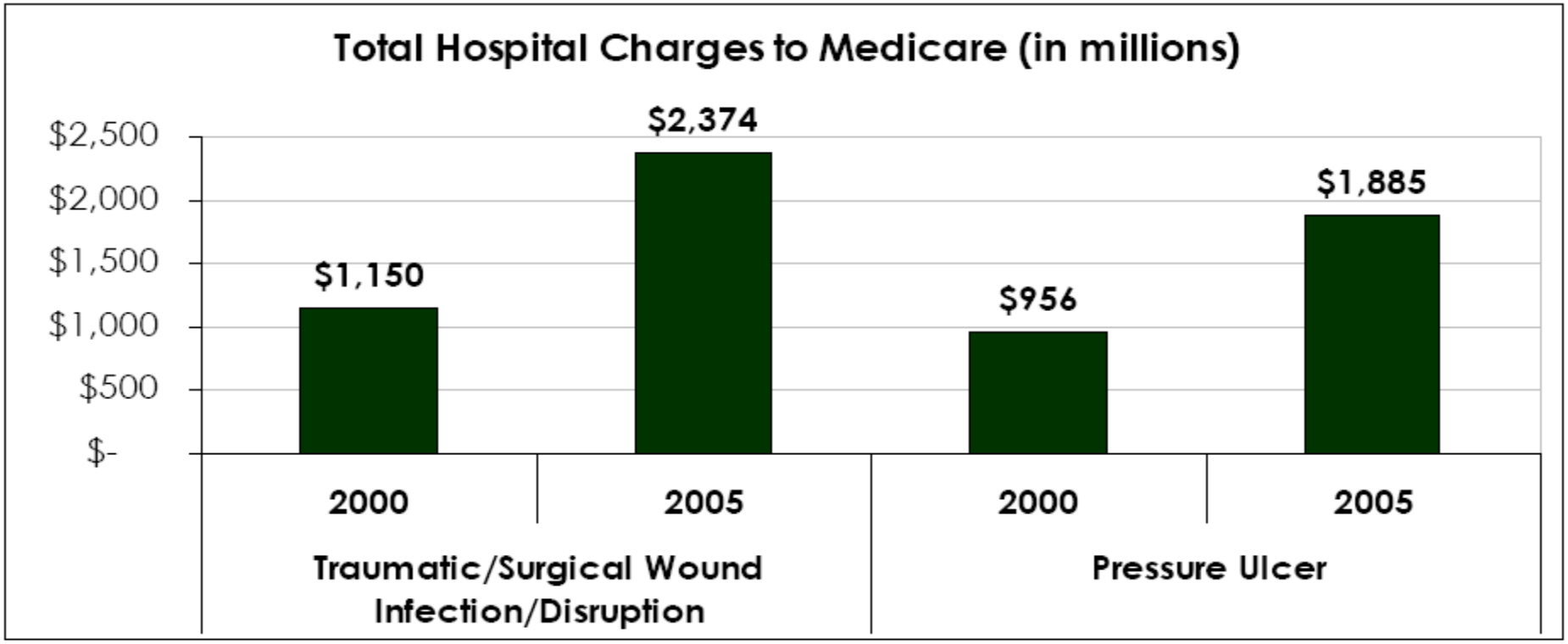
Nonhealing wounds

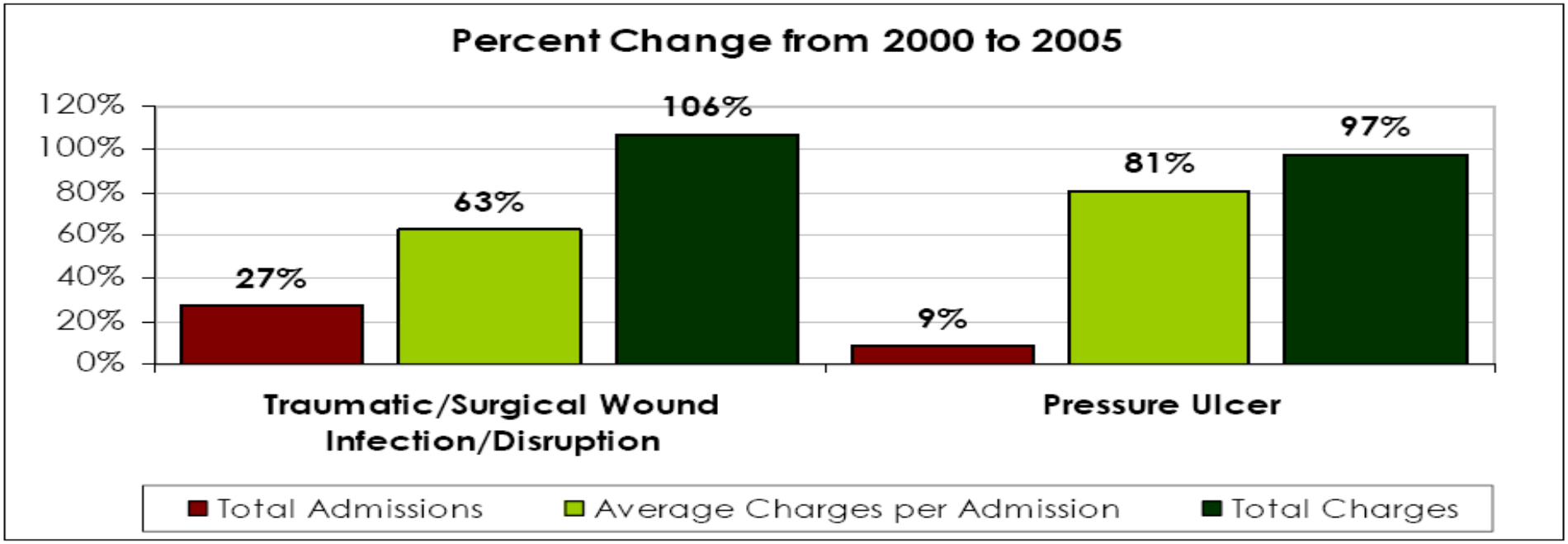
Dr. Kevin Y. Woo PhD RN FAPWCA

Objectives

- Define non-healing wounds
- Appraise factors that stall wound healing
- Determine appropriate approaches to non-healing wounds
- Think and share

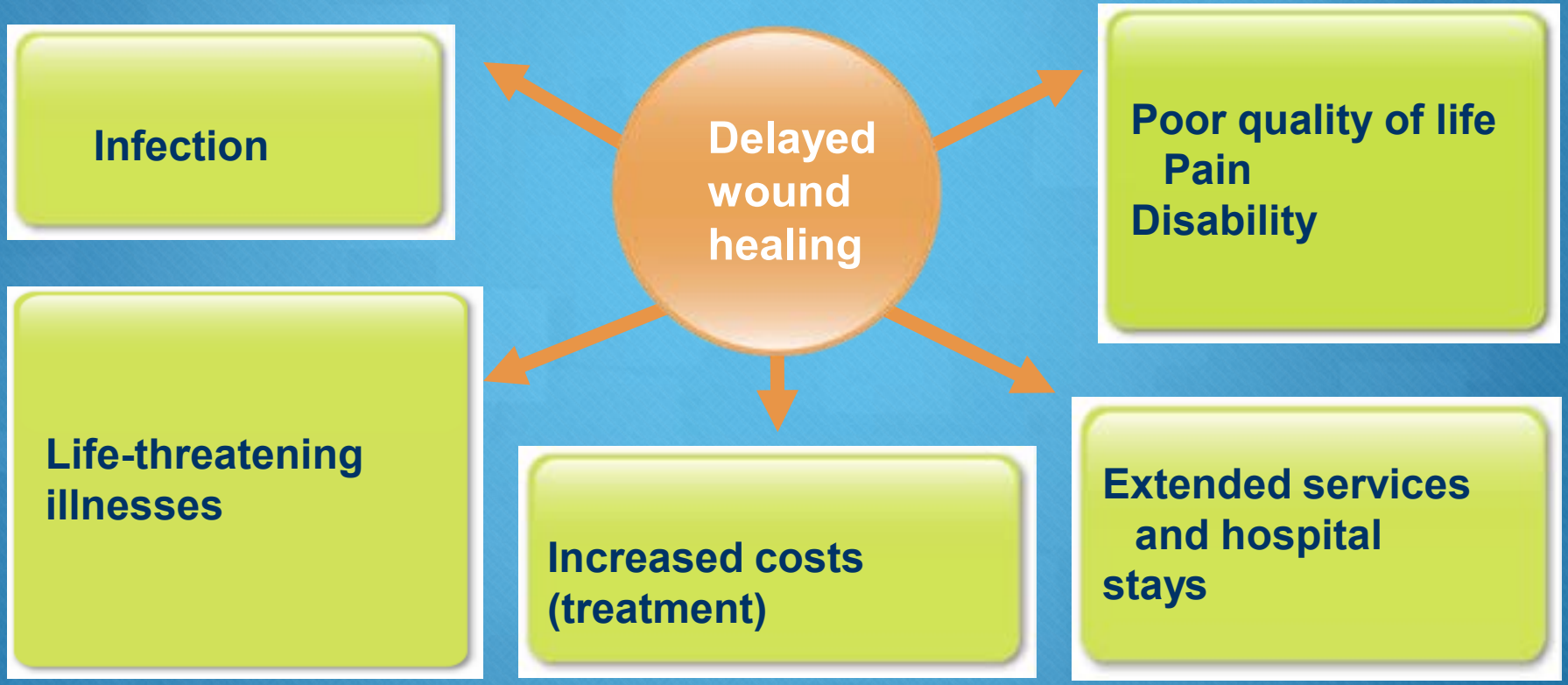
Many faces of chronic wounds


Total Hospital Charges to Medicare (in millions)
$2,500
$2,000
$1,500
$1,000
$500
$-
$1,150
$2,374
$956
$1,885
2000
2005
2000
2005
Traumatic/Surgical Wound Infection/Disruption
Pressure Ulcer


Percent Change from 2000 to 2005
120%
100%
80%
60%
40%
20%
0%
27%
63%
106%
9%
81%
97%
Traumatic/Surgical Wound Infection/Disruption
Pressure Ulcer
Total Admissions
Average Charges per Admission
Total Charges

Chronic non-healing wounds constitute a significant burden for patients and healthcare systems[1]

1. White RJ, Cutting K, Kingsley A et al. Topical antimicrobials in the control of wound bioburden. *Ostomy Wound Manage.* 2006;52:26–58.



Predictors: Time to healing

- Venous Ulcers

	Compression
Michaels, 2009 (n=213)	67 days (54-80)
Tawflick & Sultan,2009 (n=83)	182 days
O'Meara (n=5RCTs; n=797)	94.5 days
Szewcyk, 2009 (n=112)	84 days
Milic, 2007 (n=138)	133 days (28-464)
AVERAGE	112 days (67-182) 16 weeks; 4 months

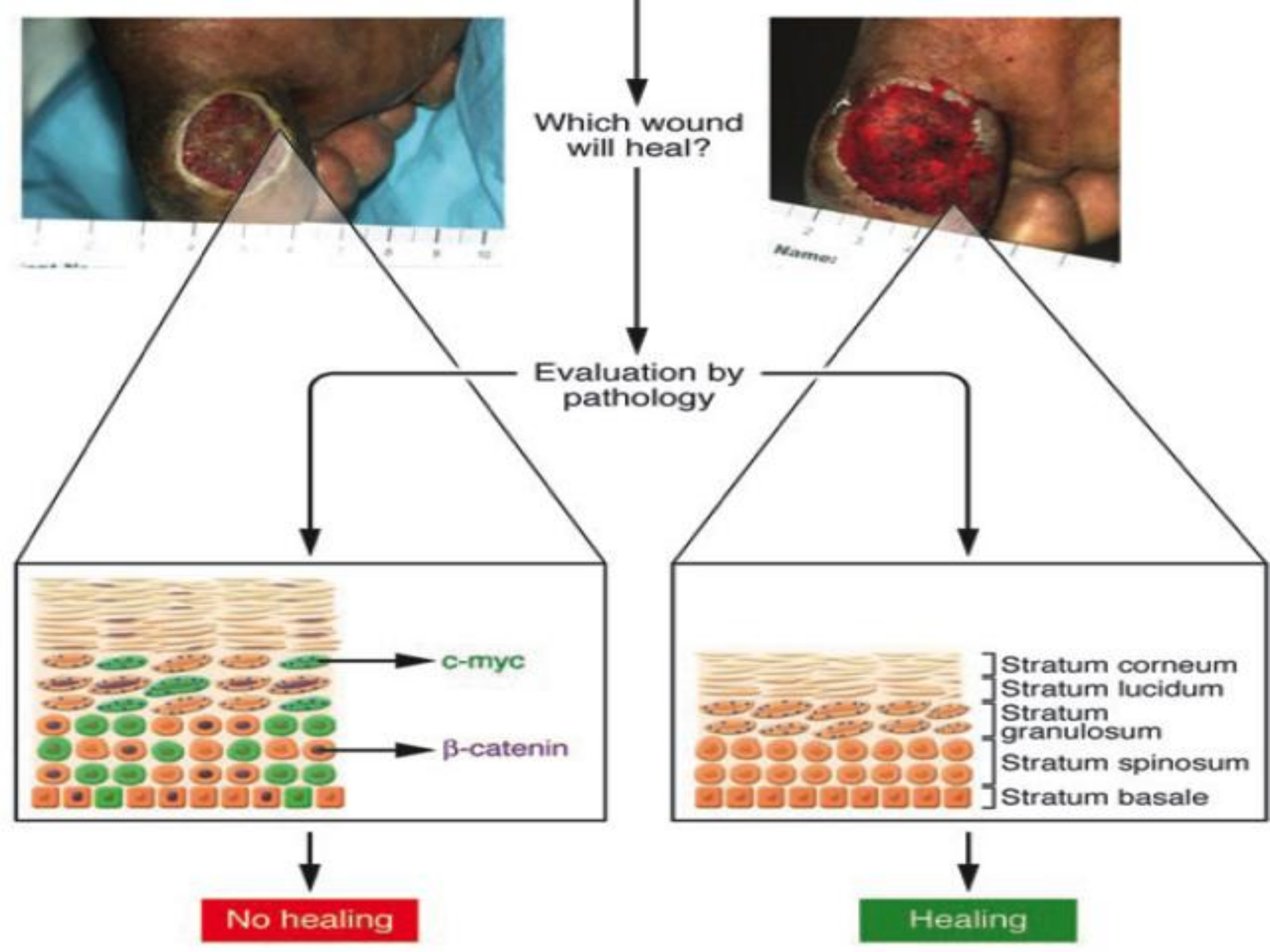
Predictors: Time to healing

- Diabetic Foot Ulcers

	Gr. 2	Gr. 3	Gr. 4
Richard, 2008 infected n= 188	42 days (35-49)	98days (77-105)	140days (98-231)
Mars, 2008 (n=60)		82.7 ± 30.7 days	
Pirayjesh, 2007 (n=20)		126 days	
Moretti, 2009 (n=30)		82.2 days	
Edmonds, 2009 (n=74)		84 days	
Shukrimi et al., 2008 (n=80) Wagner Gr.2	15 days (9-36)		
AVERAGE	29 days		

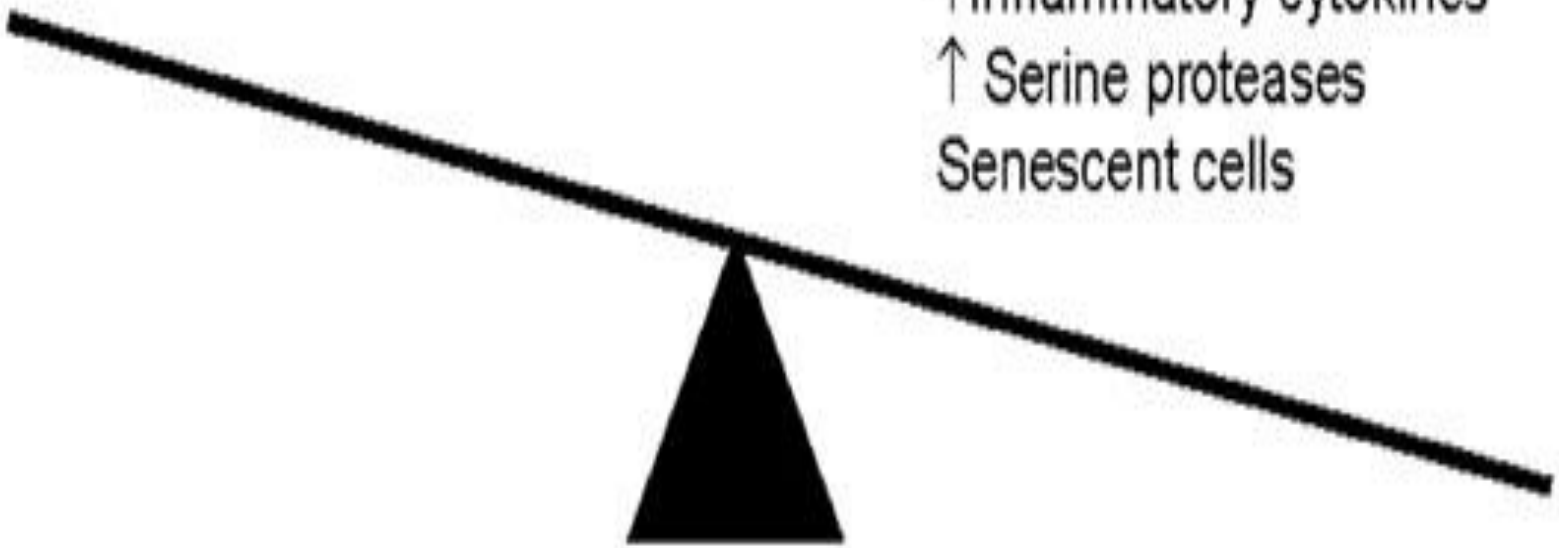
95 days (83-126)

13.6 weeks, 3.5 mos


Which wound will heal?
Evaluation by pathology
c-myc
β-catenin
Stratum corneum
Stratum lucidum
Stratum granulosum
Stratum spinosum
Stratum basale
No healing
Healing

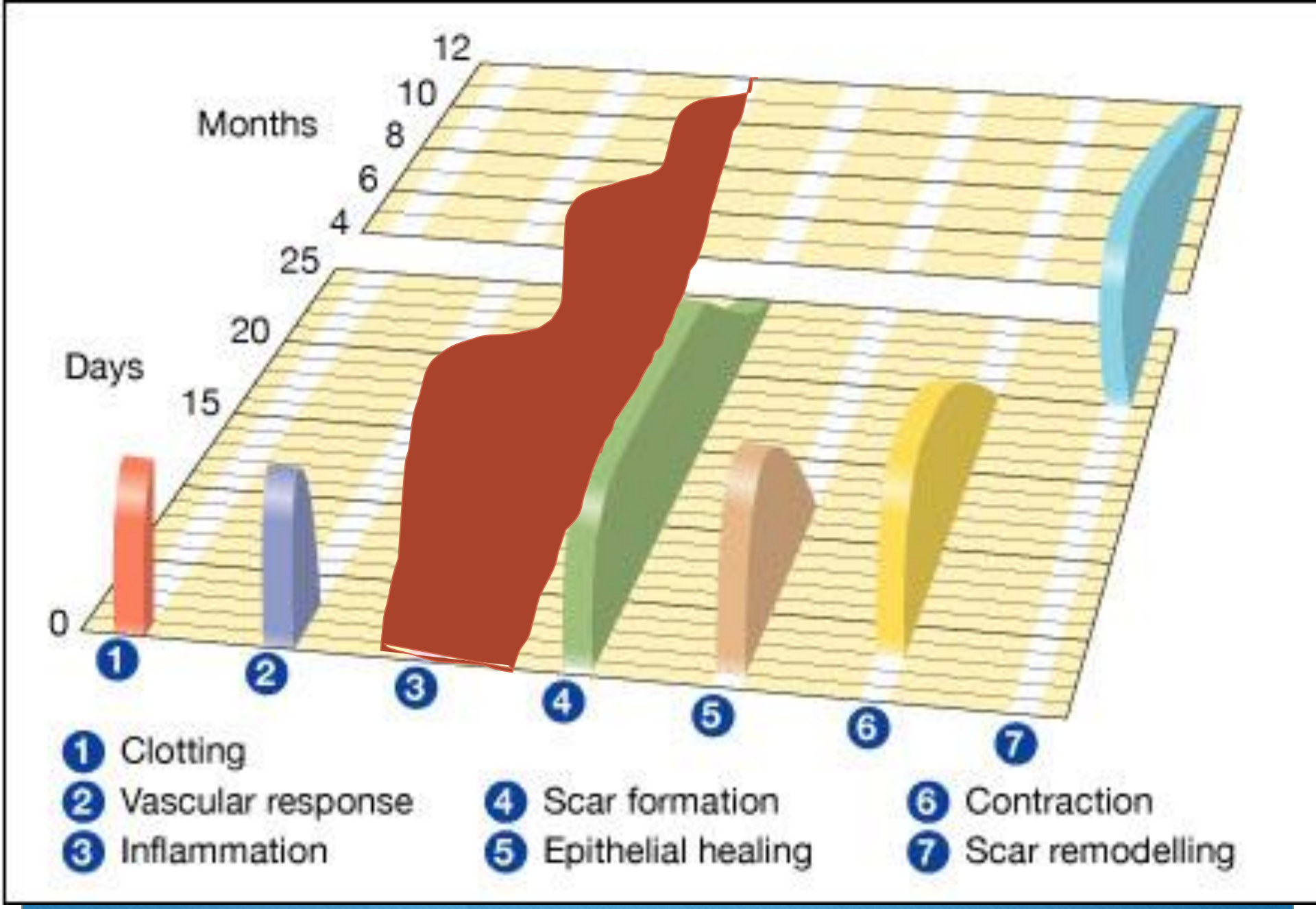
Healing Wounds:
↑ Mitogenic activity
↓Inflammatory cytokines
↓ Serine proteases
Mitotically competent cells

Chronic, non-healing wounds:
↓Mitogenic activity
↑Inflammatory cytokines
↑ Serine proteases
Senescent cells

