



Smoking and Wound Healing

By Kate Cassidy



- Smoking has long been targeted as a risk factor for many diseases and seen as detrimental to our health.
- The aim of this presentation is to briefly outline the effect smoking has on wound healing in the skin at the cellular level.

Skin

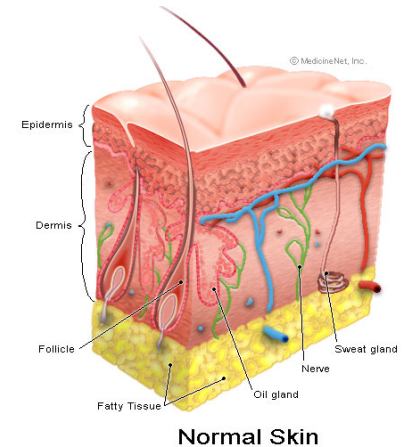
- Complex structure made up of:

- Epidermis

- Thick keratinised stratified squamous epithelium
- Cells present; keratinocytes, melanocytes, Langerhans' cells and Merkel cells

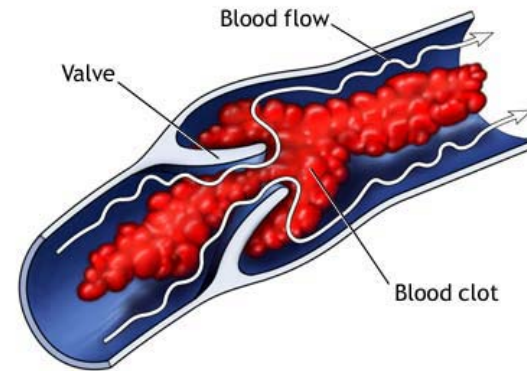
- Dermis

- Strong, flexible connective tissue layer
- Cells present; fibroblasts, macrophages, occasional mast cell and white blood cell
- Richly supplied with nerve fibres, blood and lymphatic vessels



Wound Healing

- Very complicated process
- Although continuous, has been separated into phases
 - Coagulation
 - Inflammation
 - Proliferation
 - Remodelling
- Delay or absence of any one component can lead to prolongation or inhibition of healing



Factors Affecting Healing



■ Local

- Growth factors, oedema, ischaemia, low oxygen tension and infection

■ Regional

- Arterial and venous insufficiency and neuropathy

■ Systemic

- Inadequate perfusion and metabolic disease

■ Miscellaneous

- Nutritional status, pre-existing illness, radiation treatment and smoking

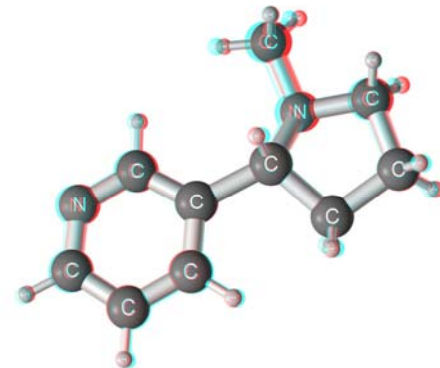
Cigarette Smoke

- Nicotine is the only pharmacologically active substance in tobacco smoke, apart from carcinogenic tars, HCN and CO.
- Nicotine is rapidly absorbed and can easily cross membrane barriers.
- Elimination half life of about 2 hours



Nicotine

- Initially causes nausea and vomiting
- Central nervous system effects
 - Balance neuronal excitation and desensitisation
 - Spinal level; skeletal muscle relaxation
- Peripheral effects
 - Mainly of heart and lungs; tachycardia, increased cardiac contractility and increased arterial BP
 - Reduced gastric motility
- Fluid retention



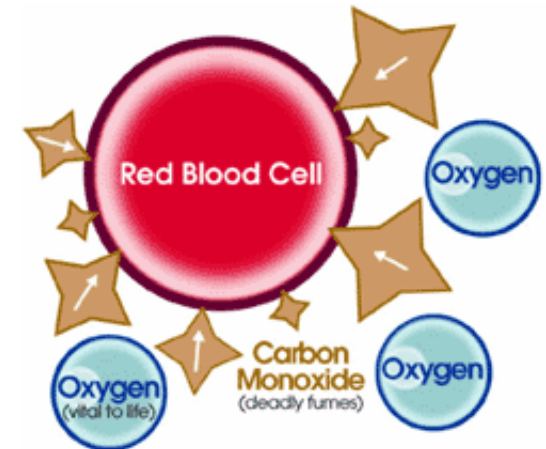
Smoking and the Skin

- Smoke itself has a drying effect
- Nicotine causes vasoconstriction
- CO damages prostacyclin production in the lining of the vessels
- Affects wound healing via tissue perfusion and oxygenation, cell function and replication, epithelialisation and collagen production

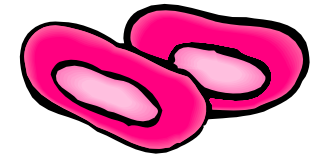


Tissue perfusion & oxygenation

- Smoking found to decrease tissue oxygen
 - Cell replication, collagen deposition and angiogenesis are all oxygen-dependent
- Hypoxia correlated with levels of Nicotine
- Carboxyhaemoglobin
- Individuals that smoke 1 pack per day will be hypoxic for majority of the day



Cell function & replication

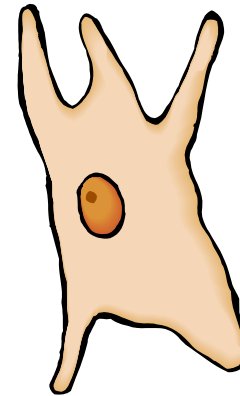


Red Blood Cell

- Enhanced platelet aggregation.
- HCN inhibits enzyme systems responsible for oxidative metabolism & oxygen transport
- Reduced oxidative burst of inflammatory cells
- Decreased keratinocyte, leukocyte and fibroblast migration. Also increased fibroblast survival

Collagen synthesis

- Decreased synthesis rate of type I and III collagens in skin
- Lower median amount of collagen in smokers, therefore wound sites will be weaker and less resilient



Connective tissue cell

Conclusion



- Lack of studies assessing
 - the difference in healing time frame of smokers versus non-smokers
 - the actual quality of the repaired skin
- While some effects of Nicotine are rapidly reversed some may continue, these need assessment
 - Eg the effects of pre-operative cessation of smoking on wound healing outcome

Study limitations

- Some studies involved animals
- In vitro versus in vivo
- Small number of participants
 - Less data; higher incidence error and idiosyncratic results influencing outcome
- Need for clear cut definition of what actually determines a chronic smoker
 - At what level of smoking do these effects become relevant?

