Historical Perspective

For early humans most wounds and injuries were the result of accidents and fighting.
Development of today’s dressing

World War I

- With contamination of wounds by earth and dirt being widespread, leading to gas gangrene and many subsequent deaths.
- Tulle gras dressings were developed as a low-adherent dressing.
Diagram of Wound Healing

- Injury
  - Coagulation (platelets)
  - Debridement
  - Resistance to infection

Epithelium

- Collagen lysis (Remodelling)

Inflammation

- Neovascular growth
- Collagen synthesis

Fibroblasts

- Contraction
  - Proteoglycus synthesis

Wound Healed
Phases of wound healing

- Cleansing
- Fibroblast migration and formation of granulation tissue
- Maturation and increasing wound contraction / epithelialization
Wound Care: Dressing procedures
The Development of Moist Wound Healing

George Winter (1927-1981)

- A zoologist
- Investigated wound healing in cutaneous wounds in the domestic pig. He later became interested in wound dressings and worked on covering wounds in an experimental model (using the pig) and observing healing rates.
- Winter observed that wounds covered with an occlusive dressing healed faster than those left to dry out (Winter 1962). It was from this work that the principles of moist wound healing were developed.
Moist Wound Healing

In a moist environment exudate bathes the wound bed with nutrients, and many modern dressing materials are designed to maintain moisture.

Dry Wound Healing

Under dry conditions the bed of an open wound rapidly dries out and forms a scab made up of dead and dying cells. New epidermal cells migrate under this scab in the moist environment found under it, so extending the healing phase.
Turner (1985) evaluated the needs of healing wounds and listed the criteria that should be fulfilled by a good wound dressing:

- Maintains high humidity between wound and dressing
- Removes excess exudate and toxic components
- Allows gaseous exchange
- Provides thermal insulation
- Impermeable to bacteria
- Free from particles and toxic wound components
- Allows removal without causing trauma during dressing change
Thomas (1990) evaluated and further expanded the functions of a dressing. In which, dressings should ensure that the wound remains:

- Moist with exudate, but not macerated
- Free of clinical infection and excessive slough
- Free of toxic chemicals, particles or fibres released by the dressing
- At the optimal temperature for healing to take place
- Undisturbed by frequent or unnecessary dressing changes
- At an optimum pH value
Morison (1992) provided a nursing perspective of criteria for an ideal wound dressing:

- Non-adherent / Capable of protecting the wound from further trauma / Insulating Thermally / Impermeable to bacteria / Non-toxic and non-allergenic
- Capable of maintaining a high humidity at the wound site while removing excess exudate
- Comfortable and conformable
- Requires infrequent dressing changes
- Cost-effective
- Long shelf-life
- Available both in hospital and in the community
The categories of wound dressings

- Non-woven sponges and dressings
- Impregnated
- Transparent film
- Hydrocolloids
- Hydrogels
- Exudate absorbers
- Calcium alginate
- Foams

...
Gauze dressings

- Readily available and inexpensive,
- Permeable to bacteria and moist gauze does tend to be an environment for the growth of bacteria.
- Unsuitable as a primary dressing,
- Applicable as a secondary dressing.
Pain

Secondary dressing

Adhesion to the wound

Dehydratation

Trauma of newly formed tissue and bleeding

DAILY DRESSING CHANGE !!!

HEALING IN A DRY ENVIRONMENT DELAYS THE HEALING PROCESS
Emollient dressings

- Impregnated with an emollient
e.g. Jelonet is a fine mesh gauze impregnated with paraffin.

- To remain lightly adherent or non-adherent while maintaining a moist wound surface.

- Offer minimal to no absorption; exudate absorption can be provided by a cover dressing.