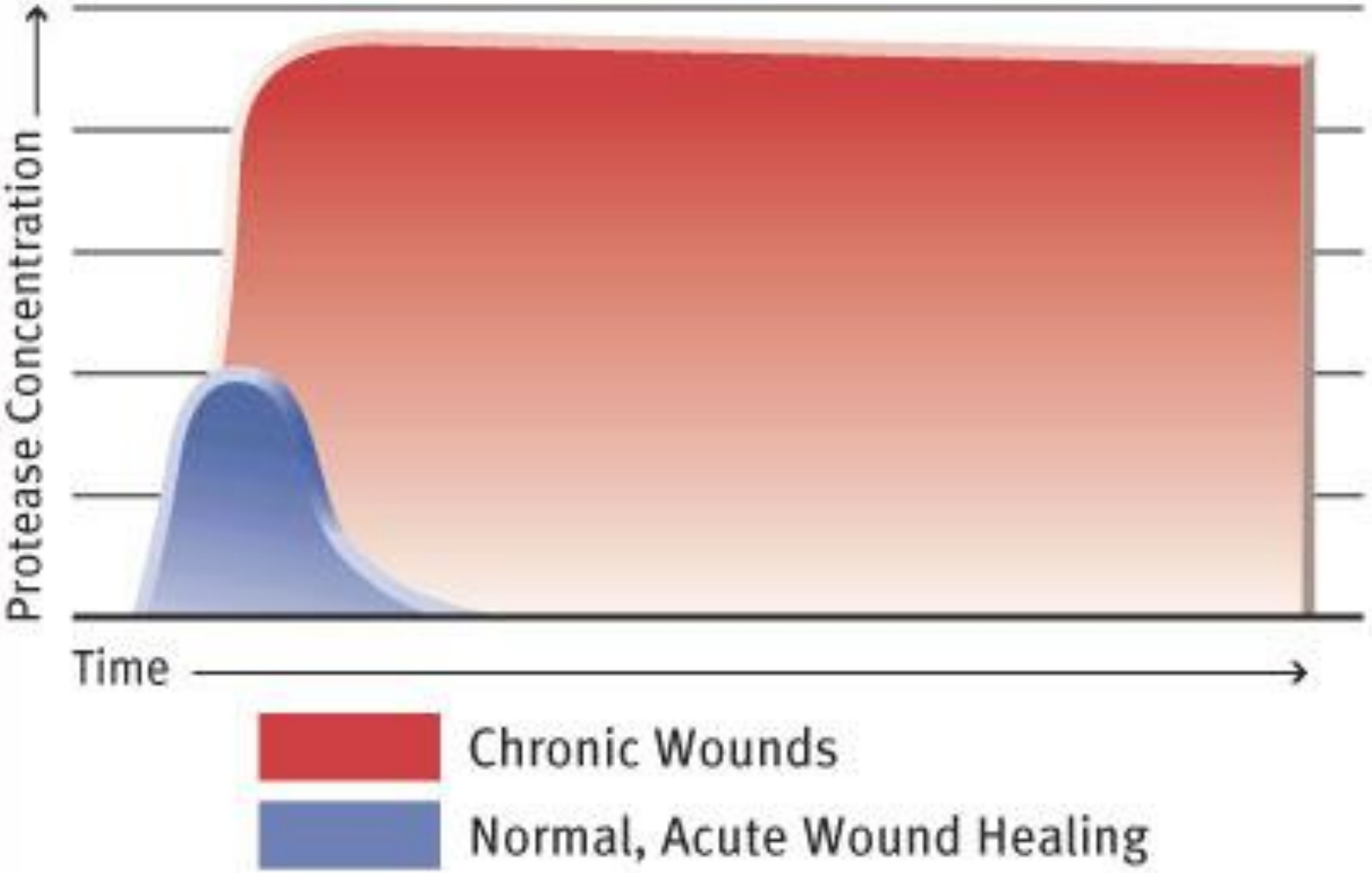


Wound bed preparation

Source: Wounds © 2003 Health Management Publications, Inc.


12
10
Months
8
6
4
25
20
Days
15
0
1
2
3
4
5
6
7
1 Clotting
2 Vascular response
3 Inflammation
4 Scar formation
5 Epithelial healing
6 Contraction
7 Scar remodelling

Protease Levels in Chronic and Normal Wounds



Should all wounds be considered healable?

What are the factors that define healability?

What are the factors that preclude healing

Which of the following wounds is not likely to heal?

A mixed arterial venous leg ulcer with ABI= 0.65

A stage 4 pressure ulcer with osteomyelitis

A diabetic foot ulcer without total contact cast

An ulcer related to pyoderma gangrenosum

Healable, Maintanance and Non-Healable Wounds

Most wounds can be segmented into three categories:

1) Healable Wounds

Healable:
Underlying cause can be corrected

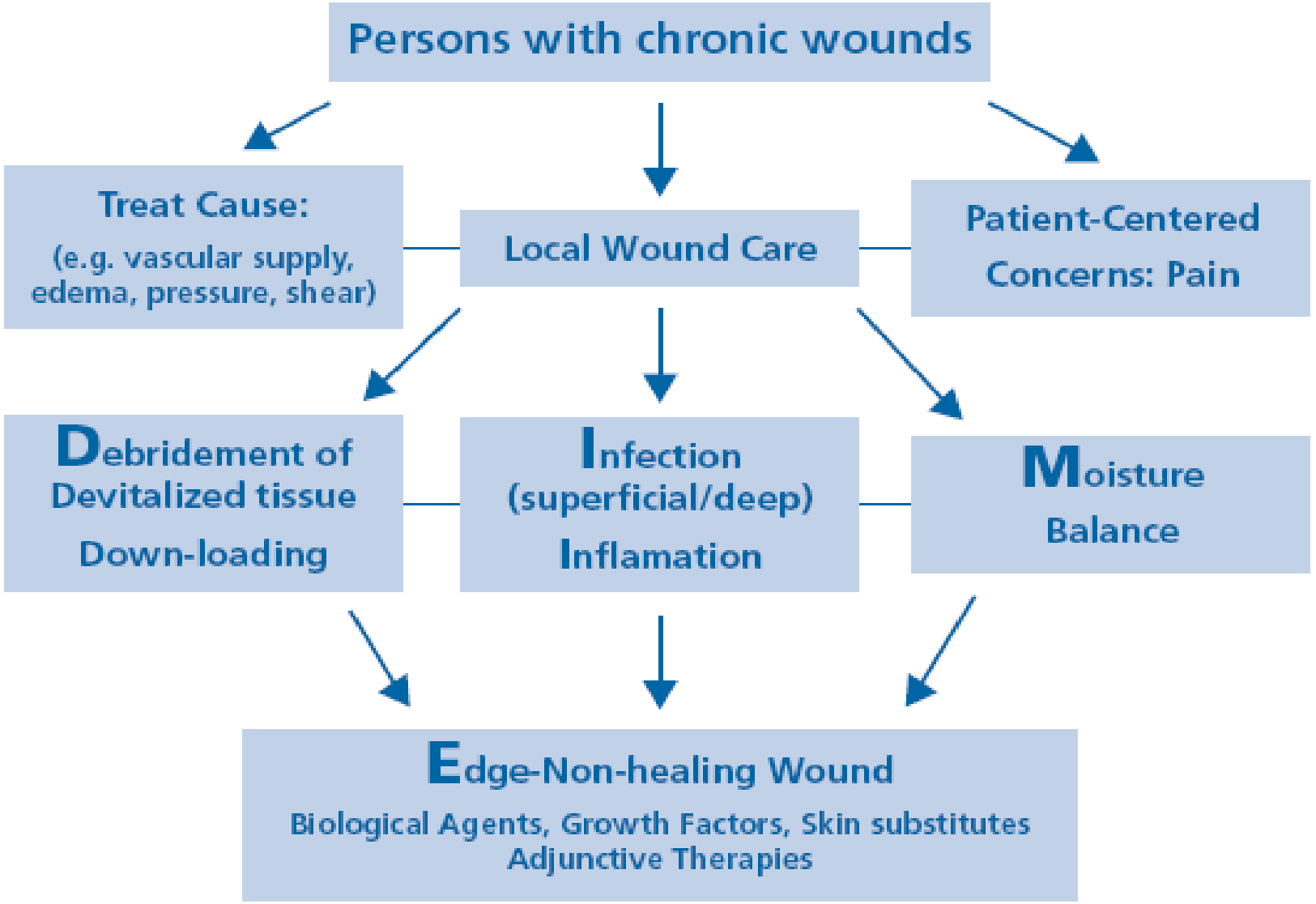
2) Maintenance Wounds

Maintenance:
The cause can be corrected - but lack of adherence or system resources

3) Non-Healable Wounds

Non-Healable:
Inadequate systemic or local factors for healing

Wound Bed Preparation Paradigm

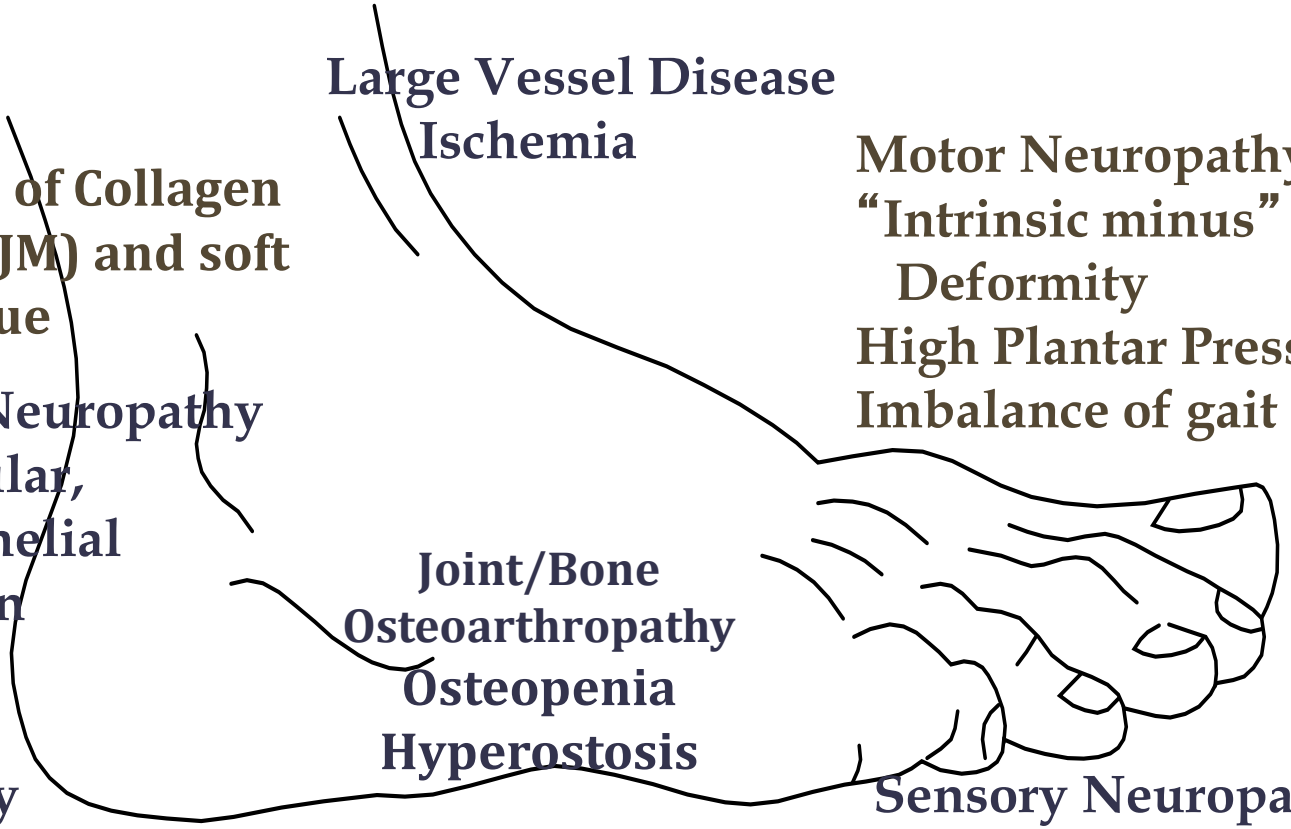


Chronic Ulcers	How to treat the cause?
Venous Leg Ulcers	• Compression bandages for healing • Compression stockings for maintenance • Compression for life
Pressure Ulcers	•Relief, & redistribute pressure •Activity and increase Immobility •Incontinence & moisture care •Shear and friction reduction •Eating & Optimize nutrition
Diabetic Foot Ulcers	•Vascular supply adequate •Infection control •Plantar Pressure redistribution

FOOT ULCERS (DIABETES)

- 2–3% PWD develop a foot ulcer/ year
- 25% lifetime risk of developing a foot ulcer
- Cost of diabetic foot ulcers (not requiring amputation): US$993 to US$17 519 (1998)
- Foot ulcers precede 84 percent of all non-traumatic lower limb amputations in PWD
- Diabetic associated lower-extremity ulcers are responsible for 92,000 amputations annually (USA)

Multifactoral Etiology

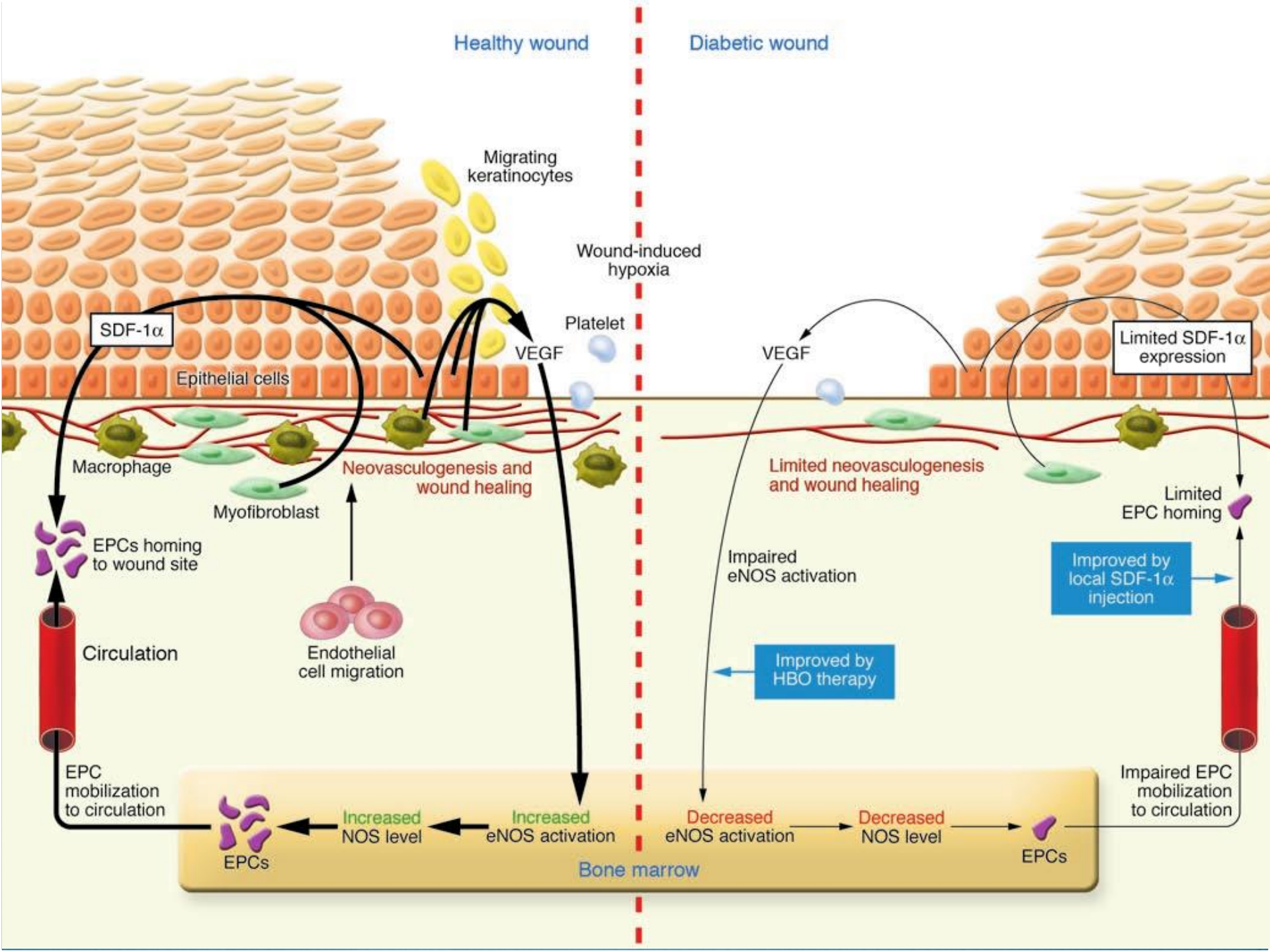


Slide Courtesy of Dr. Jane Fore

DeFronzo RA, Reasner C, The Diabetes Control and Complications Trial Study: Implications for the diabetic foot, J Foot Ankle Surg, 10=994;33:551-556.

LoGerfo FW, Gibbons GW, Vascular disease of the lower extremities in diabetes mellitus, Endocrinol Metab Clin North Am, 1996;25:439-445.

Rosenbloom AL, Silverstein JH, Connective tissue and joint disease in diabetes Mellitus, Endo and Metab Clin, 1996;25:473-483.


Healthy wound
Diabetic wound
Migrating keratinocytes
Wound-induced hypoxia
SDF-1α
Platelet
VEGF
VEGF
Limited SDF-1α expression
Epithelial cells
Macrophage
Neovasculogenesis and wound healing
Limited neovasculogenesis and wound healing
Myofibroblast
Limited EPC homing
EPCs homing to wound site
Impaired eNOS activation
Improved by local SDF-1α injection
Circulation
Endothelial cell migration
Improved by HBO therapy
EPC mobilization to circulation
Impaired EPC mobilization to circulation
EPCs
Increased NOS level
Increased eNOS activation
Decreased eNOS activation
Decreased NOS level
EPCs
Bone marrow

Oxidative stress

Enhanced aldose reductase activity

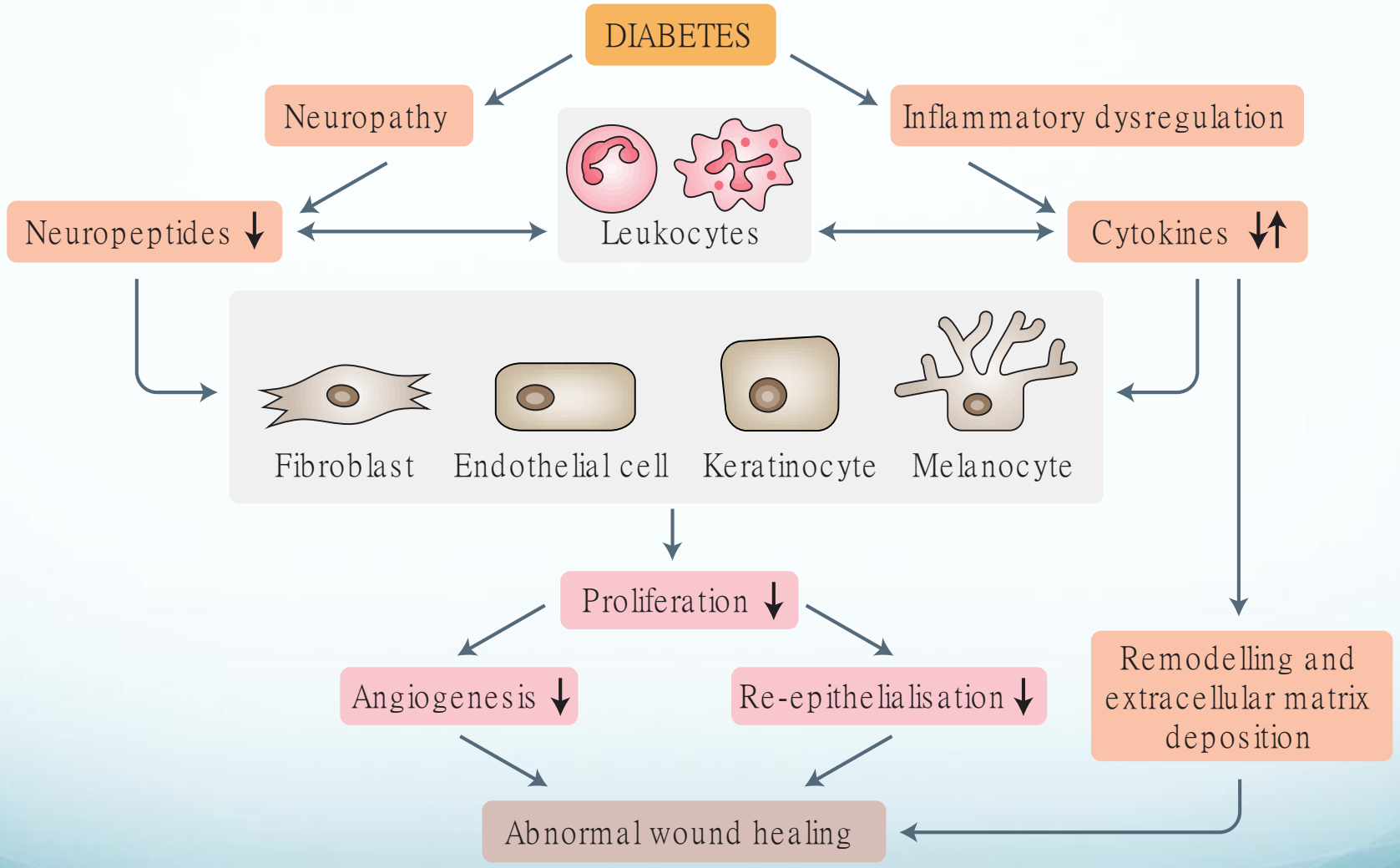
production of advanced glycation end-products (AGEs)

Protein kinase C (PKC) activity

Hex-osamine pathway flux

over-stimulation of polyol pathway

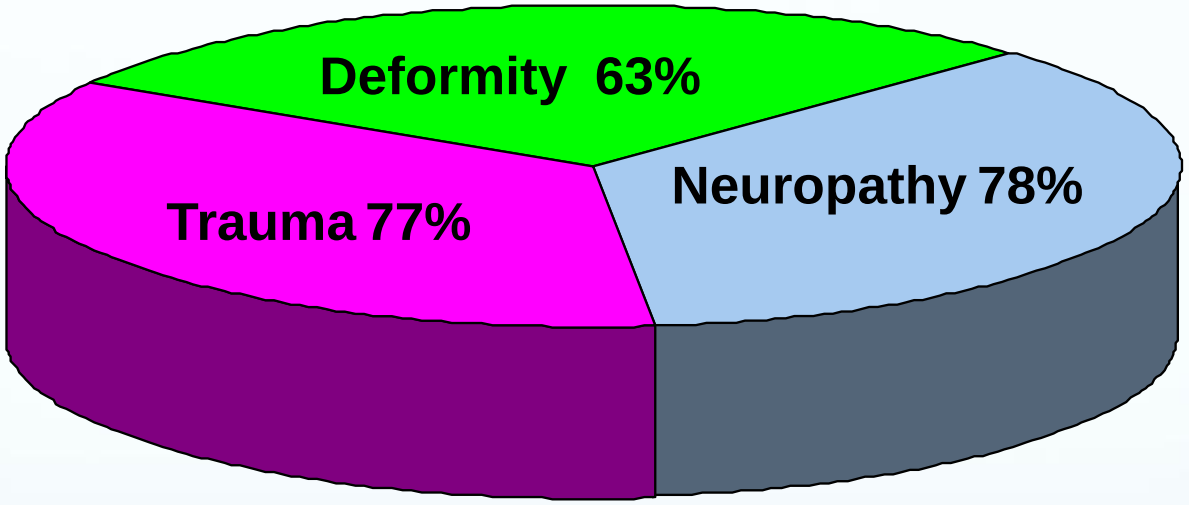
Depletion of NADPH affects the normal synthesis of key antioxidant reducing equivalents such as nitric oxide and reduced glutathione.



