in winter
- Scar monitoring, massage, desensitization
- Follow-up plan for therapy

7. Education

- Be aware of pre-injury status and work with client to make goals
- Discuss support network early
- Involve support network in education and discharge planning
- Acknowledge normal grieving process and adjustment after a trauma
- Provide education/communication with community as appropriate
 - ie) survivor's workplace, school

- Burn Fund Saskatchewan
- National Network <https://www.canadianburnsurvivors.ca/>
- Saskatchewan Burn Support Network (has Facebook page)



Psychological Supports (Weichman, et al., 2013)


- Acute Stress Disorder/Post-Traumatic Stress Disorder
 - Trauma of initial incident and/or ongoing treatment (ICU stay) can be source
 - Prevalence: ASD 6-33%, PTSD 24-40% of burn survivors
 - Can be misdiagnosed as delirium
- High rates of depression 1 year post injury

American Burn Assoc Recommends

- Screen patients during first 48 hours (as feasible), before discharge and at first follow-up outpatient visit (tools such as PHQ-9 recommended)
- Facilitate further assistance as required



Conclusion

- After session- will distribute a shared folder and list of resources
 - Follow up survey - Please let us know if you are willing to have your site or name as a contact to create a network in the province for burn supports
 - Thank you to the Burn Fund Saskatchewan for supporting the webinar
- 

+
•
○

Questions

Lacey

email: lacey.nairnpederson@usask.ca

Alanna

email: alanna.coode@saskhealthauthority.ca

References

- Ault, P., Plaza, A., & Paratz, J. (2018). Scar massage for hypertrophic burns scarring—A systematic review. *BURNS*, 44(1), 24–38. <https://doi.org/10.1016/j.burns.2017.05.006>
- Block, J. (2014) Burn Presentation 2014. [PowerPoint slides].
- Doberstein, S. (2012). Burn Manual. PThER 561. Edmonton, Canada: University of Alberta.
- Frownfelter, D., & Dean, E. (2022). Cardiovascular and pulmonary physical therapy: Evidence and practice (6th ed.). Elsevier.
- Greenhalgh, D. G. (2016) Burn Care for General Surgeons and General Practitioners, Switzerland: Springer International Publishing.
- Greenhalgh, D.G. (2023) Operative Management of Burns: Traditional Care. *Eur. Burn J.*, 4, 262–279. <https://doi.org/10.3390/ebj4020024>
- Grisbrook, T.L., Wallman, K.E., Elliot, C.M., Wood, F.M., Edgar, D.W., Reid, S.L. (2012a) ‘The effect of exercise training on pulmonary function and aerobic capacity in adults with burn’, *Burns*, 38, 607-613
- Grigsby, L. & Miles, W.K.(1995). Remoulding of scar tissue in the burned hand. In J.M. Hunter, E.J. Mackin & A.D. Callahan (Eds.), *Rehabilitation of the hand: Surgery and therapy* (pp.1267-1294). St. Louis, MI: Mosby- Year Book, Inc.
- Hale, A., O'Donovan, R., Diskin, S., McEvoy, S., Keohane, C., & Gormley, G. (2013) *Physiotherapy in Burns, Plastics and Reconstructive Surgery*. Ireland: University of Limerick.
- Holavanahalli, R. K., Helm, P. A., Parry, I. S., Dolezal, C. A., Greenhalgh, D. G. (2001) Select practices in management and rehabilitation of burns: a survey report. *Journal of Burn Care and Research*, 32:210-223.
- Luce, E. (2000) Acute and Subacute Management of the Burned Hand. *Burn Care and Management*, 27(1), 49-63.