- Are effective on dry or lightly exudating wounds such as post-surgical incisions, skin tears, and many stage ii wounds.
Paraffin gauze (non-medicated)

Mesh impregnated with Hyuronic acid
Medicated dressing: For disinfection and infection control

- **Antiseptics**
  - Salt (hypertonic)
  - Chlorhexidine
  - Povidone Iodine
  - Cadexomer iodine
  - Silver

- **Antibiotics**
  - Fusidic Acid
  - Metronidazole
  - Framycetin
Dressing Containing Iodine

- Potent anti-microbial activities
- For the prophylaxis and treatment of infection in minor burns, leg ulcers, superficial skin-loss injuries and as a dressing
Hypertonic saline dressing

- Stimulates the cleansing by absorbing exudate, bacteria and necrotic wound material
- Aid in the autolytic debridement process.

- Indicated for Heavily discharging and discharging infected wounds
Silver impregnated Dressings

Deliver through means of :

- Silver sulfadiazine
- Silver nitrate
- Nanocrystaline silver

1. Antimicrobial effect in polymicrobial environment.
2. Prohealing effects – anti-MMPs
3. Anti-inflammatory
Film dressing

- A thin, poly-urethane membrane coated with a layer of acrylic adhesive.
- Gas and water vapour permeable, impermeable to microorganisms and environmental contaminants, transparent and flexible.
- Allow easy wound assessment and are conformable.
- The products in this group includes Opsite and Tegaderm.
Poly-urethane foams:

- Foam dressings absorb moderate to large amounts of exudate while keeping the wound moist.
  - e.g. Allevyn, Lyofoam, Askina Transorbent or Biatain
- Uses in moderate to heavily exudating partial- or full-thickness wounds, including ulcers, donor sites, minor burns
- Act as a secondary dressing particularly in the use of amorphous hydrogels.
- Indicated as secondary dressings to provide additional absorption of excess body secretions.
- Not considered of value in low exudating or dry wounds with eschar.
Foam Dressing
Foam Dressing
Hydrogels

- Used to help rehydrate sloughy wounds and necrotic tissue to aid in the autolytic debridement of wounds.
  - e.g. Intrasite gel, Duoderm gel, Clearsite gel, Nu gel.

- Gauze that impregnated with a hydrogel can also be packed into the wound for the same purpose.
Alginates

- Alginates dressing products composed of materials obtained from seaweed. e.g. Kaltostat, Sorbsan, Seasorb and Sorbalgon.
- When applied to a wound, alginate form sodium alginate, a hydrophilic gel. They are practically insoluble in water and organic solvents but are biodegradable.
- The physical properties of these products also have haemostatic effects.
Hydrocolloids were originally introduced as stomahesive to protect good skin around stoma. It was subsequently found that they improve the healing of excoriated skin.

May also be used in conjunction with a paste or powder version. The paste or powder is used in a deeper ulcer or cavity, these products convert to the hydrophilic gel when contact with wound fluid.

Autolysis of fibrotic slough or necrotic tissue within the wound bed is enhanced by the interaction of the wound fluid with the composite of the hydrocolloid.
The hydrocolloids wafers are covered with water-resistant foams or films that render them occlusive.

- Duoderm GCF, Comfeel, Algoplague, Supersorb H, Tegasorb, Hydrocoll, Restore Plus

Hydrocolloid wafers give excellent protection against outside contamination and will maintain a moist surface.
High Absorbent Dressing
High Absorbent Dressing
Bacteria Attracted by hydrophobic fiber
reduce the bacterial burden in Heavily colonised / delayed healing wounds
Deliver through means of:

• Silver sulfadiazine
• Silver nitrate
• Nanocrystaline silver
How does silver kill bacteria?

Silver interacts with DNA and inhibits cell division => stops formation of colonies

Silver ions are bound to the Bacteria cell wall

=> Block proteins important for transportation of substances in & out of the cell membrane

Silver interacts with enzymes and block the respiration system,

=> the bacteria will starve, the cell membrane burst
Mechanism of Ag activation

\[ \text{[Ag-Complex]} + \text{Na}^+ \rightarrow \text{[Na – Complex]} + \text{Ag} \]
Silver Release Profile

*It is very important not to expose the patient to an unnecessarily high level of silver whilst at the same time a certain amount of silver is needed to reduce the bacterial burden. This is called the Minimum Inhibitory Concentration or MIC.
SILVER DRESSINGS