Effect of diabetic neuropathy and inflammatory dysregulation on wound healing

Expert Reviews in Molecular Medicine © 2009 Cambridge University Press

Causal Pathways to Ulceration



Critical Triad in >63% of causal pathways

From: Reiber et al: Diabetes Care 22:157-162, 1999

Causal Pathways Associated with Foot Ulcers in Diabetics

- Four consistent, dominant clusters
  - Neuropathy, deformity, callus and elevated peak pressure
  - Peripheral vascular disease
  - Penetrating trauma
  - Ill-fitting shoe gear.

Lawrence A Lavery, Edgar J G Peters and David G Armstrong What are the most effective interventions in preventing diabetic foot ulcers? Int Wound J **5**(3):425-33 (2008)

Factors Affecting Wound Healing

V= Vascular Supply

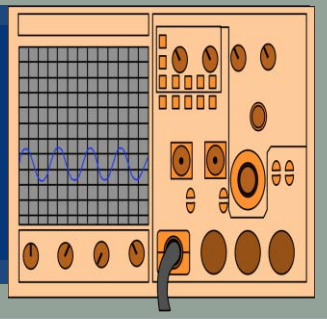
I= Infection

P= Pressure

S=sharp debridement

V= vascular supply

Vascular Supply and Healing Ability



Palpable pulse	>80 mm Hg
Ankle-brachial pressure index (ABPI)	>0.5 and <1.2
Transcutaneous O_2 tension	>30 mm Hg
Toe pressure	>50 mm Hg

I = infection

Which of the following condition indicates wound infection?

1. Wound culture with moderate growth
2. Elevated ESR and CRP
3. Increased exudate
4. Increased smell
5. Increased pain
6. Probe to bone

PAIN AND WOUND INFECTION

NERDS
Superficial:
Treat topically

- Non-healing
- Exudate
- Red + Bleeding
- Debris
- Smell

STONEES
Deep:
Treat Systemically

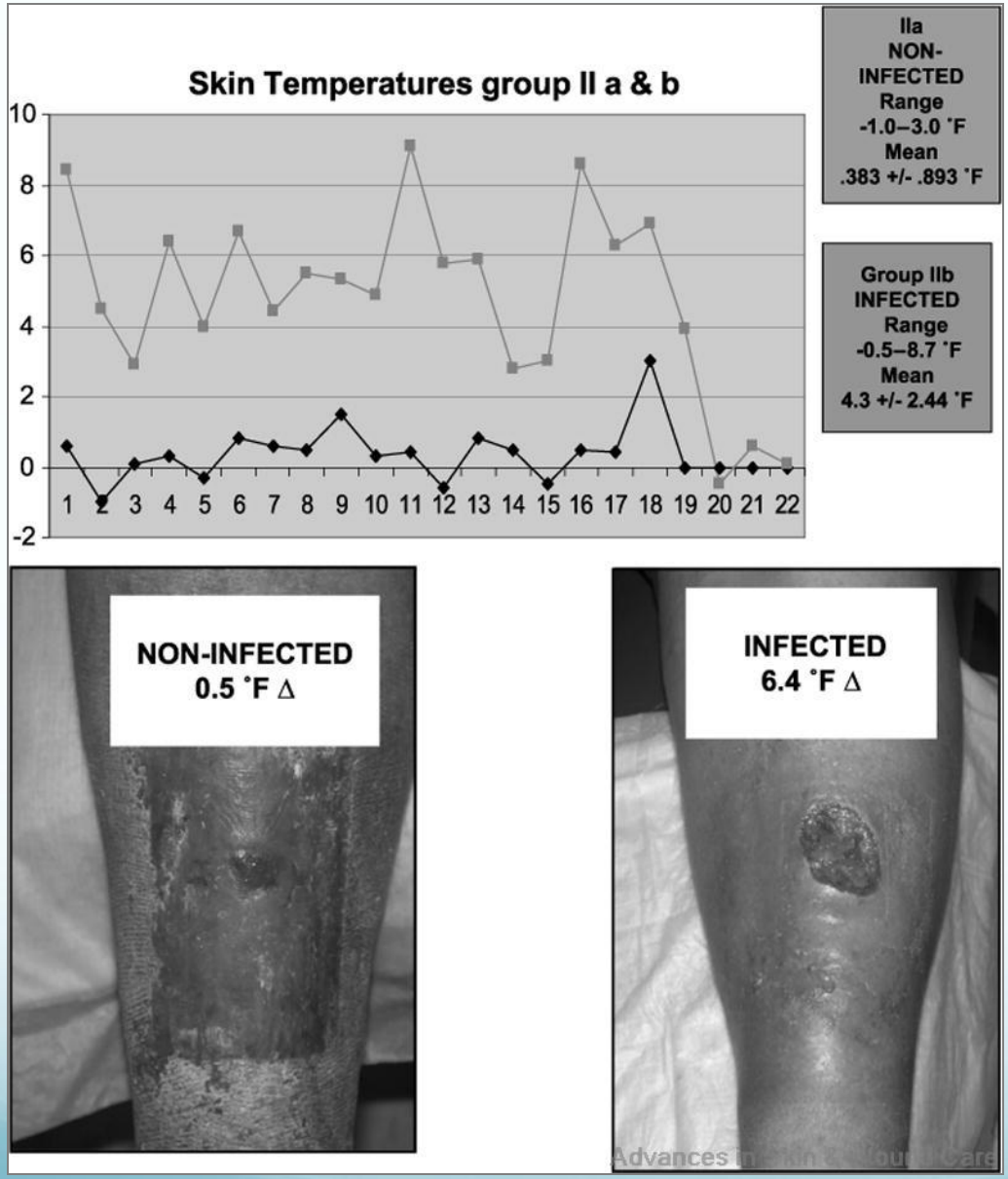
- Size is bigger
- Temperature ↑
- Os (probes, exposed)
- New breakdown
- Exudate,
- Erythema, Edema
- Smell

Speaker, Title, Hospital


Wound Ruler - Règle: taille de la plaie
SINGLE USE - À USAGE UNIQUE
PATIENT REFERENCE - IDENTIFICATION DU PATIENT:
DATE:
19-oct-05


H.K 31 RIM0001
Sept 4, 2006

Figure 11



[A Clinical Investigation into the Relationship between Increased Periwound Skin Temperature and Local Wound Infection in Patients with Chronic Leg Ulcers]

Fierheller, Marjorie; Sibbald, R. Gary

Advances in Skin & Wound Care.

NONINFECTED PERIWOUND SKIN TEMPERATUREOne-way analysis of variance between and within wounded noninfected and infected groups identified a significant relationship: F = 44.238, P = .000.

Wolters Kluwer Health | Lippincott Williams & Wilkins

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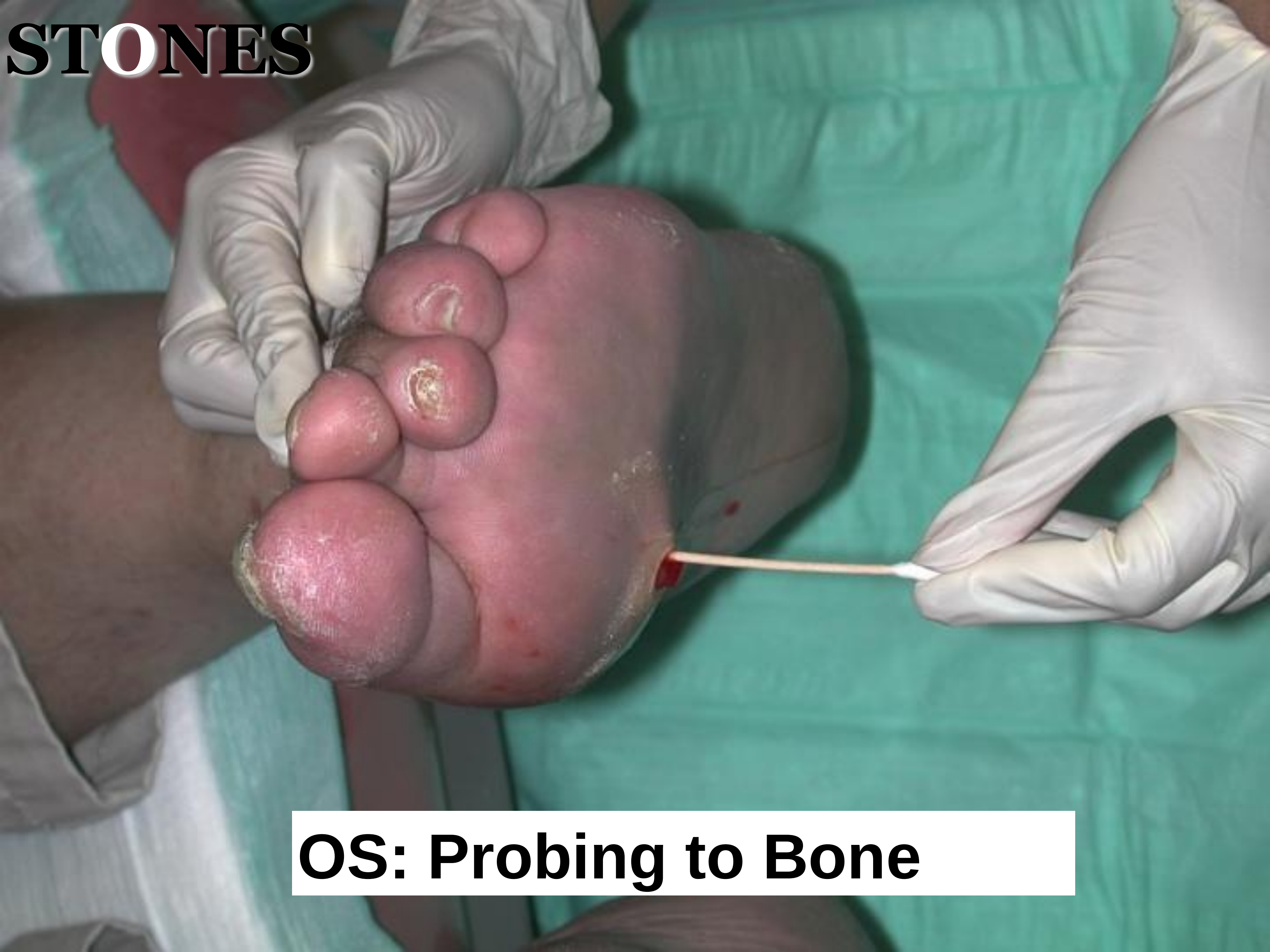


OS: Probing to Bone

Level	Bacterial status	Treatment profile
Surface	Contamination	Infection control
Superficial	Colonization Critical colonization	Topical antimicrobial DIM
Surrounding and deep	Infection	Systemic agents
Systemic	Sepsis	Parenteral therapy

Honey

Silver

PHMB

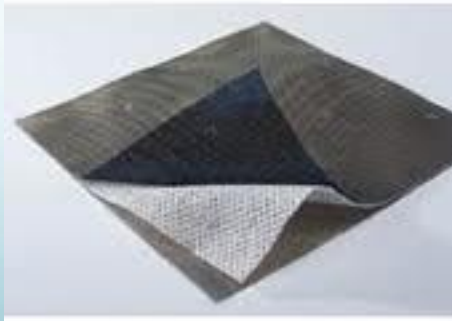
Fatty acid

Iodine

Gentian violet

Many faces of silver

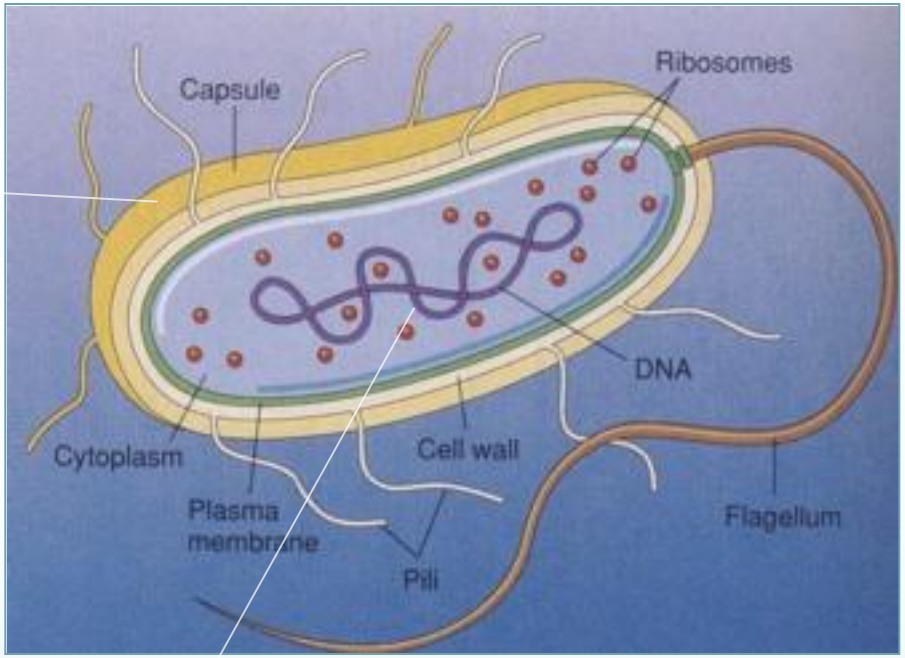
- Powder
- Gel
- Cloth
- Foam
- Alginate
- Hydrofiber
- In NPWT



Mode of action: Ag

1. Cell wall rupture

When Ag+ binds to proteins in the cell wall the wall fractures and the contents of the cell leak out, resulting in death of the bacterial cell.



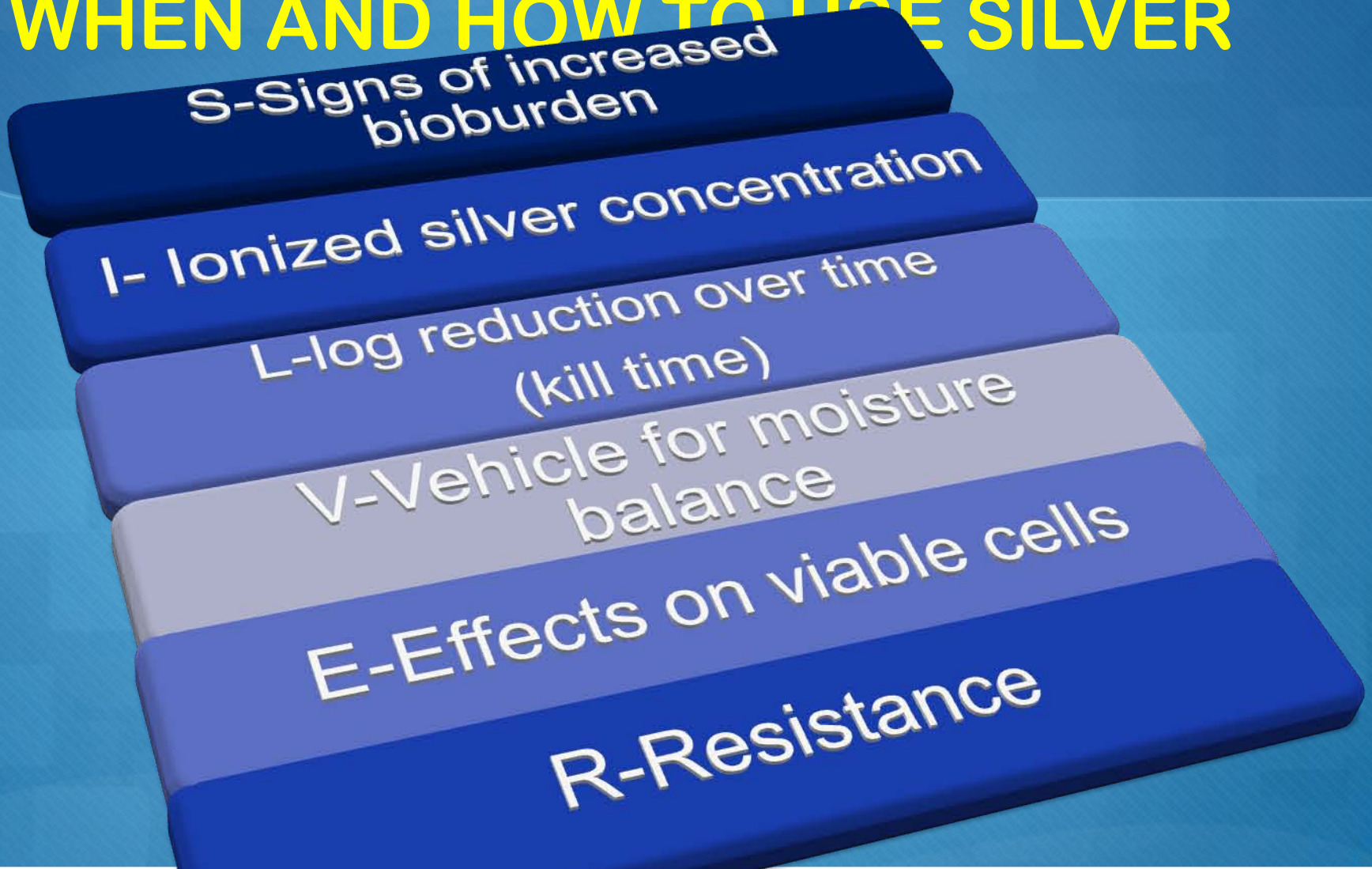
2. Preventing eating and breathing

Ag+ binds to bacterial enzymes, resulting in the inability of the bacterial cell to carry out processes necessary for respiration or to take in or process nutrients.

3. Disturbing replication

Ag+ also binds to bacterial cell DNA and interferes with cell division and the replication process

WHEN AND HOW TO USE SILVER



Meta-analysis of silver dressings

- Storm-Versloot et al: This review identified 26 trials (involving 2066 participants): insufficient evidence to support the benefits of silver on wound healing or prevent wound infection.
- Carter et al. : leg ulcers that were treated by silver dressings achieved significant wound size reduction compared to comparative treatments.
- Lo et al: Silver dressings improved wound healing, mitigate painful symptoms, reduce exudate and odour, enhanced dressing wear time

Honey Technology

- Antimicrobial effect is physical & chemical[1]
  - Very high osmotic pressure
  - Dehydration of organisms & inhibits microbial growth
  - main antibacterial component is hydrogen peroxide, formed in a slow-release by the enzyme glucose oxidase present in honey, which varies widely in potency

1.Source: *Mwipatayi BP* et al.Primary Intention. June 2004

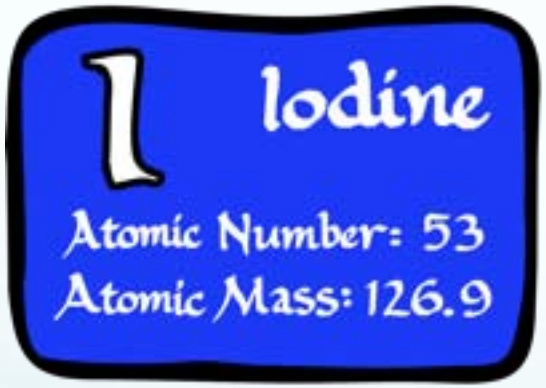
Honey

- Even at low concentration (4%) that emulates the actual wound environment, honey was effective against common pathogens.
- Hydrogen peroxide also activates the proteases to facilitate the debridement of sloughy and fibrinous materials in wounds.
- Gethin and Cowman: compared with hydrogel after 4 weeks of treatment (29% vs 43%).