References

- McVeigh, K., Herman, M., & Barrett, N. (2001). Physiology of Wound Healing and Burns. In K. Masker & H. Gift (Eds.), Test Prep for the CHT Exam 4th edition: Study outline and clinical reference (pp 49-67). Association Headquarters.
- Nedelec, B., Serghiou, M. A., Nizszczak, J., McMahon, M., Healy, T. (2012) Practice Guidelines for early ambulation of burn survivors after lower extremity grafts. *J Burn Care Res*, 33 (319-329).
- Nedelec, B., Parry, I., Acharya, H., Benavides, L., Bills, S., Bucher, J. L., Cheal, J., Chouinard, A., BSc, PT, Crump, D., Duch, S. et al. (2016). Practice Guidelines for Cardiovascular Fitness and Strengthening Exercise Prescription After Burn Injury. *J Burn Care Res* 2016;37:e539–e558.
- Osterman, A. L., Skirven, T. M., Fedorczyk, J. M., Amadio, P. C., Feldscher, S. B., & Shin, E. K. (2022). Rehabilitation of the hand and upper extremity (Seventh edition).
- O'Sullivan, S. B., & Schmitz, T.J. (2009). Physical Rehabilitation, 5th Ed. Philadelphia, PA : F. A. Davis Company.
- O'Sullivan, S. B., Schmitz, T. J. & Funk G. D. (2014) Physical Rehabilitation, 6th Ed. Philadelphia, PA : F. A. Davis Company.
- Palackic, A., Suman, O. E., Porter, C., Murton, A. J., Crandall, C. G., & Rivas, E. (2021). Rehabilitative Exercise Training for Burn Injury. *Sports Medicine (Auckland)*, 51(12), 2469–2482. <https://doi.org/10.1007/s40279-021-01528-4>
- Parry, I.S., Bell, J.F., Schneider, J.S., Bidwell, J.T., Catz, S. L., Tancredi, D.J. (2025) Cutaneous functional units (CFU's) versus total body surface area burned (TBSA) for predicting range of motion outcomes: A comparison of predictive models; *Burns*, 51.
- Parry, I., Richard, R., Aden, J. K., Yelvington, M., Ware, L., Dewey, W., Jacobson, K., Caffrey, J., & Sen, S. (2019). Goniometric measurement of Burn Scar Contracture: A paradigm shift challenging the standard. *Journal of Burn Care & Amp Research*, 40(4), 377–385. <https://doi.org/10.1093/jbcr/irz038>
- Pessina, M.A. & Orroth, A.C.(2008). Burn injuries. In M.V. Radomski & C.A. Trombly (Eds.), *Occupational therapy for physical dysfunction* (pp.1244-1263). Baltimore, MD: Lippincott Williams & Wilkens.

References

- Taylor, S., Manning, S., & Quarles, J. (2013). A multidisciplinary approach to early mobilization of patients with burns. *Crit Care Nurs Q*, 36(1), 56-62.
- Ure, Z & Schetzsl, S (2015). U of A Burn Presentation 2015 - Occupational Therapy Management of Burn Injuries [PowerPoint Slides].
- van Hasselt, E. J. (2008) Burn Manual: A manual for health care workers, 2nd Ed. The Netherlands: Dutch Burns Foundation.
- Wax, M. K., Pittman, A. L., & Ghanem, T. A. (2015). Split-thickness skin grafts. *Medscape- Drugs and Diseases*, Retrieved from: <http://emedicine.medscape.com/article/876290-overview#aw2aab6b7>
- Wiechman, S., Myer, W., Eselman, W., Fauerbach, L., Gibbons, L., Holavanahalli, R., Hunt, C., Keller, K., Kirk, E., Laird, J., Lewis, G., Moses, S., Sproul, J., Wilkinson, G., Wolf, S., Young, A. & Yovino, S. (2013). Psychological Outcomes: American Burn Association Consensus Statements. *Journal of Burn Care and Research*, 34(4).
- Yelvington, M. L., & Parry, I. (2023). Integration of Cutaneous Functional Units Principles in Burn Rehabilitation: A Diffusion of Innovations Assessment. *Journal of Burn Care & Research*, 44(5), 1134–1139. <https://doi.org/10.1093/jbcr/irad007>