Deliver through means of:

- Silver sulfadiazine
- Silver nitrate
- Nanocrystaline silver

- Antimicrobial effect in polymicrobial environment.
- Prohealing effects – anti-MMPs
- Anti-inflammatory
SILVER DRESSINGS

AQUACEL®
10x10
Hydrofiber™ Dressing with Silver

10 cm x 10 cm

Acticoat

10 cm x 10 cm
SILVER DRESSINGS

Atrauman Ag

ACTICOAT ABSORBENT
SILVER DRESSINGS
SILVER DRESSINGS

SeaSorb - Ag

Suprasorb A - Ag
SILVER DRESSINGS

Vliwaktiv Ag
Aktivkohle-Tamponade mit Silber
Meche charbon actif et a l’argent
Activated Charcoal Rope with Silver
Tropimiento de carbón activo con plata

10 x 15 cm
10 %
REF 20702

ACTISORB SILVER 220
Activated Charcoal Cloth with Silver
Silber-aktivkohle-Auflage

10.5 cm x 10.5 cm

Back of dressing
Non-adherent nonwoven
Clothing protection

Celulose
Activated charcoal
Viscose fibres
Mepilex AG®
Antimicrobial Soft Silicone Foam Dressing
Other dressings
Tender Wet Therapy

- Continuous wound cleansing
- Take up wound exudate
- Trap micro-organism
- To avoid trauma during removal

- Provide moist environment for promoting autolytic debridement and wound healing

Disadvantage:
Need to manage excessive droplet from dressing
Honey

- Traditional treatment for anti-biotic resistant strains of bacteria e.g. MRSA
- Worthless but harmless substances
- Make the smell of discharge less offensive
- Molan (2001)

Limitations:
- Quality control in honey production
- Sensitive to pollen
- Lack of evidence base in therapeutic effects and chemical properties of honey
Controlling Odour

Carbo-Flex
Controlling Odour

Active

Metronidazole cream / powder

Passive

Charcoal impregnated sheet
Gold Dust (金塵)

Gold Dust ™
Super Absorbent Wound Filler

See Instructions for Use

southwest technologies inc.

Treating the world well®

See Instruction for Use

Single Use Only
Do Not Use If Damaged
Consult Instructions

Sterile

5 Grams

LOT
041912A

Rev. E 2-12

DR9300

041912A
含甘油敷料（Glycerine）
Methylene Blue 亚甲蓝
Collegen

- For the management of all types of chronic wounds that are free of necrotic tissue and visible signs of infection.
- The matrix, which also has haemostatic properties, can be used in conjunction with compression therapy.
Composition

Collagen sponge

- thickness 0.8 cm
- white, porous structure, open-celled
- with high and fast absorption capacity and quick gelation
- air permeable
Hyuronic Acid
Contact layers

- Allow the passage of exudate from the wound to a secondary absorbent dressing of choice.

- May be applied to partial and full thickness wounds, deep dermal burns, donor sites (after haemostasis achieved), traumatic and chronic wounds and dermatological lesions.
Matching of wound condition and various kind of dressings need training and experience.
Maceration and odorous gel
Fig. 1. Bactericidal activities of silver-impregnated dressings against Gram-positive and Gram-negative bacteria. Values are means of two experiments performed in duplicate. $\Delta \log_{10}$ c.f.u. ml$^{-1}$ is the difference in $\log_{10}$ c.f.u. ml$^{-1}$ at the time of bacterial inoculation, starting from $t=0$. Strains: (a) methicillin-resistant S. aureus (MRSA) ATCC BAA-43; (b) methicillin-sensitive S. aureus ATCC 29213; (c) Enterococcus faecalis ATCC 29212; (d) E. coli ATCC 35218; (e) Proteus vulgaris ATCC 6380; (f) Enterobacter cloacae ATCC 13047; (g) Acinetobacter baumannii ATCC 19606; (h) Acinetobacter baumannii BM4454; (i) P. aeruginosa ATCC 27853.
Bacterial resistance to silver in wound care