BIOFILMS

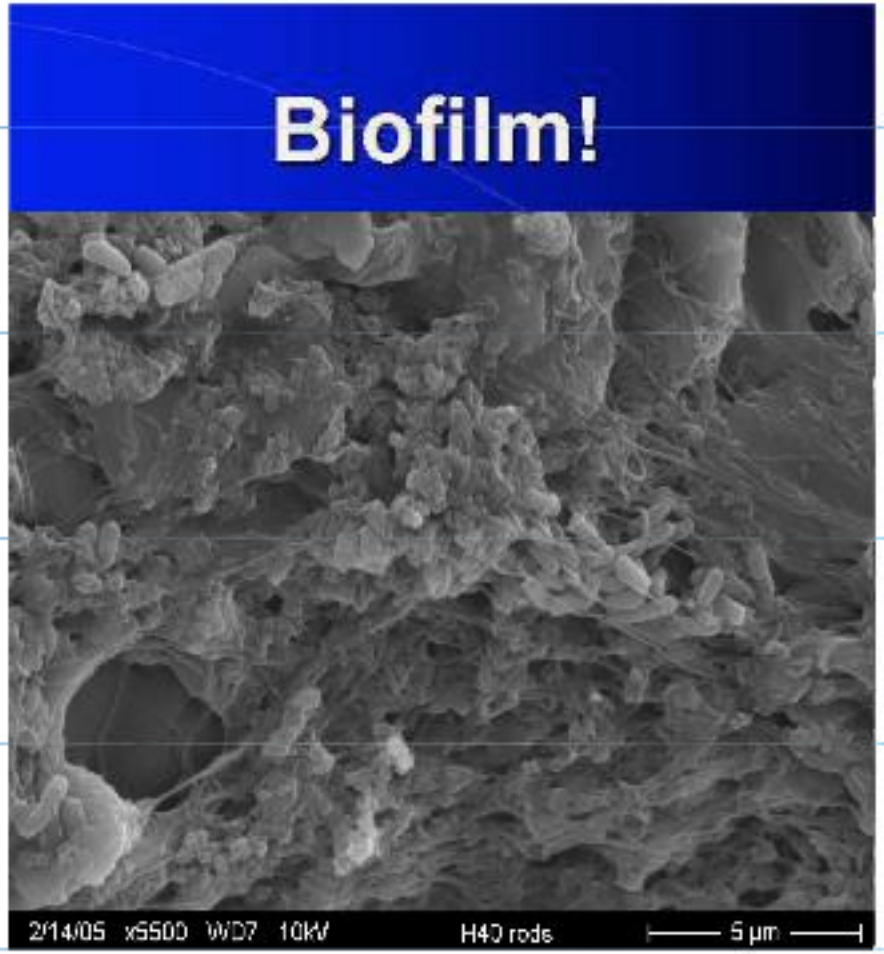
- Importance: 10-1000 times more resistant to antimicrobials
- Biofilms probably play a vital role in protecting bacteria from host defenses (phagocytosis)
- They create a protective barrier of external polysaccharide (difficult to penetrate)
- Biofilm-associated infections have been shown unresponsive to antibiotic therapy (slow growth).

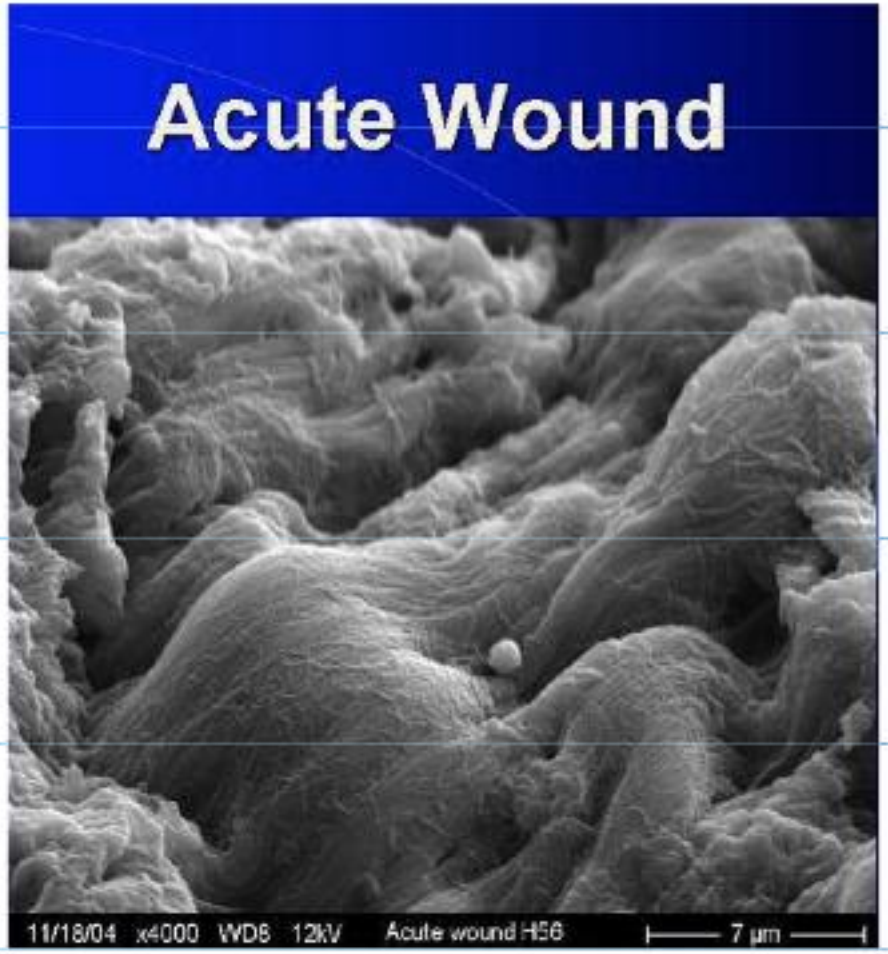
Povidone Iodine



- A systematic review was performed of 27 randomised clinical trials.
- Iodine did not lead to a reduction or prolongation of wound-healing time compared with other (antiseptic) wound dressings or agents.
- In individual trials, iodine was significantly superior to other antiseptic agents (such as silver sulfadiazine cream) and non-antiseptic dressings
- Adverse effects, including thyroid function derailment, did not occur more frequently with iodine.

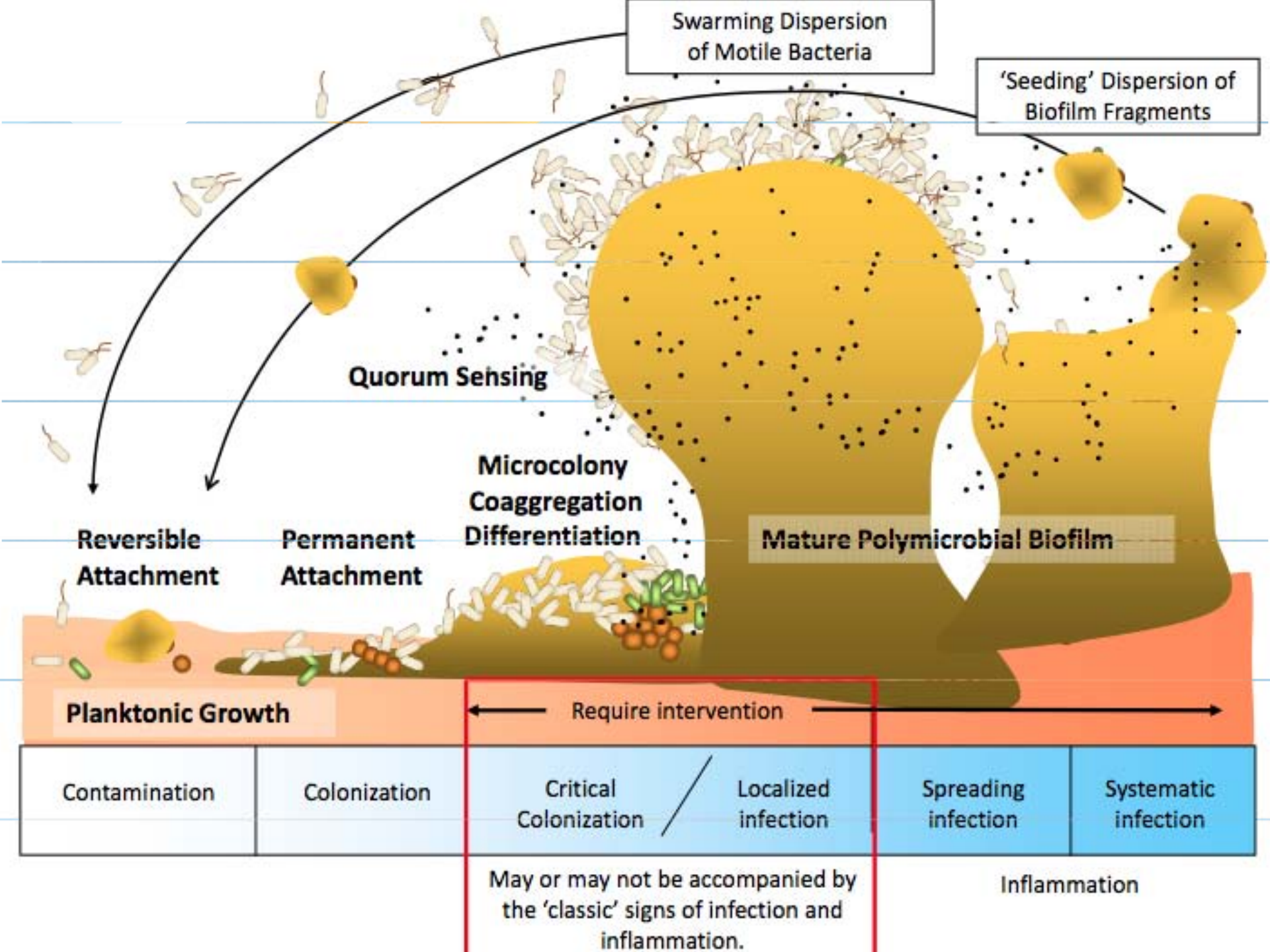
Biofilms Identified in 60% of Biopsies of Chronic Wounds but in Only 6% of Acute Wounds





Garth James et al, Wound Repair Regen, 2008

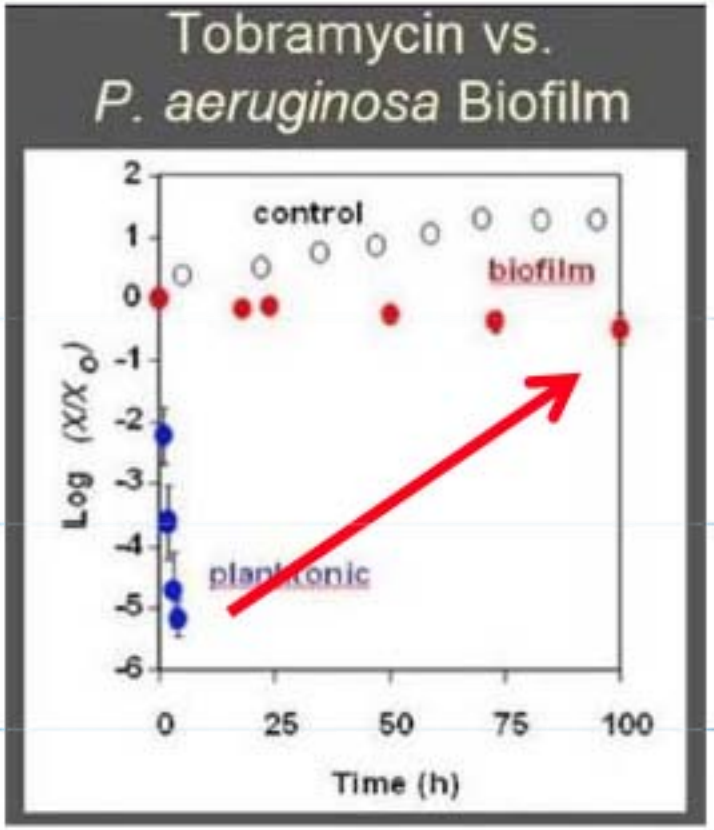
Photographs by Randy Wolcott


Swarming Dispersion of Motile Bacteria
'Seeding' Dispersion of Biofilm Fragments
Quorum Sensing
Microcolony
Coaggregation
Differentiation
Reversible Attachment
Permanent Attachment
Mature Polymicrobial Biofilm
Planktonic Growth
Require intervention
Contamination
Colonization
Critical Colonization
Localized infection
Spreading infection
Systematic infection
May or may not be accompanied by the 'classic' signs of infection and inflammation.
Inflammation

Biocides verses Biofilms
Bacteria are Hard to Kill in Biofilms

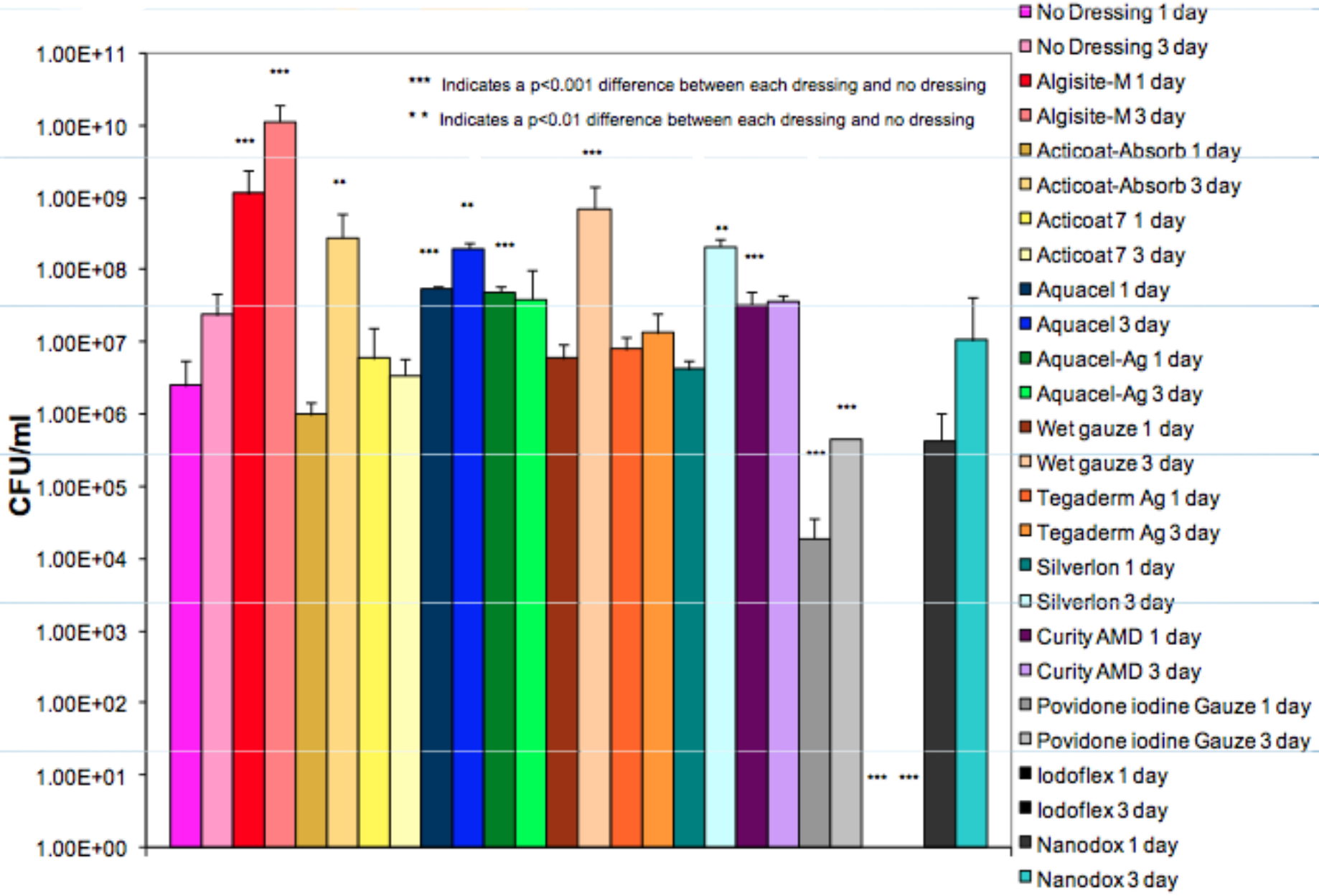
After 60 minutes of exposure to dilute bleach (Dakin's solution), many bacteria in this biofilm were dying (green cells), but many cells in the interior of the biofilm were still alive (orange cells)

Costerton, Sci Am, 2001



Tobramycin rapidly kills planktonic Pseudomonas aeruginosa (●) very effectively, but is not effective against biofilm Pseudomonas (●).

Antimicrobial Efficacy of Dressings on Mature Pseudomonas Biofilms after 1 & 3 Days of Exposure



P=Plantar pressure redistribution

NEUROPATHY: SAM

DIABETES DIAGNOSIS

symptomatic

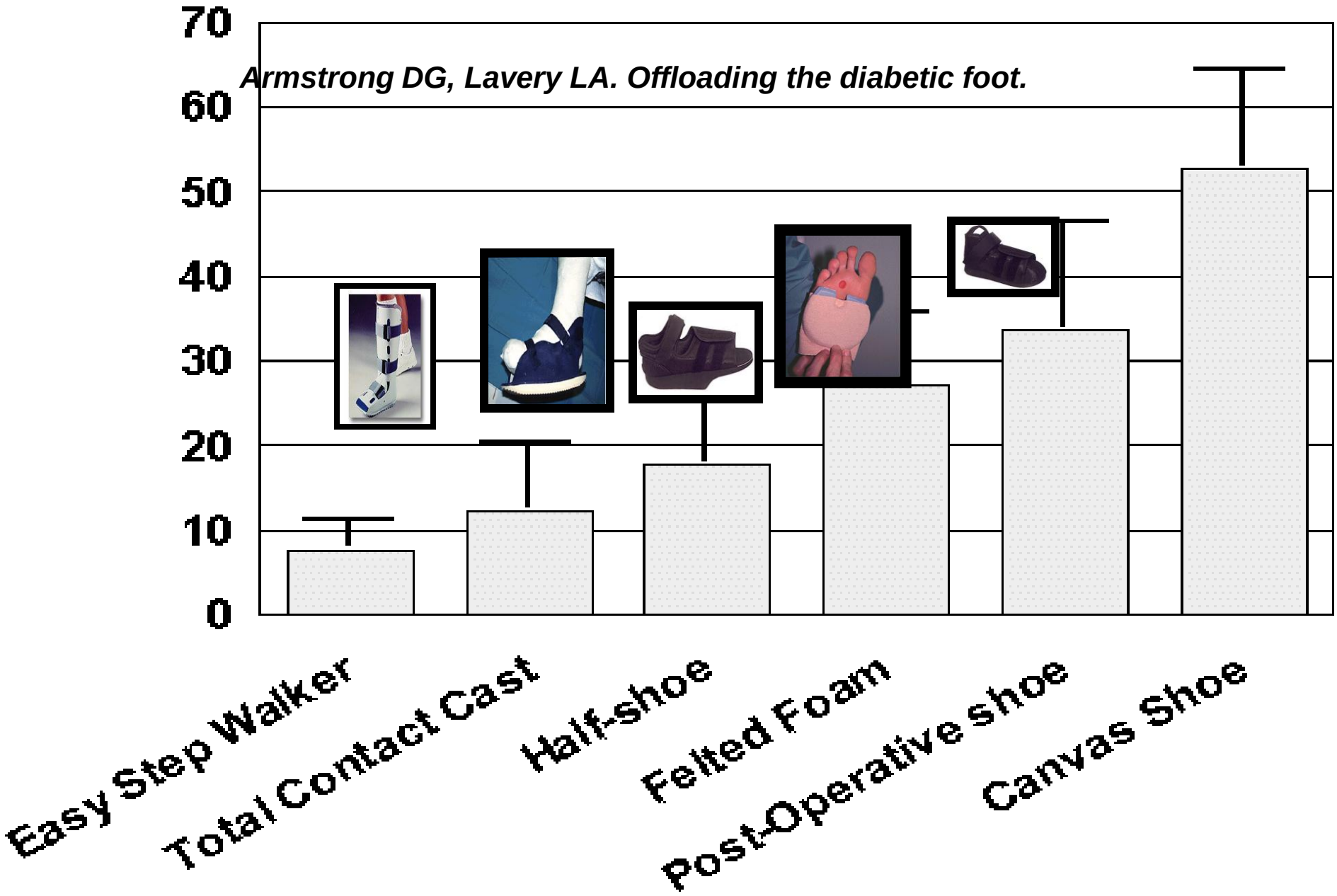
PRE-DIABETIC

asymptomatic

=/- SYMPTOMS

NERVE FIBER DENSITY

Time in years



Mean Peak Pressure Under the Metatarsal Heads

Transitional Approach to Tissue Protection

Open Wound

- TCC / Instant Total Contact Cast
- Wound Isolation TCC
- Football Dressing

Shallow Wound or Newly Closed

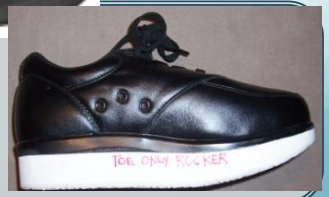
- Removable Cast Walkers
- Felted Foam

Newly Healed Wound

- Carville Healing Sandal
- Diabetic Healing Shoe

Closed Wound x 2-4 Weeks

- Depth Shoe with Rocker Sole



: Keeping Off- Loading Simple

Offloaing in India:

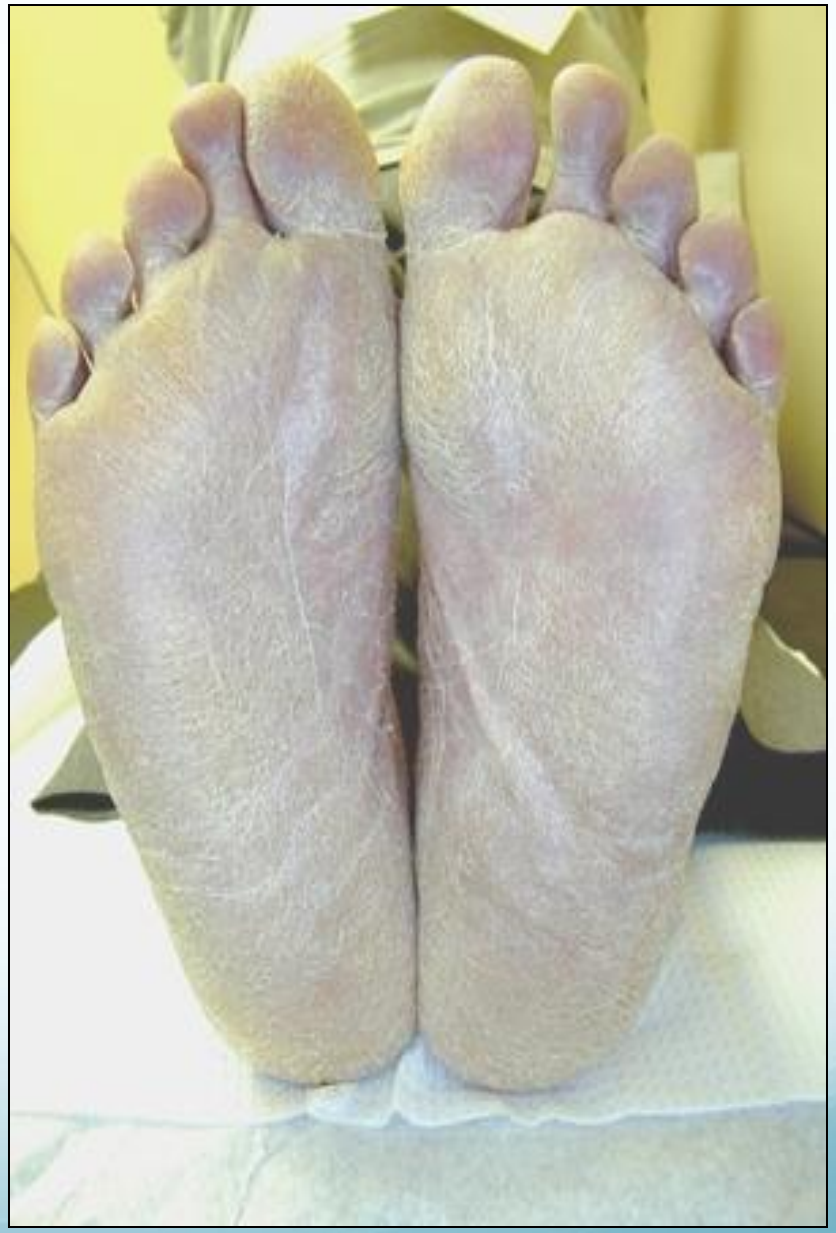
Shankhdhar et al

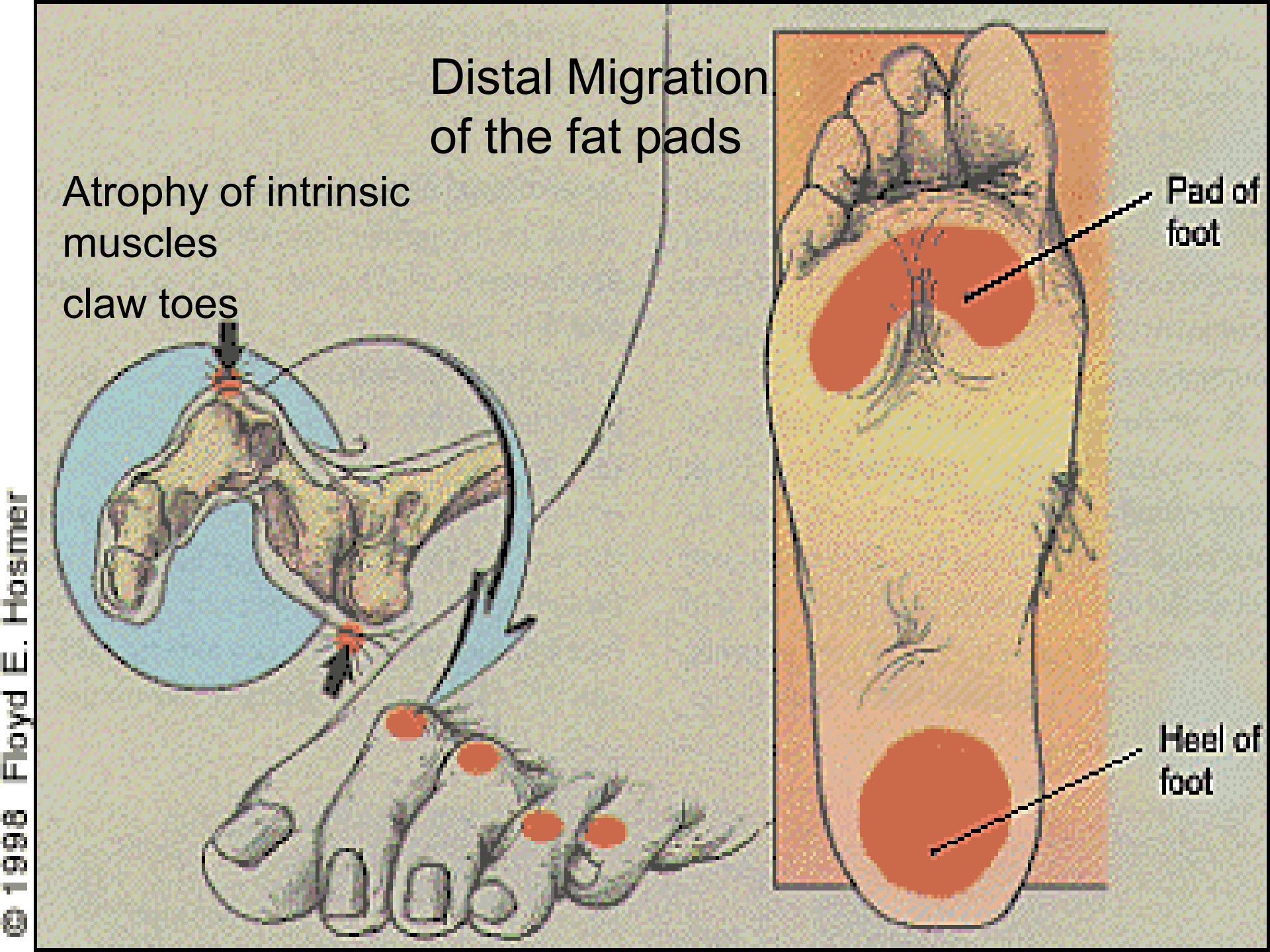
The simple device is made with a piece of foam, some adhesive, and a piece of an elastocrepe bandage.

Prevention- Context Specific Screening

0-15 SEC	Examine for callus, colour, toenails and structure
15 – 30 SEC	Palpate foot for pulse & Range of motion
30 – 60 SEC	Monofilament Test: Sensory intactness
ASK	Are your feet… Numb, tingling, burning, insects crawling?

Anhydrosis related to autonomic neuropathy





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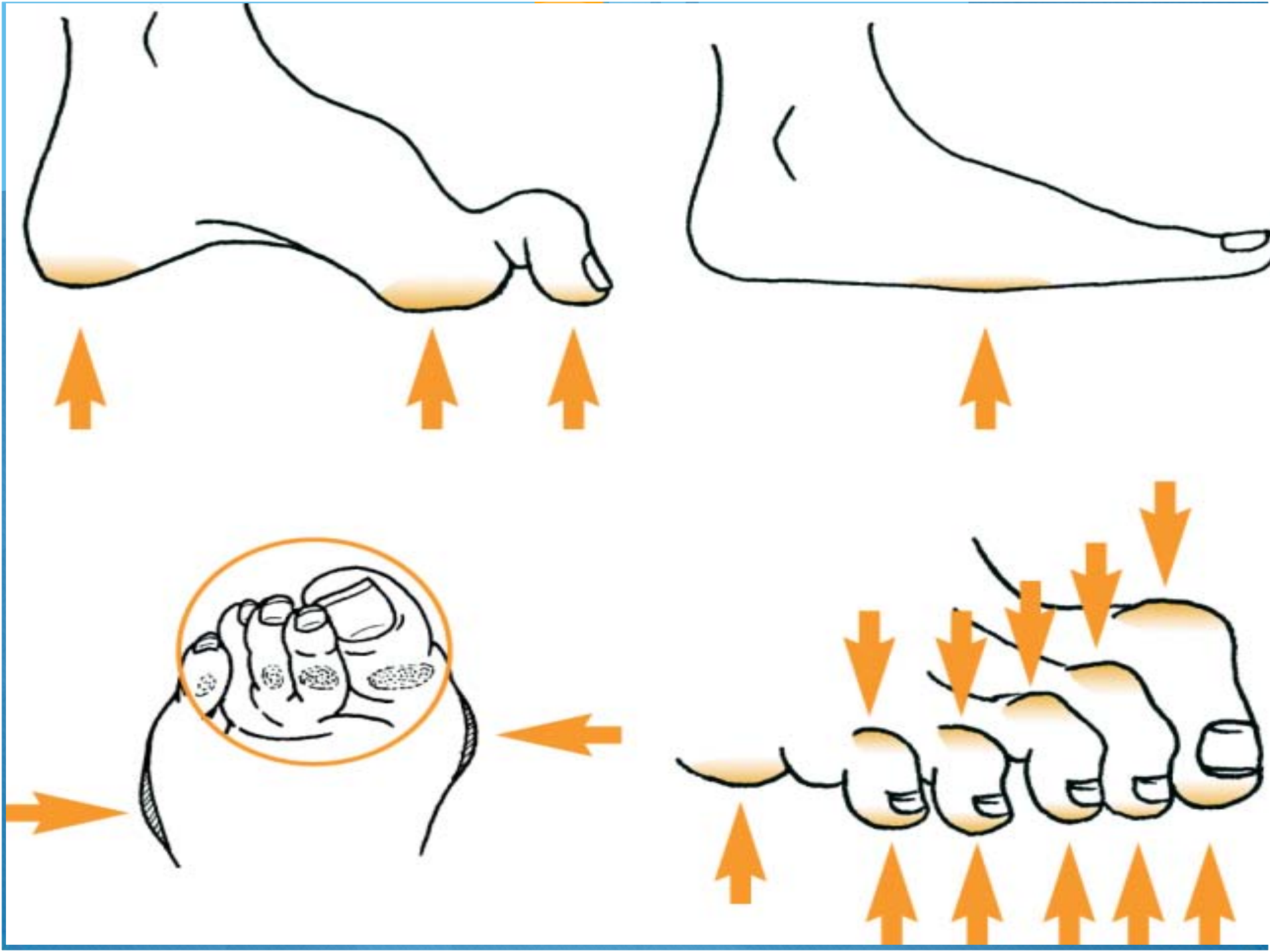


Structure

Digital deformity & high arches

Charcot – Collapse of midfoot

Foot Type-Lesion Patterns

Ankle Plantarflexion (Equinus) Deformity

Tinea:

Active margin, toe webs and nails

Sensation-
Monofilament Testing

10 Points

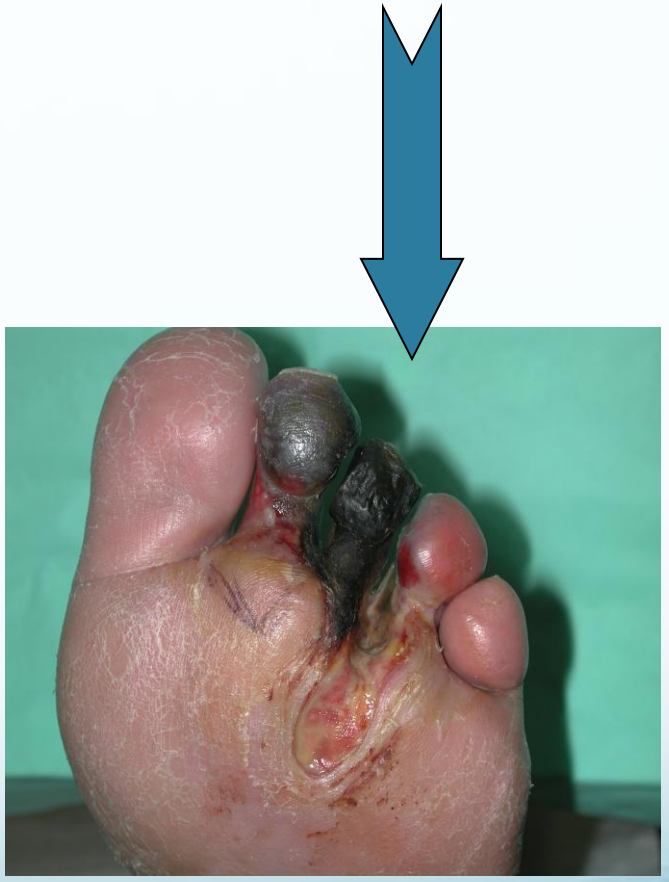
NEUROPATHY SCREENING

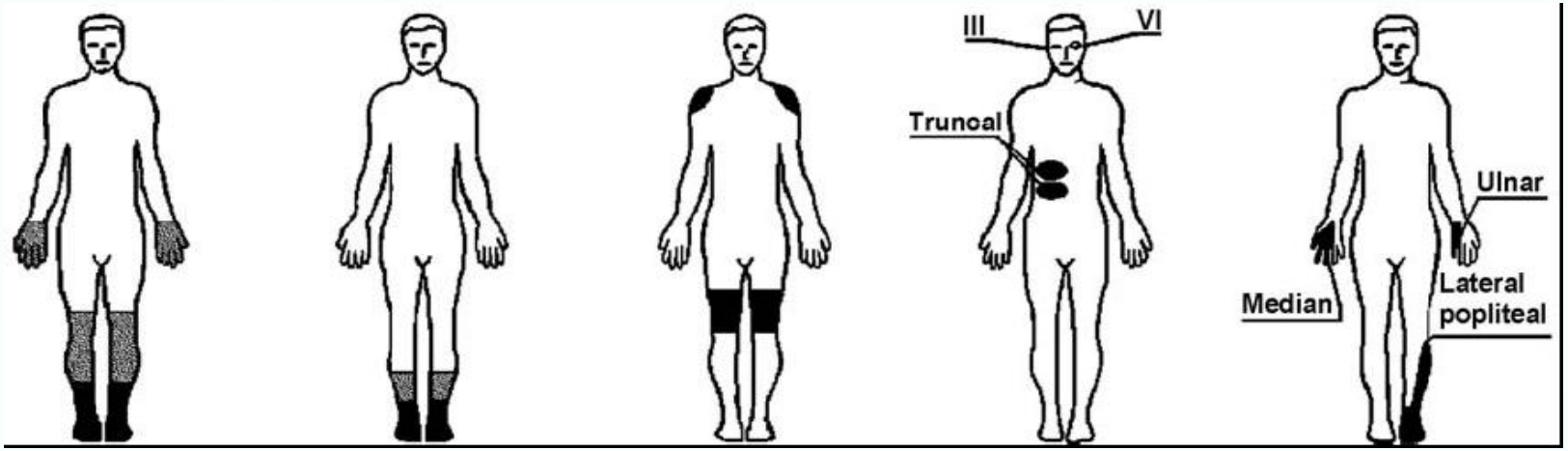
- 128-Hz TUNING FORK*
- PIN PRICK
- 10 GRAM FILAMENT*
- ANKLE REFLEXES
- > 87% SENSITIVITY

•PREDICTIVE OF FOOT ULCERATION

•BOULTON AJ, VINIK AL, ARREZO JC, BRIL V, FELDMAN EL, FREEMAN R, MALIK RA, MASER RE, SOSENKO JM, ZIEGLER D. DIABETIC NEUROPATHIES: A STATEMENT BY THE AMERICAN DIABETES ASSOCIATION. DIABETES CARE, 28; 2005

Check the pulse



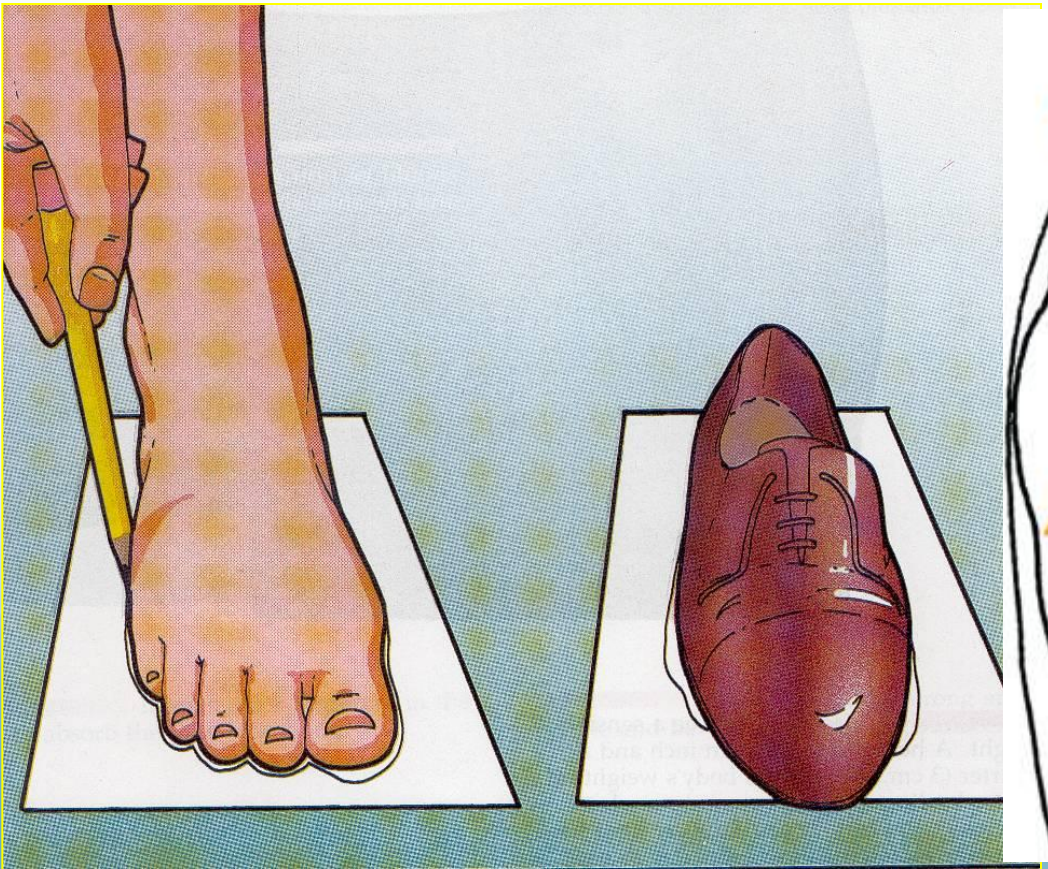


Large Fiber Neuropathy	Small Fiber Neuropathy	Proximal Motor Neuropathy	Acute mono Neuropathies	Pressure Palsies
Sensory Loss: 0 - 3+ (Touch, vibration) Pain:1 + - 3+ Tendon reflex:: N-3- Motor deficit:: 0-3+	Sensory Loss: 0-1+ (thermal, allodynia) Pain: 1+-3+ Tendon reflex:: N-1- Motor deficit:: 0	Sensory loss: 0-1+ Pain:1+-3+ Tendon reflex:: 2- Proximal Motor deficit: 1+-3+	Sensory loss: 0-1+ Pain: 1+-3+ Tendon reflex: N Motor deficit: 1+-3+	Sensory loss in Nerve distribution: 1+-3+ Pain: 1+-2+ Tendon reflex: N Motor deficit: 1+-3+

Vinik AJ, Mehrabyon A Medical Clinics of North America 2004:947-999.