“.... silver is included in many commercially available healthcare products. The use of silver is increasing rapidly in the field of wound care, and a wide variety of silver-containing dressings are now commonplace. However, concerns associated with the overuse of silver and the consequent emergence of bacterial resistance are being raised. ..... Despite the sporadic evidence of bacterial resistance to silver, there have been very few studies undertaken and documented to ascertain its prevalence. The risks of antibacterial resistance developing from the use of biocides may well have been overstated.....“

“Gilbert and McBains suggested that in wound care, hygiene should be emphasized and targeted towards those applications which have demonstrable benefits. “

Other treatment modalities
Negative pressure wound therapy

NPWT assists:
- To provide a moist, protected environment
- Reducing peripheral oedema around the wound
- Stimulate circulation to the wound bed
- Decreasing bacterial colonization
- Increasing the rate of tissue formation and epithelialization.
- As adjunct therapy in infected wound

- Eastman (2001)
NPWT machines
Mini NPWT devices
Apply NPWT
Protects against wound contamination and infection

Increased granulation tissue growth

More local blood flow

Control of fluids to maintain a moist wound environment

Less oedema
Negative pressure wound therapy

Limitation

- Wound must be cleared of all devitalized tissue before the therapy
- Contra-indicated in wounds with necrotic tissue, untreated osteomyelitis, fistula or placement over vessels
- Risk of contamination due to back-flow
- Possible malfunction of device
- Alternative to expensive device / sponge
- Confining patient by the suction apparatus
COMPRESSION BANDAGES
Permanent dressing with bandages

tg tubular bandage as skin protection
Permanent dressing with bandages

Padding with Rosidal soft or Cellona Syntethic padding
Permanent dressing with bandages

Forefoot - heel – instep – heel – forefoot – ankle
The lower leg is bound up with half overlapping turns
Permanent dressing with 2 Rosidal® K bandages

Short stretch bandage (Rosidal K 8 cm / 5 m)
forefoot – heel - instep – heel – forefoot – ankle
the lower leg is bound up
with half overlapping turns
Permanent dressing with bandages

The end of the bandage is fixed below the knee with plaster strips
The second bandage (Rosidal K 10 cm / 5 m) is wrapped over the first one, using the same technique, but in the opposite
Permanent dressing with bandages

Additional plaster strips over the heel prevent formation of creases and the bandage from slipping in the shoe.
Permanent dressing with bandages

tg tubular bandage as protecting the compression dressing
Permanent dressing with bandages

Finished compression dressing
Hypergranulation

- Granulation tissue can be produced in excessive amounts and rise above the level of the skin.
- Epithelium will not cover this tissue and intervention is required to flatten the wound surface and so facilitate re-epithelialization.

Treatments:

- Silver nitrate sticks (75%)
- Corticosteroid cream.
- Foam dressing  
  (Harris and Rolstad 1993)
- Hypertonic Saline gauze  
  (Rice 2001)
Scar Management

- Silicone Sheet
Skin Protection

Skin Sealants

Barrier Cream
What's New ?
Low Energy Laser light therapy (LLLT)

- Laser phototherapy (LPT) is used in many biomedical applications to promote tissue regeneration, and it has been shown to possess several advantages, including
  - the control of pain,
  - stimulation of the healing process,
  - anti-inflammatory action,
  - increase in the production of collagen,
  - increase in fibroblastic proliferation, and
  - increase in local microvascularization.
Low Energy Laser light therapy (LLLT)

- General effects of the laser light
  - Ability to increase the rate of healing through mitochondrial ATP production
  - Alteration in the cellular lipid bilayer.
  - The subsequent capacity of irradiated cells to alter their ion exchange rate, and thus influence the catalytic effects of specific enzymes and substrates
Bioptron polarised light therapy
LED LASER
What we need to do it better?

- Hyperbaric Oxygen Device / Facilities
- RCT Vs Cost
"People are looking for peptides in frog skin and alligators, for example, to see if they are effective at reducing virulence, killing bacteria or improving the ability of the immune system to fight infection."
Thank you!

Q & A session