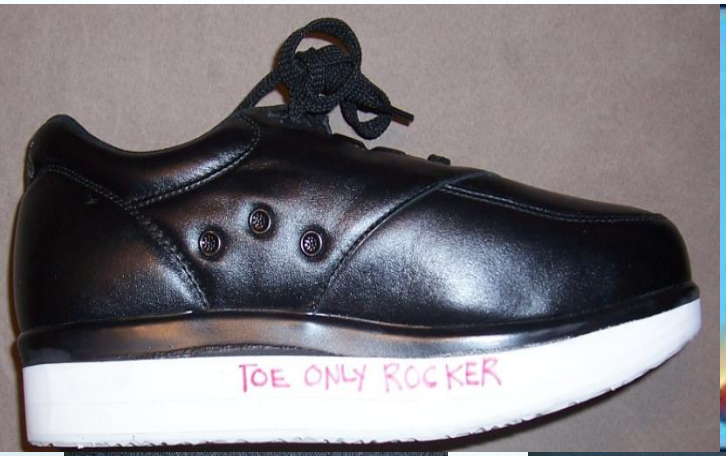
Choose appropriate footwear

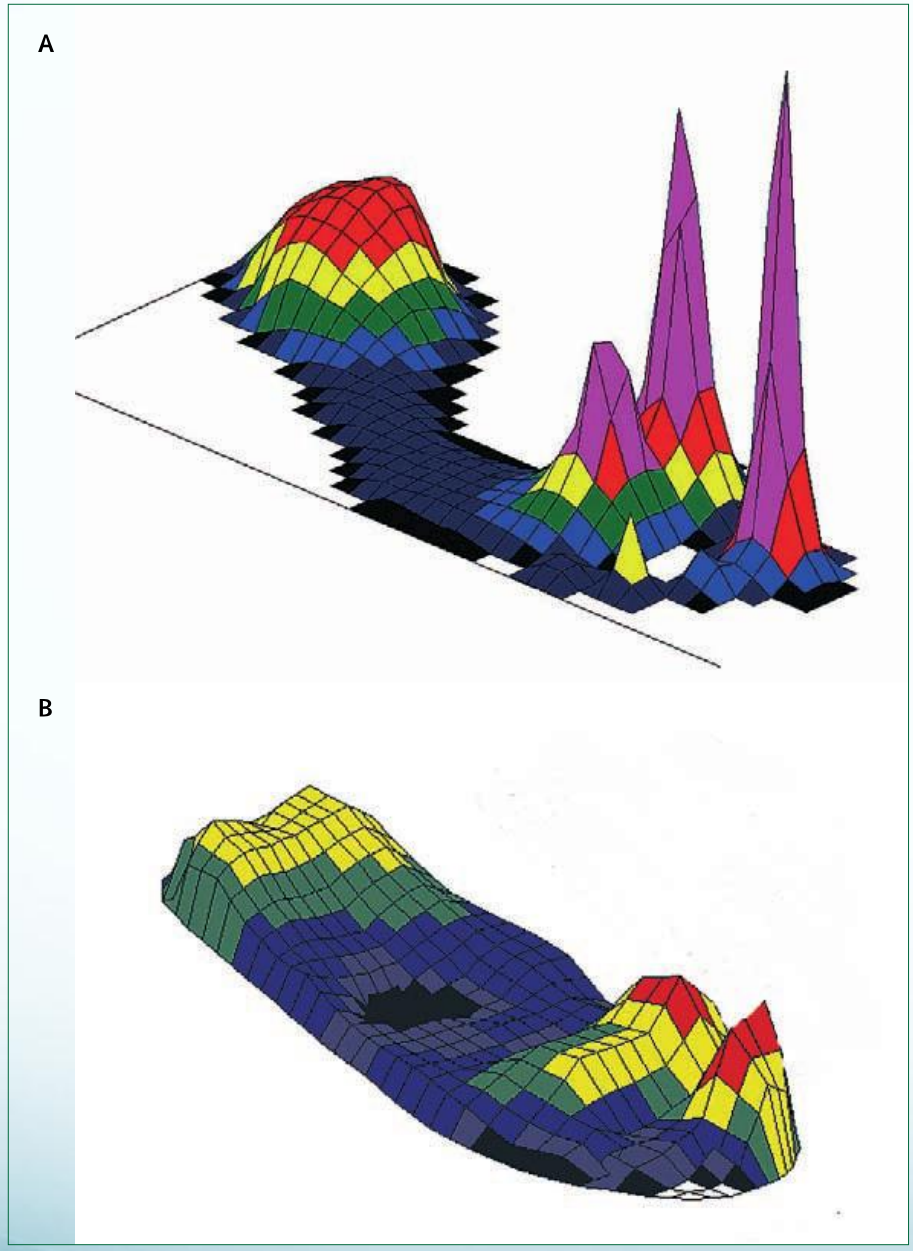
Clinical techniques to improve adherence



Adherence

Orthosis and shoe modification





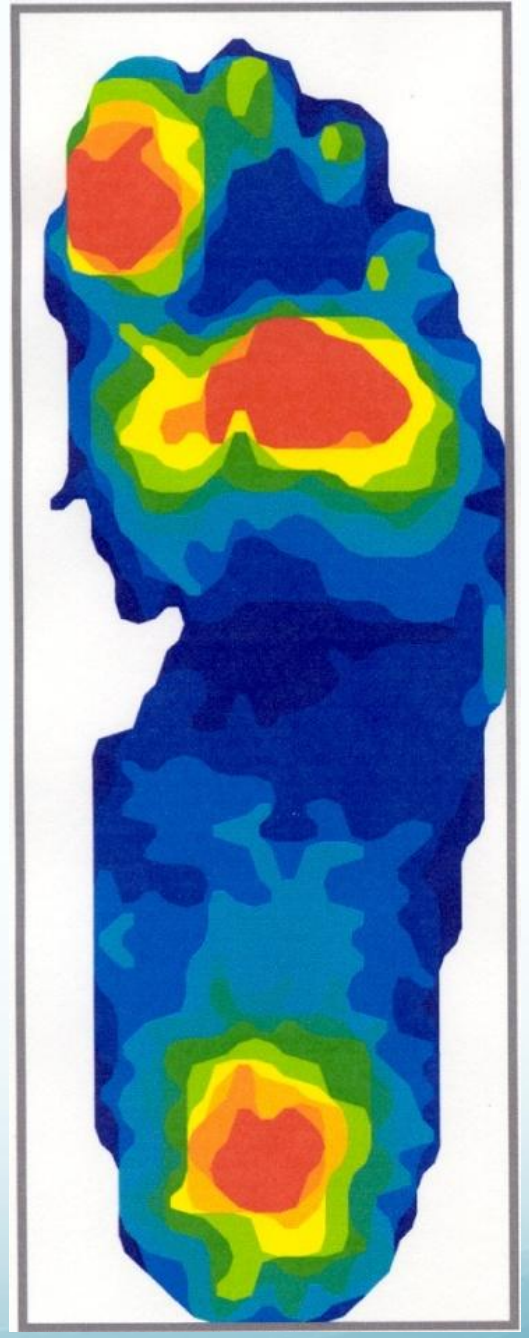


Figure 3: Plantar pressure distribution under the foot during (A) barefoot walking and (B) walking in appropriate therapeutic shoes and custom insoles[181]

Awareness / Education

Maintenance:

poor treatment adherence or lack appropriate resources

- e.g. lack financial resources to acquire appropriate footwear for foot ulcers
- Coexisting medical conditions and drugs that may stall healing e.g. hyperglycemia
- Goal
  - Prevent further skin deterioration or breakdown, trauma, and wound infection.
  - Promote patient adherence.
  - advocate for patients to acquire appropriate resources.
  - Optimize pain and other symptom(s) management.

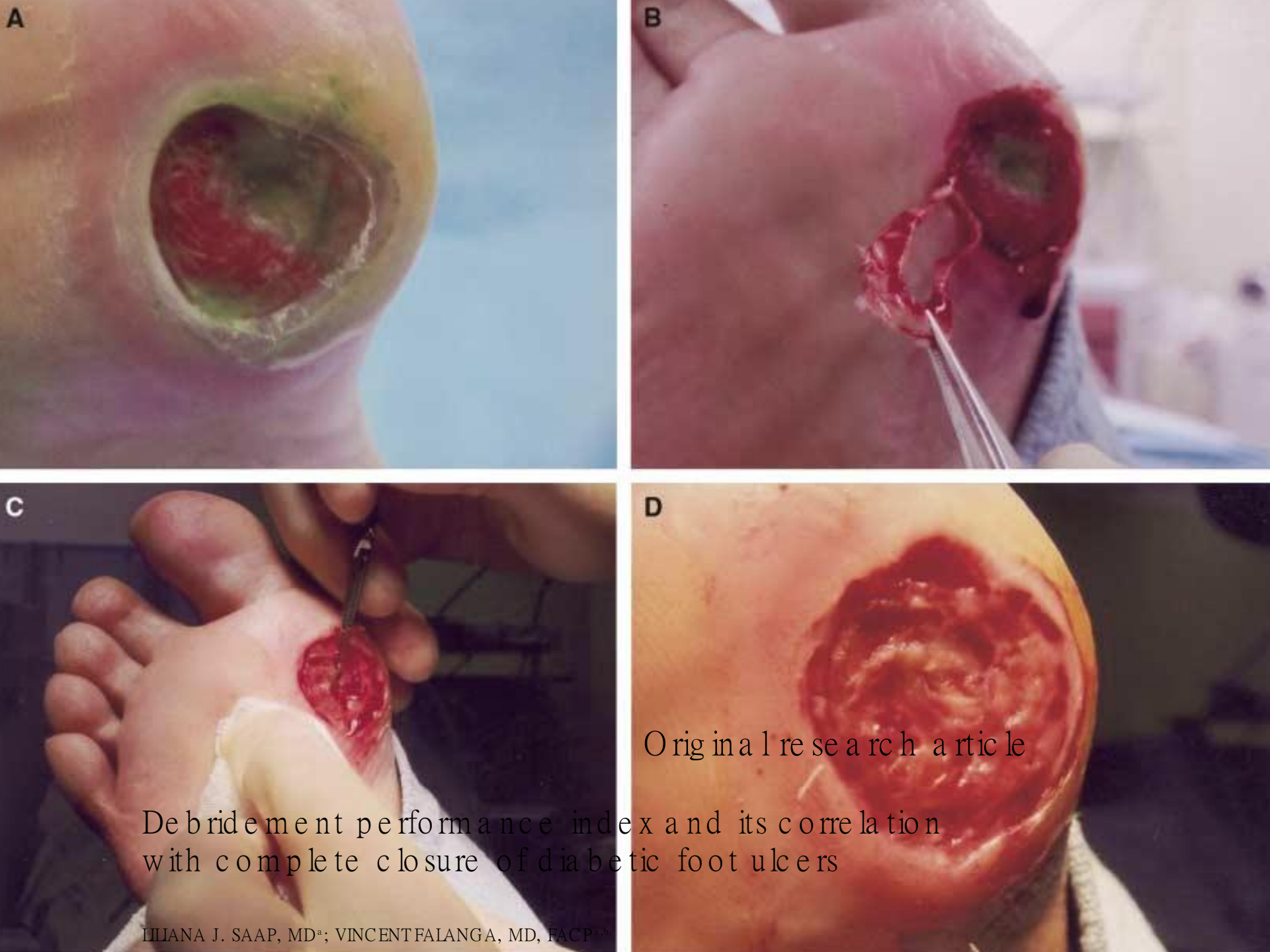
S = Sharp debridement

Serial / maintenanc
surgical debrideme

Cardinal et al.2008

Callus care

Don’t be careless with callus

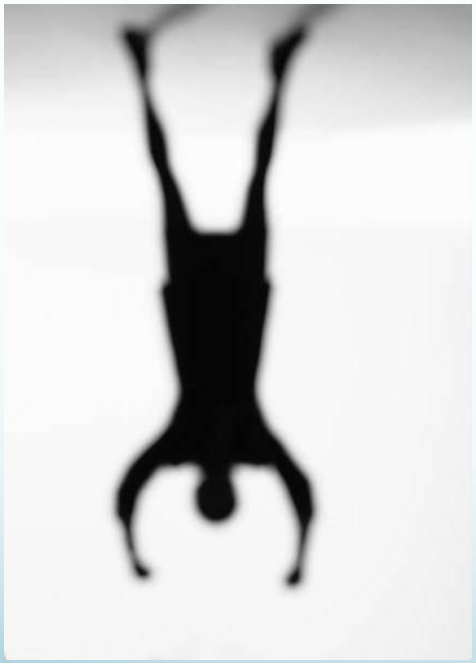


Original research article

Debridement performance index and its correlation with complete closure of diabetic foot ulcers

LILIANA J. SAAP, MD[a]; VINCENT FALANGA, MD, FACP[a,b]

Complications of Diabetes



Neuropathy
PVD (Arteries)
Kidney
Heart
Eyes
Brain

INTER-PROFESSIONAL TEAMS

Diabetic foot in Guyana

Poster Rambaran, Ostrow, Sibbald, Woo

International Diabetes Federation, Montreal 2009

Pre-intervention:

- Single greatest reason (10%) for surgical admission at GPHC
- 30% inpatients on surgical ward
- Estimate 400-500 patients /yr admitted
- 42% amputation

Time period	Mean # patient-amputation /month	St. Dev.	95% CI	Statistical analysis: Unpaired two-way t-test p=0.003
Before DFC (43 mo)	7.95	3.999	1.19	
After DFC (11 mo)	4.45	2.944	1.74	

Currently:

•Decreased length of stay on surgical unit

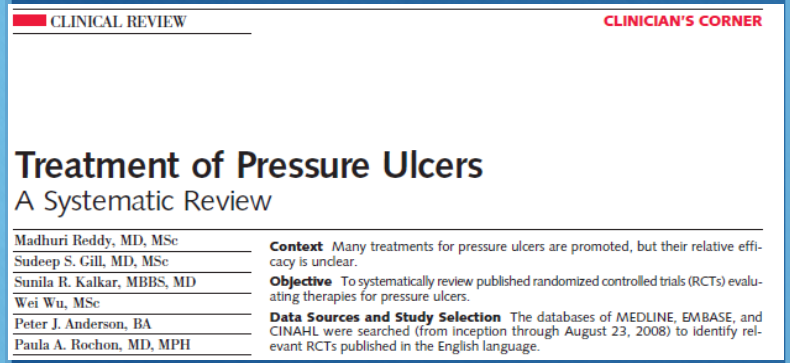
•Decreased amputations by 46% including major amputations

Is this wound healable???

Never say never, never say always

Pressure Ulcer Treatment

•103 RCT's, methodological quality was variable



CLINICAL REVIEW

CLINICIAN'S CORNER

Treatment of Pressure Ulcers
A Systematic Review

Madhuri Reddy, MD, MSc
Sudeep S. Gill, MD, MSc
Sunila R. Kalkar, MBBS, MD
Wei Wu, MSc
Peter J. Anderson, BA
Paula A. Rochon, MD, MPH

Context Many treatments for pressure ulcers are promoted, but their relative efficacy is unclear.

Objective To systematically review published randomized controlled trials (RCTs) evaluating therapies for pressure ulcers.

Data Sources and Study Selection The databases of MEDLINE, EMBASE, and CINAHL were searched (from inception through August 23, 2008) to identify relevant RCTs published in the English language.

- Little evidence supporting:
  - specific support surface
  - Dressing types
  - Routine nutritional supplementation
- Authors conclusion:
  Management of underlying contributing factors is likely more valuable in treating pressure ulcers than either topical or adjunctive therapies.

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Evidence on turning?

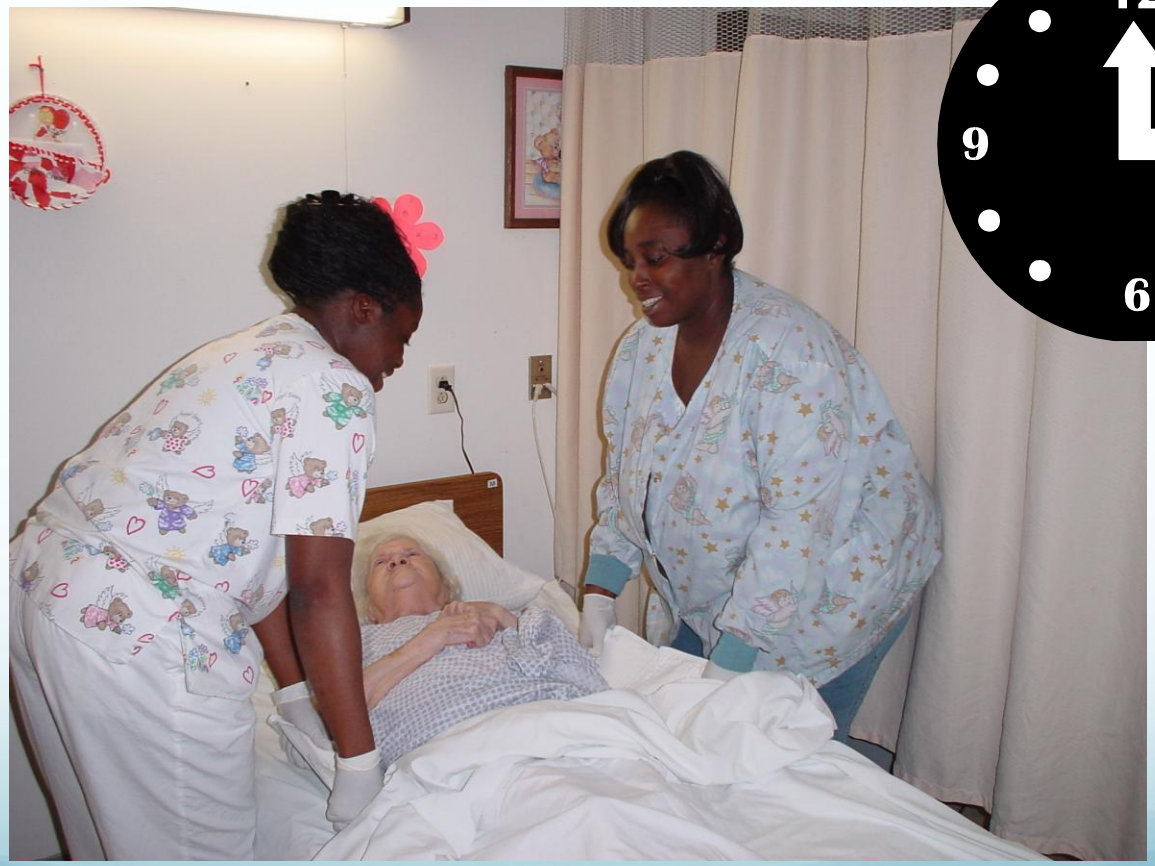
- Limited evidence suggests that repositioning every 4 hours, when combined with an appropriate pressure redistribution surface, is just as effective for the prevention of facility- acquired PUs as a more frequent (every 2 hour) regimen.

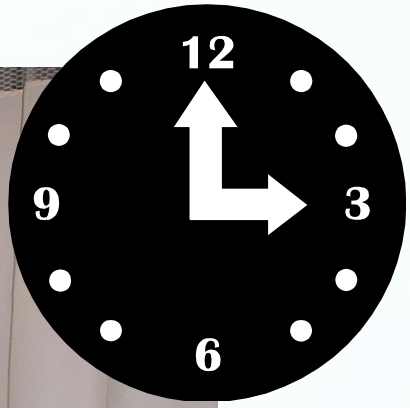
- Are all pressure ulcers avoidable?

Does regular repositioning prevent pressure ulcers?

Krapfl & Gray J Wound Ostomy Continence Nurs. 2008, 35(6):571-7. Review

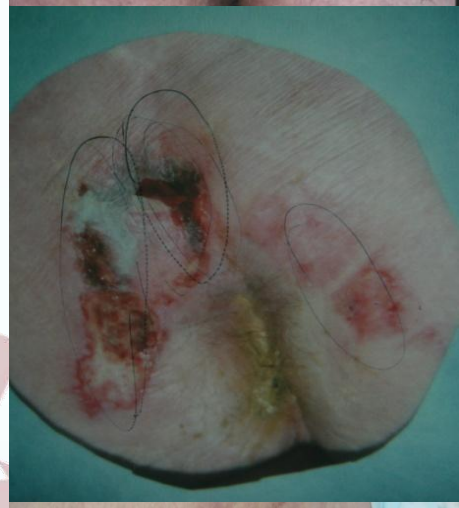
Turn Every Two Hours? While in Bed!





Kennedy Terminal Ulcer

- Shaped like a pear
- Always on the coccyx or sacrum
- Red, yellow and black
- Sudden onset
- Death is imminent



Venous Stasis Disease

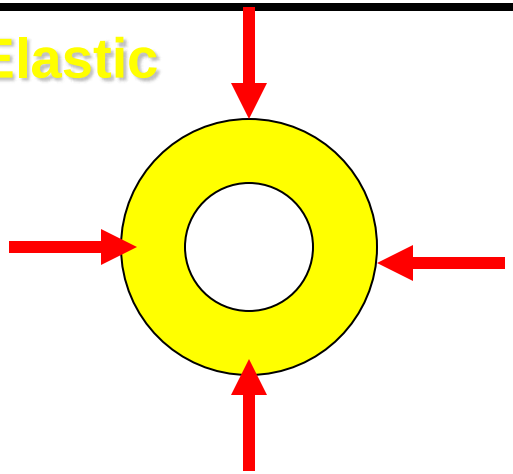
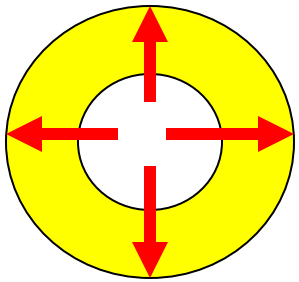
- Varicose veins
- Edema
- Hyperpigmentation of gaiter area
- Atrophie blanche

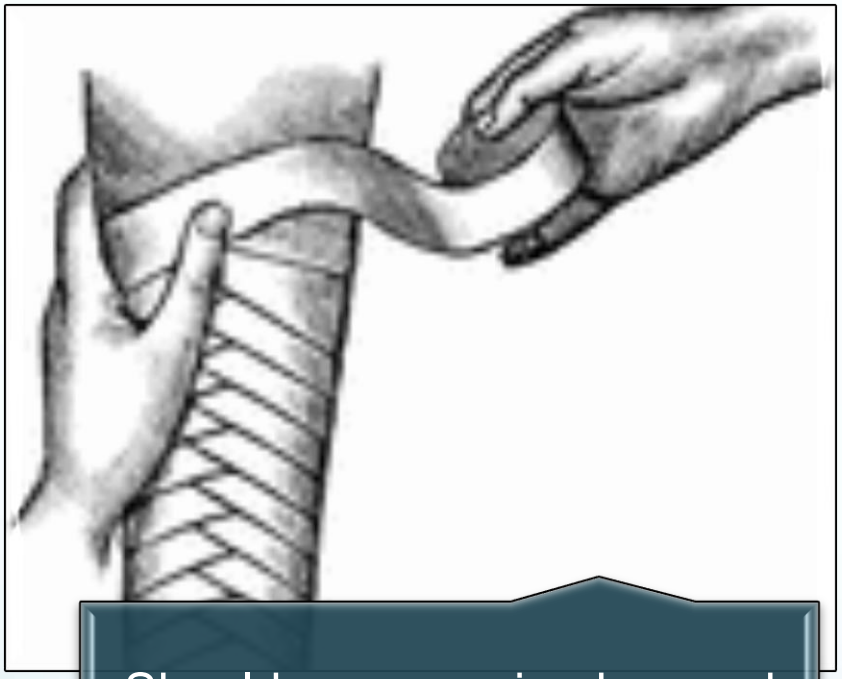
- Scale and erythema
- Woody hardness
- Inverted champagne bottle appearance
- lipodermatosclerosis

The most effective treatment for a venous leg ulcer is:

1. Compression Stockings
2. Leg elevation
3. Walking program
4. Diuretics
5. Thromboembolic Stockings
6. Compression Bandaging

Non Elastic Systems have no pressure at rest

	Compression	*Support*
Type of System **Pattern of Pressure**	**Elastic** 	**Non elastic** 
Rest	**High Pressure**	**Low Pressure**
Muscle Contraction	**High Pressure but less**	**High Pressure**
Low	**Single Layer Elastic bandages**	**Unna's Boot**
High	**Long stretch 4 layer**	**Short stretch Modified Unna's Boot (Duke Boot)**

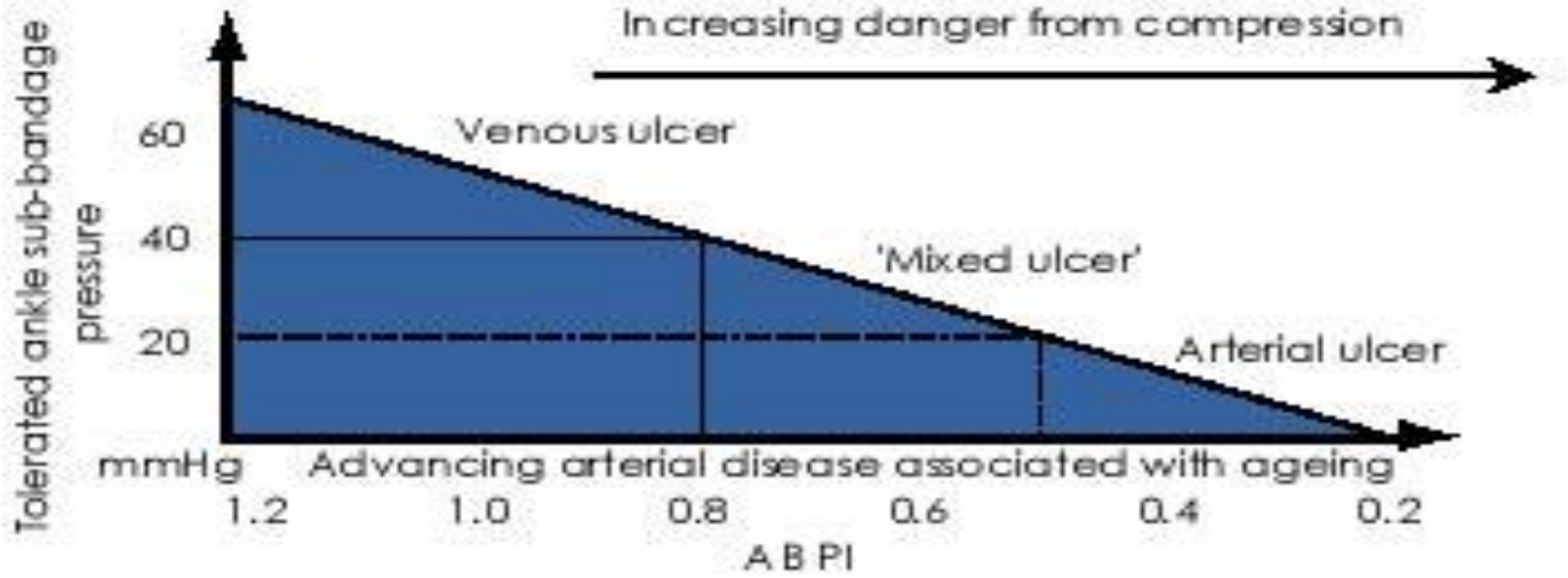


Should compression be used for the treatment of leg ulcers?

What is the appropriate compression for mixed venous arterial leg ulcers?

Ankle Brachial index and Compression

0.8 +	**Adequate vascular supply**	**High compression**
0.6-0.8	Some arterial compromise	Modified compression
<0.6	Definite arterial compromise	No compression

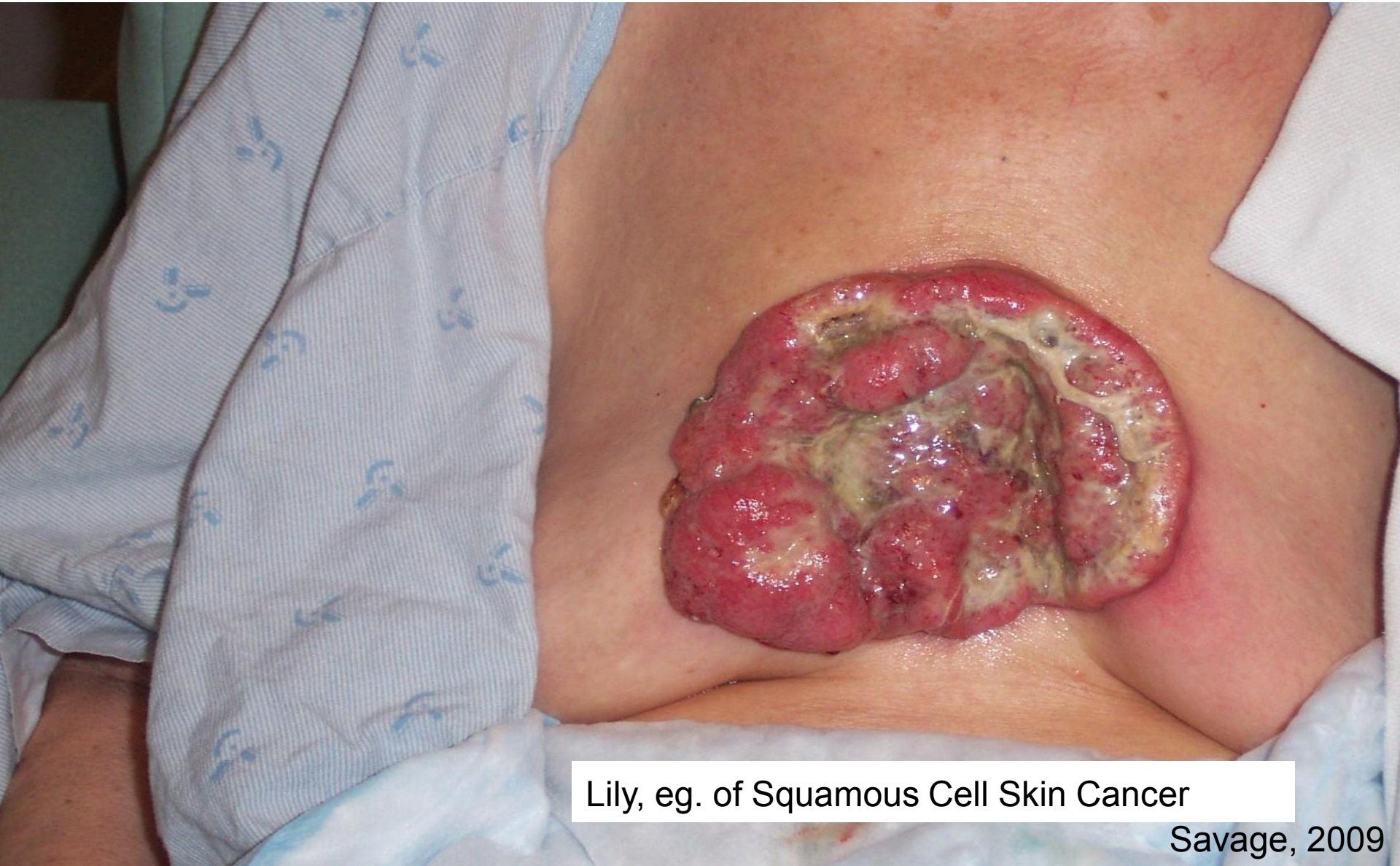


Non-healing ulcers

Malignant Wounds Are:

1. Primary malignancies of the skin
2. Erosions, ulcers or eruptions of the skin related to solid tumours such as breast, colon, lung etc
3. Metastatic spread of cancer (lesions, nodules or ulcers) to the skin layers.

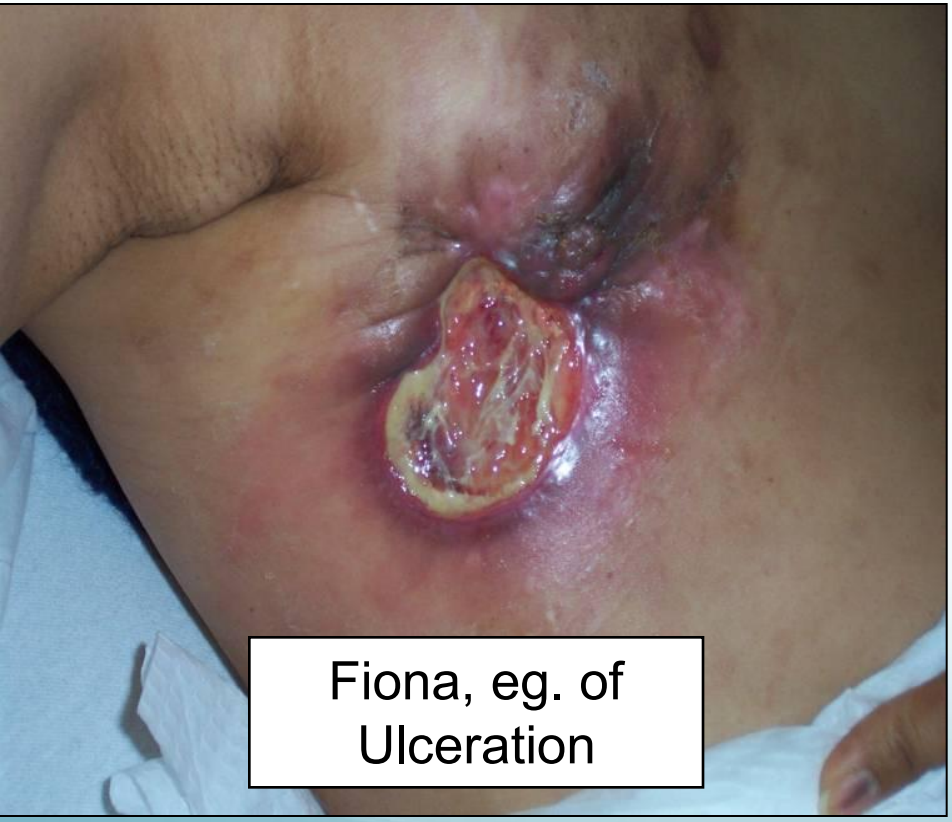
1. Primary Skin Cancer



Lily, eg. of Squamous Cell Skin Cancer

Savage, 2009

2. Ulcerations, nodules, eruptions, related to a solid tumour



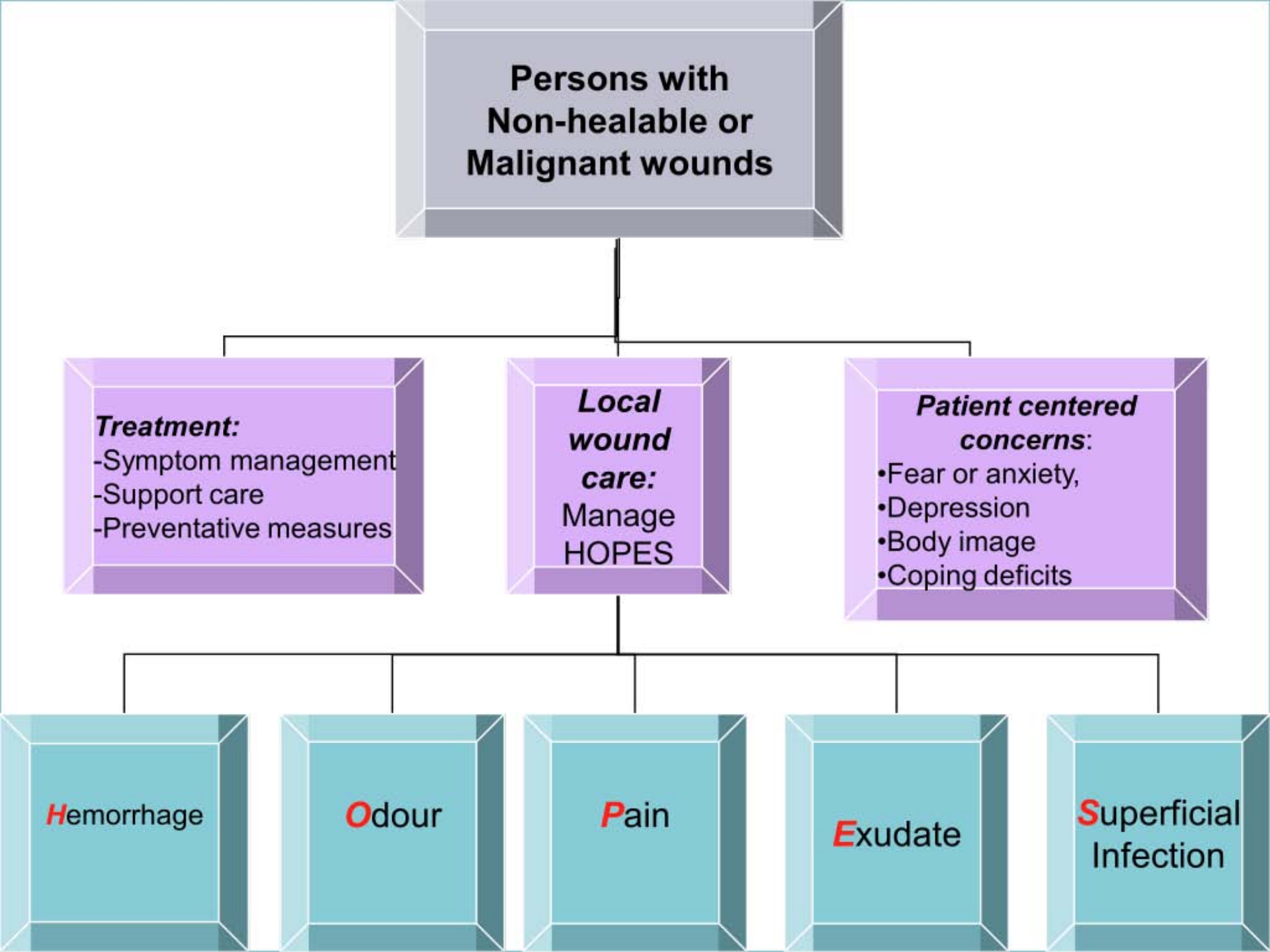
Fiona, eg. of Ulceration

Susan, eg. of Nodules

Savage, 2008

3. Cutaneous Metastases

Savage, 2008


Persons with Non-healable or Malignant wounds
Treatment:
-Symptom management
-Support care
-Preventative measures
Local wound care:
Manage HOPES
Patient centered concerns:
•Fear or anxiety,
•Depression
•Body image
•Coping deficits
Hemorrhage
Odour
Pain
Exudate
Superficial Infection

Non-healable:Palliative or malignant

a cause that is not treatable

- e.g. widespread metastasis including the skin, advanced stages of cutaneous malignant conditions, chronic osteomyelitis.
- Coexisting medical conditions that would prevent normal healing (4), such as:
- Goal
  - Prevent further skin deterioration or breakdown, trauma, and wound infection.
  - Keep wound dry to minimize the risk of infection
  - Promote comfort
  - Optimize pain and other symptoms management.

HOPES: hemorrhage

Less trauma

Case Study

55 yo female
History of ovarian carcinoma (1997)

Chemo+Rx
Nodules x 2 years

Symptoms
Heavy exudate, Odour
Macerating to periwound area
Itching , Bleeding, Bulky dressing

MAIN CAUSES OF TRAUMA AND PAIN

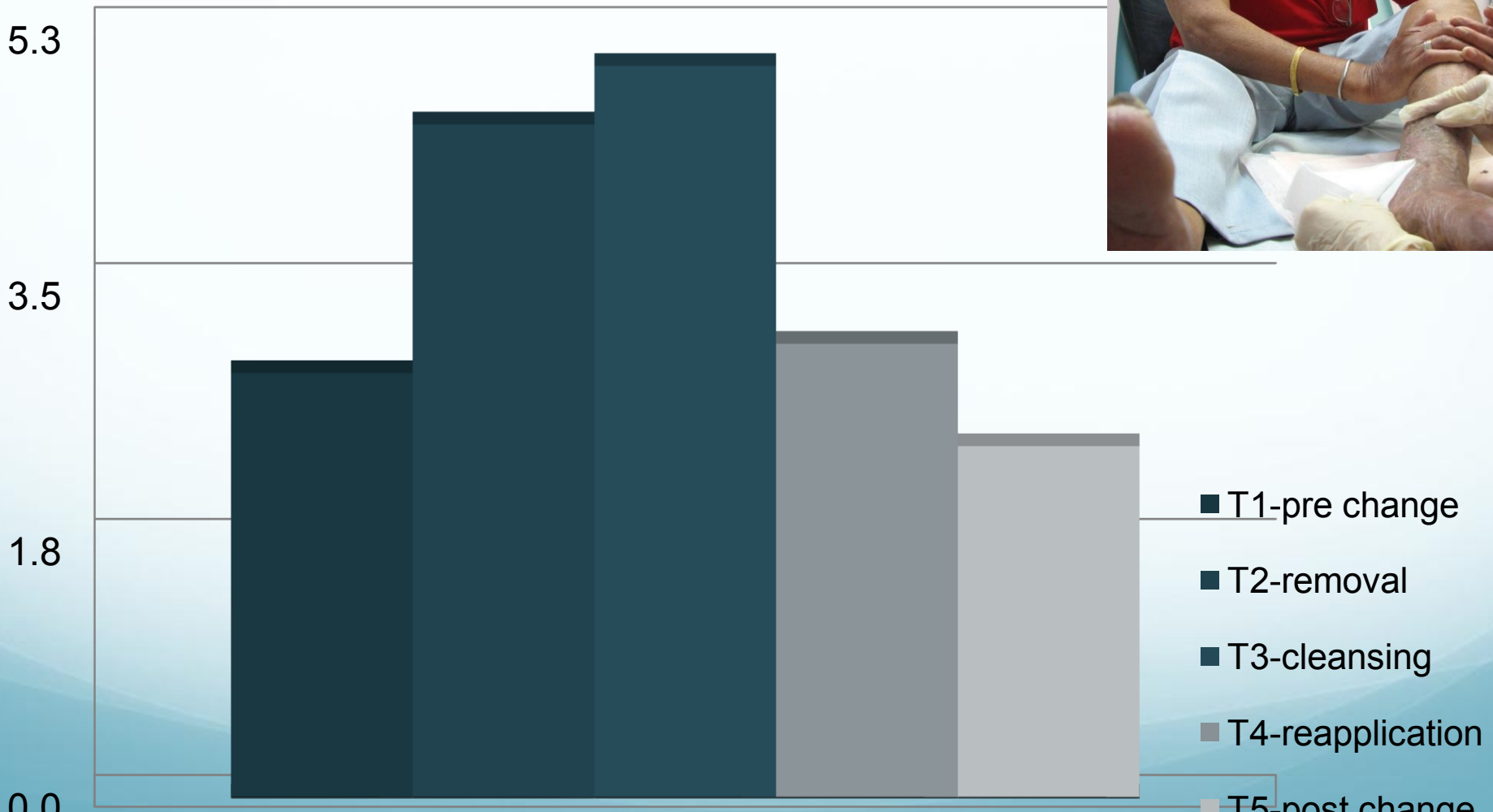
- Trauma to the wound and to the surrounding skin
  - Wound bed adherence
  - Skin stripping due to aggressive adhesives
  - Maceration
- Pain to the patient when removing dressings

Gauze sticking to wound

Skin stripping

Maceration

Pain at dressing change



HOPES: odour

Drainage

1. Fusidic acid (Fucidin)
2. Mupirocin (Bactroban)
3. Silver sulfadiazine (Flamazine) cream
4. Neomycin
5. Metronidazole (Flagyl)
6. Negative pressure wound therapy
7. Honey
8. Baking soda
9. Toxic antiseptics

HOPES: pain

Pain and stress

Pain in fungating wounds

Nociceptive	• inflammatory response, local infection, systemic disease
Neuropathic	• radiation skin damage, local ischemia • Invasion of soft tissue • Injury to cutaneous nerves: neuropathic pain
Iatrogenic	• dressing changes, radiotherapy
Psychogenic	• body image, loss of control, fear

Pain and Anxiety

Pain

Anxiety

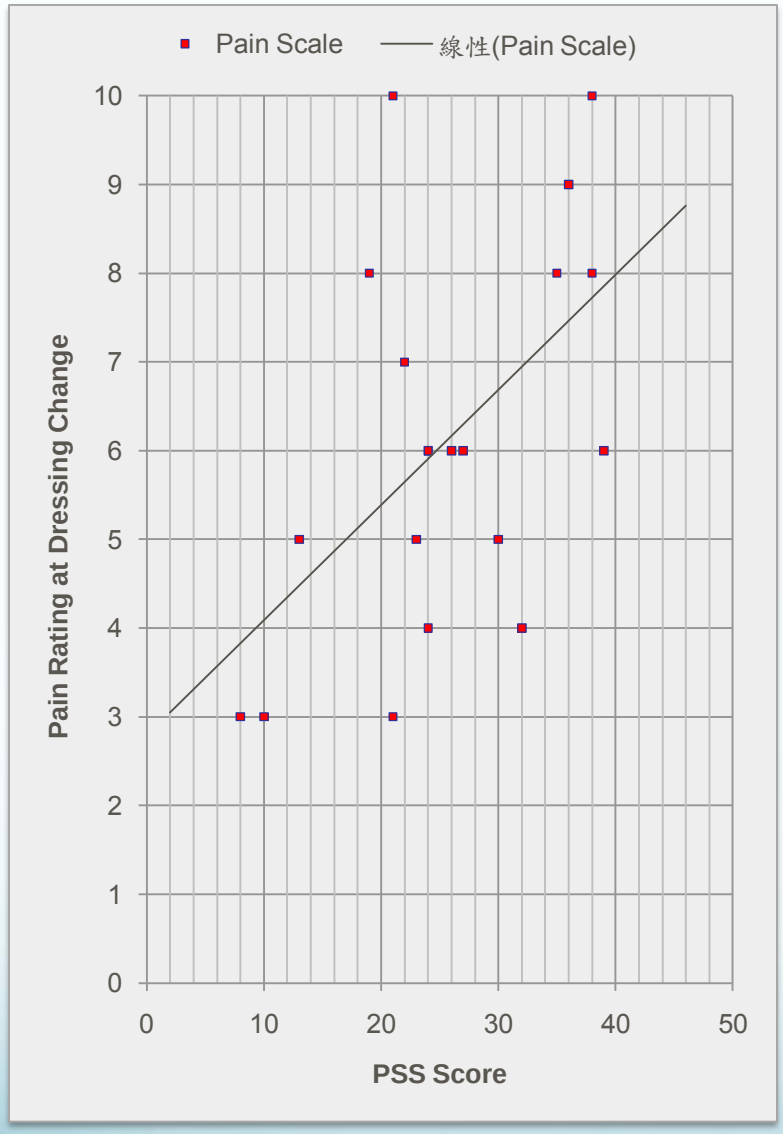
Anticipatory pain

Pain and stress study

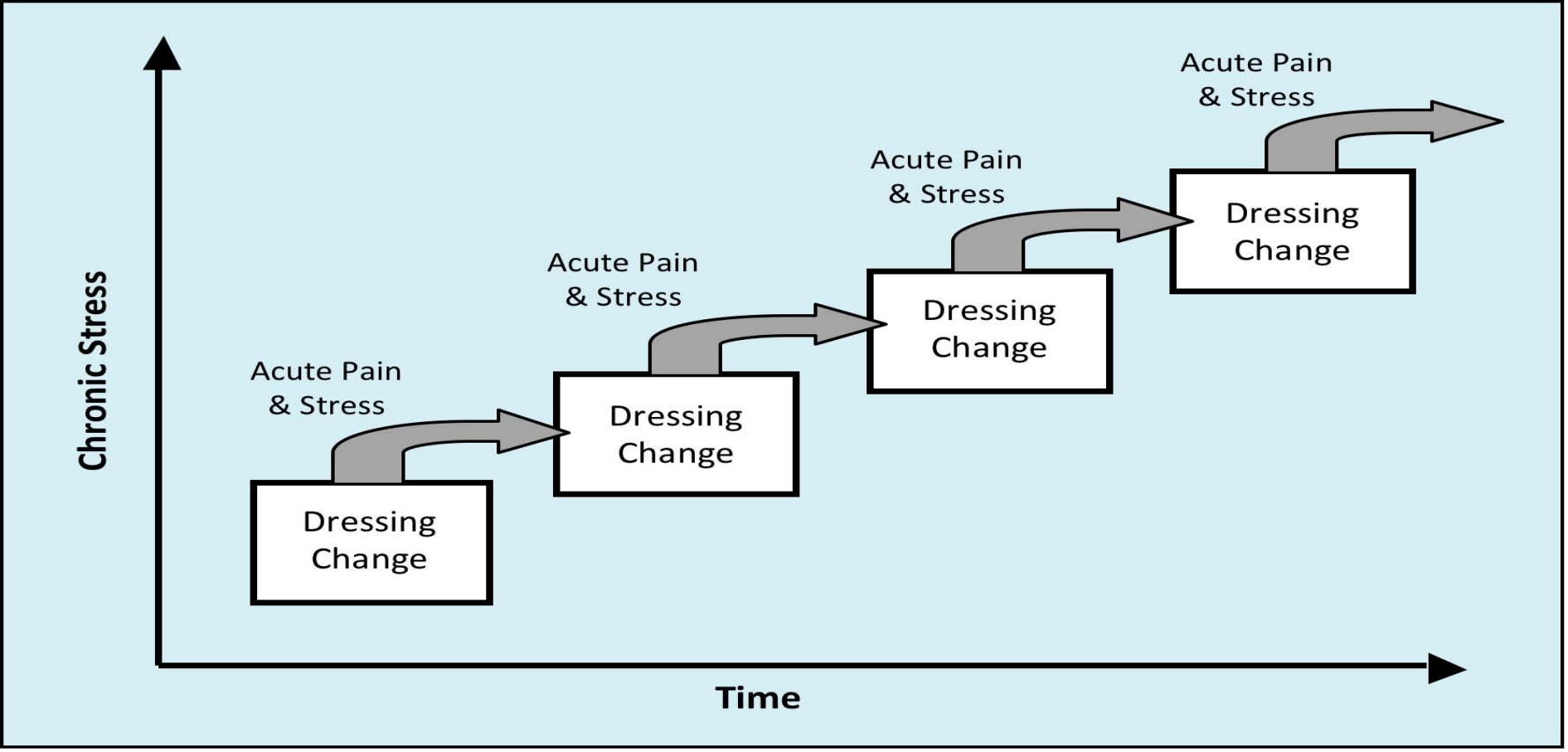
- 39 out-patients with a median age of 75 years.
- female (72%)
- Physiological and psychological measurements of pain and stress (including numerical ratings, heart rate, blood pressure, respiration rate, salivary cortisol, galvanic skin response (GSR),
- a questionnaire survey of state and trait anxiety and chronic stress
- recorded immediately prior to dressing change and in a control condition (at least 24 hours before/after dressing change, during a period of rest).

Results

- Mean heart rate, GSR, numerical pain rating, numerical stress rating and state anxiety scores were significantly higher during dressing change.
- Patients with high pain levels: significant relationships were found between chronic stress, acute stress and pain.

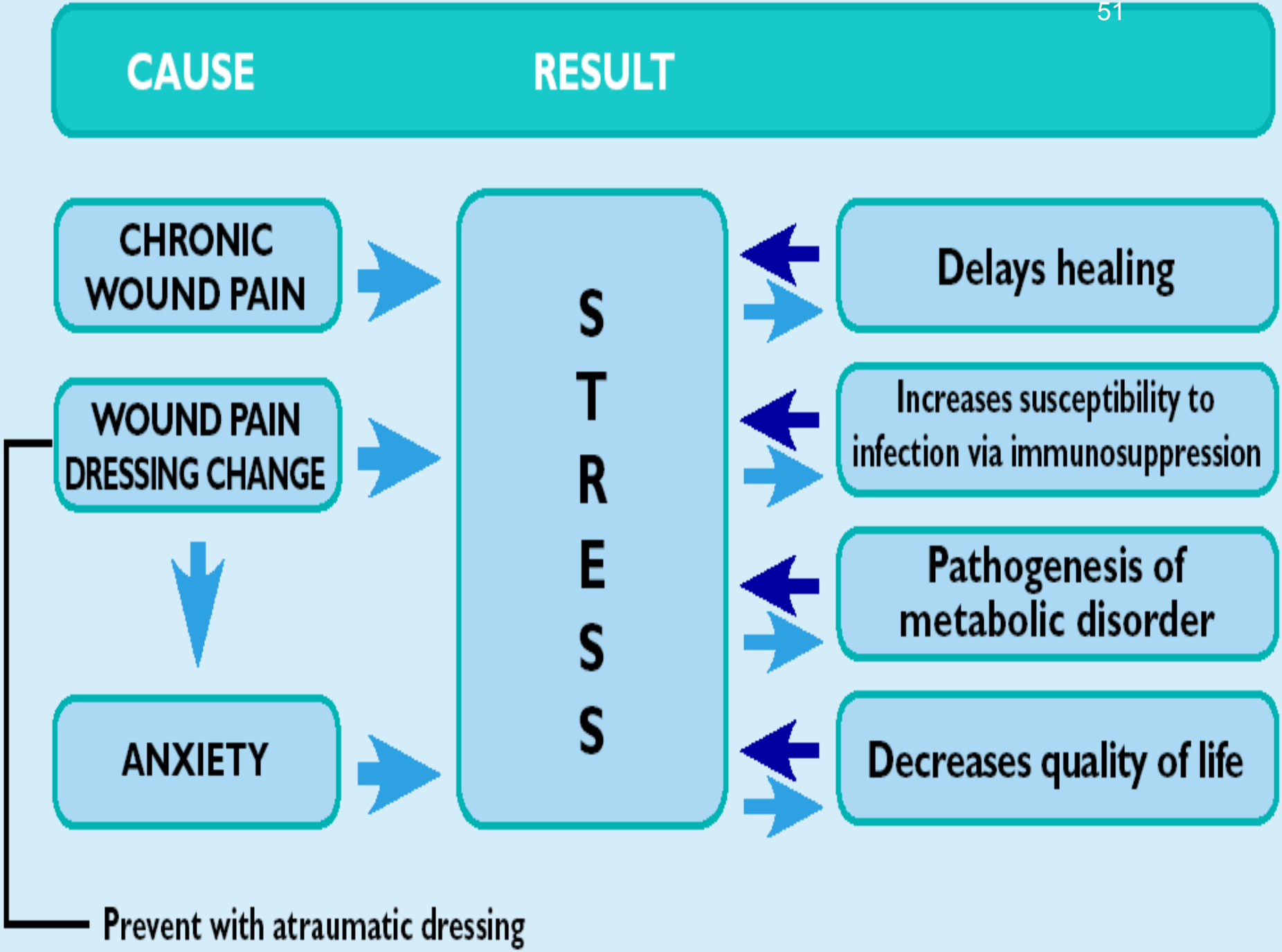


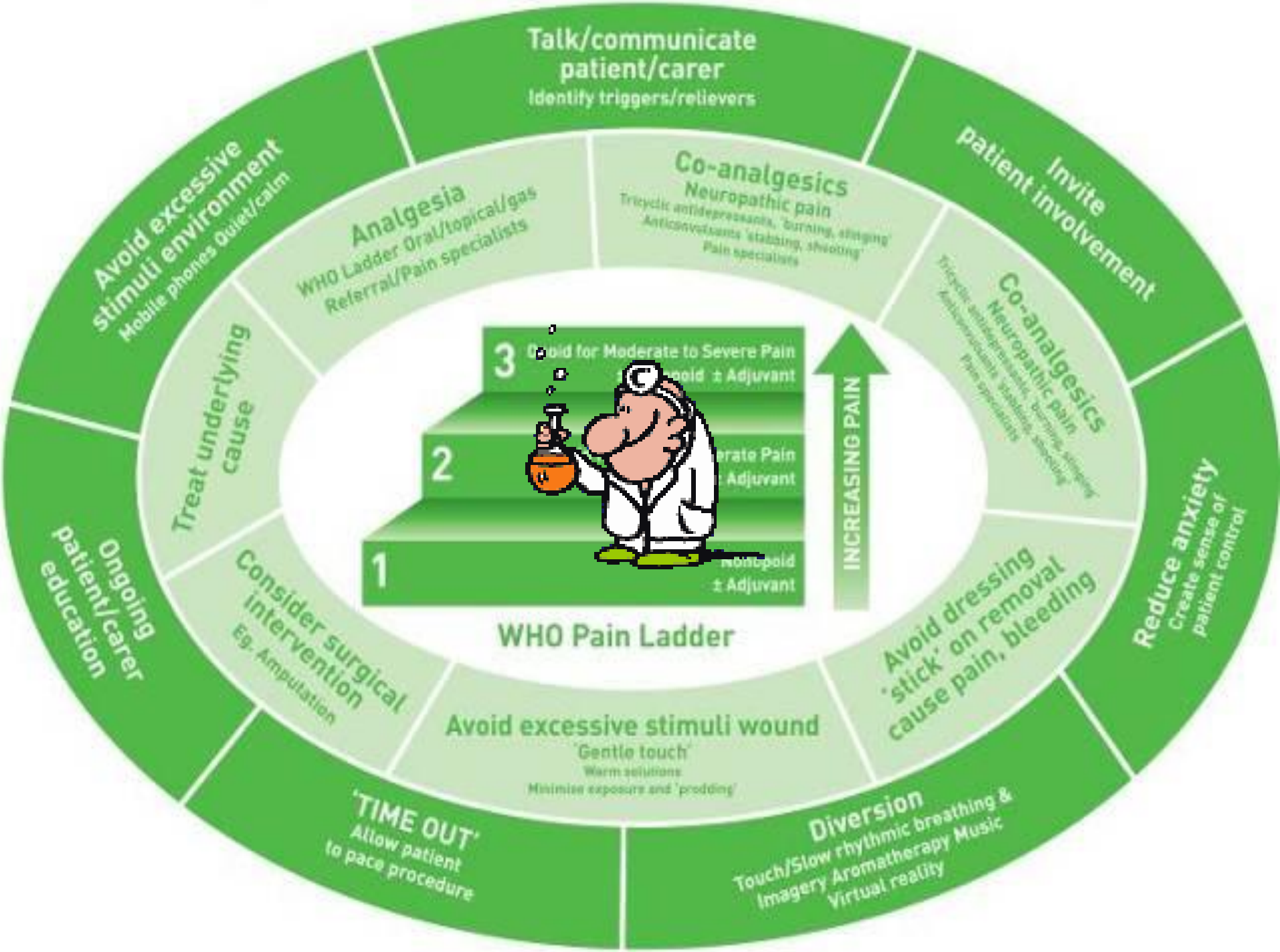
Chronic stress as measured by the PSS questionnaire was found to correlate with pain reported at dressing change ($r(18) = 0.54, p < 0.01$)



Conclusion:

This study highlights how increased acute pain and stress at dressing change may be related to chronic stress, which has been shown to contribute to delayed wound healing.


CAUSE
RESULT
CHRONIC WOUND PAIN
WOUND PAIN DRESSING CHANGE
ANXIETY
STRESS
Delays healing
Increases susceptibility to infection via immunosuppression
Pathogenesis of metabolic disorder
Decreases quality of life
Prevent with atraumatic dressing


Talk/communicate patient/carer
Identify triggers/relievers
Invite patient involvement
Reduce anxiety
Create sense of patient control
Diversion
Touch/Slow rhythmic breathing & Imagery Aromatherapy Music Virtual reality
'TIME OUT'
Allow patient to pace procedure
Ongoing patient/carer education
Avoid excessive stimuli environment
Mobile phones Quiet/calm
Analgesia
WHO Ladder Oral/topical/gas Referral/Pain specialists
Co-analgesics
Neuropathic pain
Tricyclic antidepressants, 'burning, stinging'
Anticonvulsants 'stabbing, shooting'
Pain specialists
Co-analgesics
Neuropathic pain
Treat underlying cause
Consider surgical intervention
Eg. Amputation
Avoid excessive stimuli wound
'Gentle touch'
Warm solutions
Minimise exposure and 'prodding'
Avoid dressing 'stick' on removal cause pain, bleeding
3
Opioid for Moderate to Severe Pain
± Adjuvant
2
erate Pain
Adjuvant
1
Non-opioid
± Adjuvant
INCREASING PAIN
WHO Pain Ladder

HOPES: Exudate

Moist wound healing

Absorbency

- Foams/Absorptive
- Hydrofiber
- Calcium Alginates
- Acrylic dressing
- Hydrocolloids
- Films
- Hydrogels

Soaking wet

↓

Wet

↓

Dry and stuck

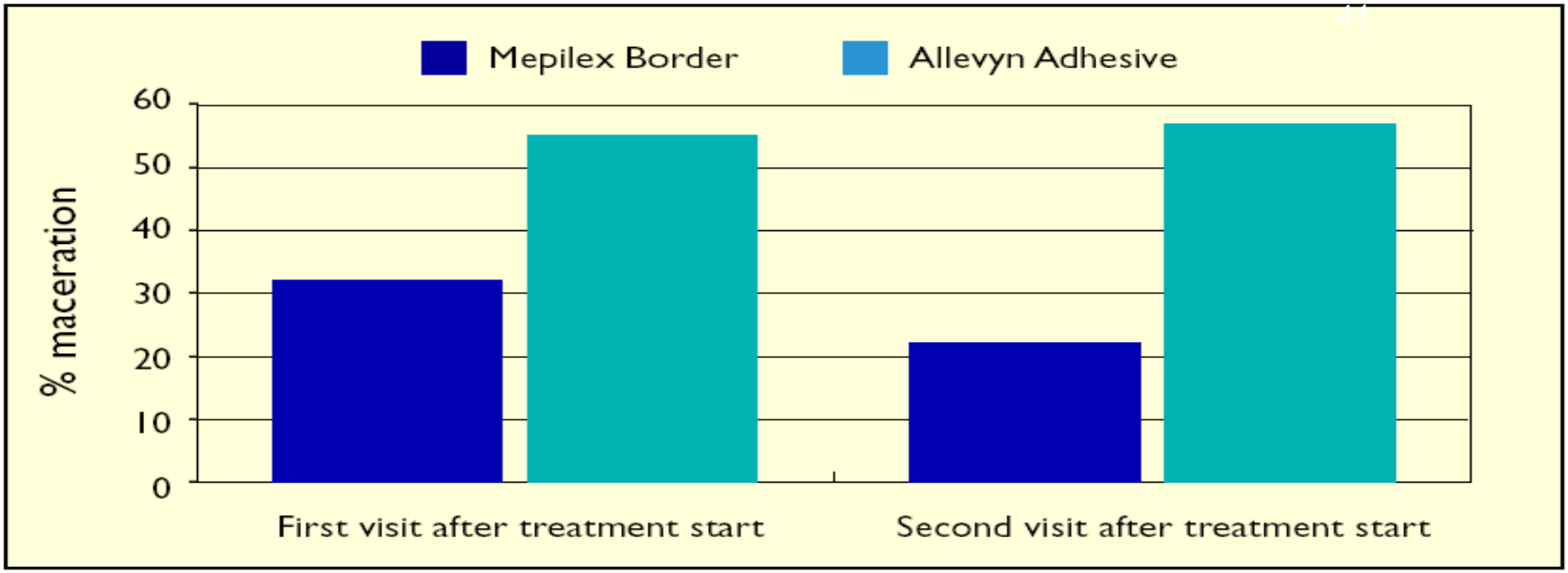


Figure 16. Dressings with Safetac (Mepilex Border) vs dressings with acrylic adhesive (Allevyn Adhesive) in terms of maceration in a randomised controlled study in patients with chronic wounds.[86]

HOPES: superficial bacteria

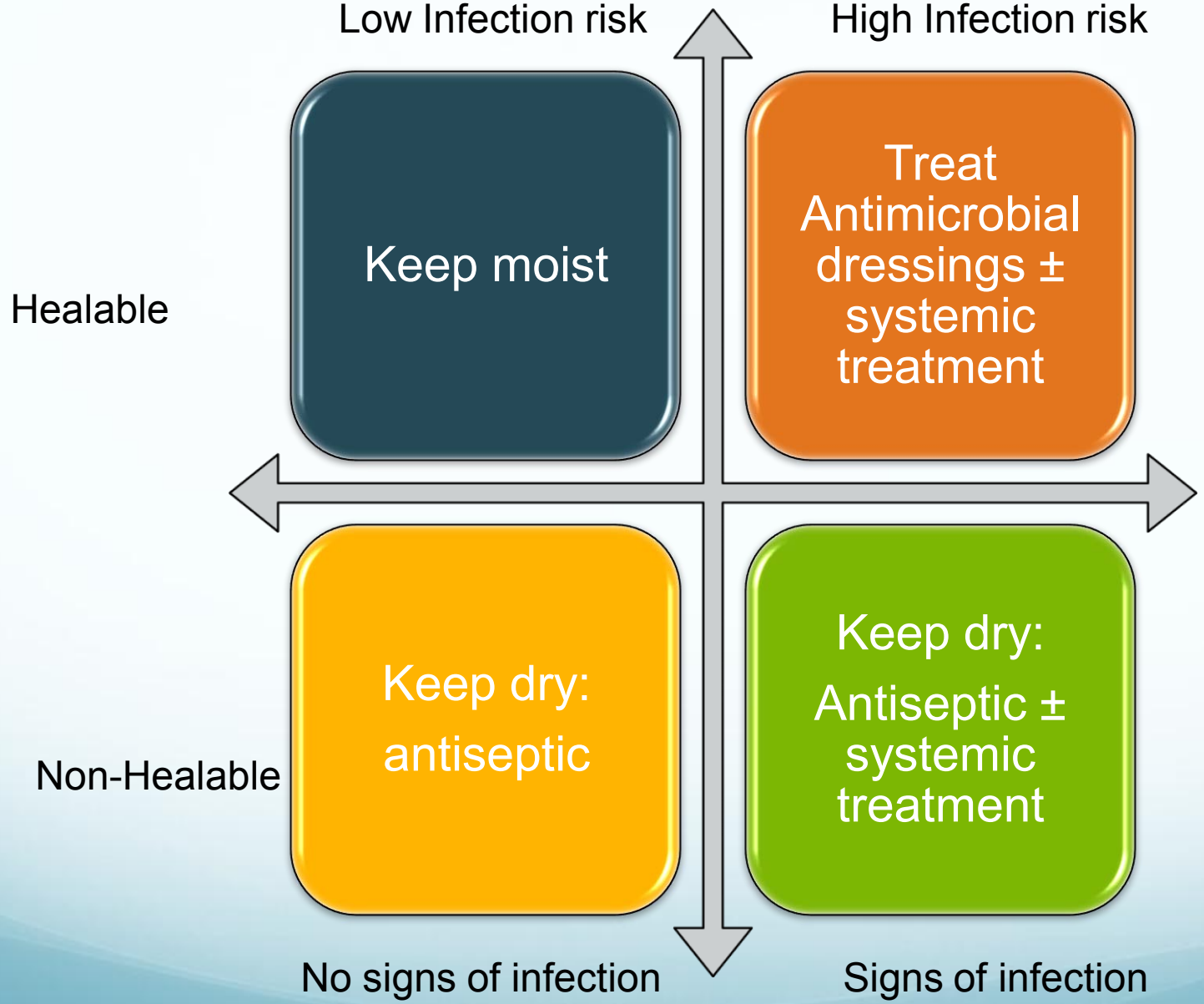
Local wound infection

Antiseptic Agents for use in Non-Healable wounds cytotoxicity is less important than anti-microbial action

AGENT	EFFECTS
Chlorhexidine	Low toxicity
Povidone Iodine- Betadine	Broad spectrum
Acetic Acid	Pseudomonas
Dyes-Scarlet red, Proflavine	Select out Gm neg.
Na Hypochlorite-Dakins, Eusol	Toxic = bleach
Hydrogen Peroxide	Action = Fizz
Quaternary Ammonia- Cetrimide	Very high toxicity

Woo, et al: Poster SAWC 2007

Wound Treated with Povidone Iodine (Betadine)					
	N	**Min**	**Max**	**Mean**	**SD**
Initial size (cm^2)	42	.06	66	4.5	10.4
Final size (cm^2)	42	.00	54	3.3	9.2
Duration (mth)	42	1.0	12	5.2	2.7
Size □ in %	**31**	1.9	100	73.6	33.7
Size □ in %	10	4.2	367	162	127


Low Infection risk
High Infection risk
Healable
Non-Healable
Keep moist
Treat Antimicrobial dressings ± systemic treatment
Keep dry: antiseptic
Keep dry: Antiseptic ± systemic treatment
No signs of infection
Signs of infection

Case Study

55 yo female
History of ovarian carcinoma (1997)

Chemo+Rx
Nodules x 2 years

Symptoms
Heavy exudate, Odour
Macerating to periwound area
Itching , Bleeding, Bulky dressing