

NEW MODALITIES IN SCAR TREATMENT

An Essay

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Contents

	<i>Page</i>
• Introduction and aim of work	1
• Review of literature:	
➤ Chapter (1): Skin anatomy and wound healing	6
▪ Skin anatomy	6
▪ Normal wound healing	16
▪ Types of wound healing	27
➤ Chapter (2): Scars pathogenethesis	30
➤ Chapter (3): Management of scars	42
▪ Surgical management of scars	43
▪ Non surgical management of scars	49
▪ Laser	58
▪ New modalities of laser in scar management	89
▪ Future management of scars	91
• Summary	96
• References	100
• Arabic summary	—

List of Figures

Figure No.	Content	Page No.
Figure (1):	Diagram of the layers of human skin	6
Figure (2):	Anatomy of hair follicle	13
Figure (3):	Blood supply and lymphatics of the skin	15
Figure (4):	Types of wounds	17
Figure (5):	Inflammatory phase of wound healing	21
Figure (6):	Proliferative phase of wound healing	22
Figure (7):	Remodeling phase of wound healing	26
Figure (8):	Typical appearance of pigmented scar	31
Figure (9):	Typical appearance of atrophic scar	32
Figure (10):	Typical appearance of hypertrophic scar	33
Figure (11):	Typical appearance of Keloid	35

Figure (12):	Typical appearance of striae distensae	40
Figure (13):	Relaxed skin tension lines	45
Figure (14):	Techniques of z-plasty	46
Figure (15):	Technique of w-plasty	47
Figure (16):	The Geometric Broken-Line Technique	48

List of Tables

Table No.	Content	Page No.
Table (1):	Histopathological features of keloid and hypertrophic scars	36
Table (2):	Difference between keloid and hypertrophic scars	37
Table (3):	Pathogenesis of normal and abnormal wound healing	38

List of abbreviations

AHAs	alpha hydroxyl acids
ALA	aminolevulinic acid
b-FGF ...	Fibroblast growth factor beta
Co2	Carbon dioxide
CW	continuous wave
ECM	extracellular matrix
Er:YAG	erbium-yttrium- aluminum-garnet
FP	Fractional photothermolysis
FPPDL ..	The flashlamp-pumped pulsed dye laser
5-FU	5-flurouracil
GAG	glycosaminoglycans
GBLC	The geometric broken line closure
IL-I	interleukin-I
ILGF	insulin like growth factor
IPL	intense pulsed light
KTP	potassium titanyl phosphate
LED	the light emitting diodes
MTZs	microscopic treatment zones
Nd:YAG	Neodymium yttruim-aluminum-garnet
PAS	Periodic acid Schiff

PDGF platelet-derived growth factor
PDL pulsed dye laser
RF radiofrequency
RSTL Relaxed skin tension lines
TCA trichloroacetic acid
TGF- β transforming growth factor-beta

Introduction

Man protects himself when exposed to trauma by haemostasis, clot formation then scar formation. Scar formation is an inevitable end point of full thickness skin injury. The wound reparative process results in a spectrum of scar formation ranging from nearly scar less healing to excessive fibrosis.

Wound is described as disruption of tissue integrity. Wound healing is a complex and dynamic process of restoring cellular structures and tissue layers. The wound healing process can be divided into 3 phases: the inflammatory phase, the proliferative phase, and the remodelling phase. Within these 3 broad phases is a complex and coordinated series of events that includes chemotaxis, phagocytosis, neocollagenesis, collagen degradation, collagen remodeling, angiogenesis and epithelization (*Hawkins and Abrahamse, 2007*).

Scar formation is a natural part of the healing process after injury. Various factors influence how skin scars. Of course, the depth and size of the wound or incision and the location of the injury are going to impact the scar's characteristics. But age, heredity,

Introduction and Aim of the Work

even sex or ethnicity, will all affect how skin reacts (*Porter, 2002*).

Scars are categorized according to their clinical features into: erythematous scars, pigmented scars, hypertrophic scars, keloid, and atrophic scars (*Alster, 1997*).

Treatment options of scars are subdivided into two categories, both non-surgical and surgical.

Scars that are resistant to corticosteroid injection, pressure therapy, or other topical therapy should be considered for surgical excision. Surgery alone is associated with recurrence rates of 50%–80% and is therefore indicated only in compliant patients who are willing to undergo adjuvant therapy postoperatively to try to avoid a recurrence (*Cosman, et al 1961*).

Non-surgical treatment includes, over the counter or prescription creams, ointment or gel, steroid injection, collagen injections, fillers, low-dose radiation, interferon, pressure dressings, silicone application and laser (*Porter, 2002*).

Laser technology can now be used to improve different types of scars. It is imperative not only to

Introduction and Aim of the Work

categorize properly the type of scar present, but also to determine which laser or lasers can best treat them. When properly used, lasers can achieve superior clinical responses in scar improvement (*Alster, 1997*).

For erythematous, hypertrophic, and keloid scars, the 585-nm pulsed dye laser is used. Treatments should begin at lower fluencies, allowing for flexibility of upward adjustment depending on scar response. A combination of high-energy, pulsed CO₂ laser scar deepithelization followed immediately by the 585-nm PDL can be used to treat non erythematous hypertrophic scars that are not clinically erythematous. Pigmented scars can be treated by pigment-specific 510-nm pulsed dye, 532-nm frequency-doubled and Nd:YAG lasers. Atrophic scars usually resulting from acne, surgery, or trauma can be treated with CO₂ laser resurfacing (*Alster, 1997*).

Because of the increasing desire of patients for minimal downtime and decreased morbidity from elective cosmetic procedures, the non ablative laser resurfacing has gained widespread popularity.

While the results are highly variable and cannot compare with those obtained from ablative lasers, non ablative techniques are still deservedly popular.

Introduction and Aim of the Work

Examples of non ablative laser resurfacing are cool touch1320 YAG, smooth beam 1450 nm diode, pulsed dye intense pulsed light (*Leffell, 2002*).

Another new modalities of laser is Fractional photothermolysis which uses an array of small laser beams to create many microscopic areas of thermal necrosis within the skin. These areas of necrosis are deemed microscopic treatment zones. Fractional photothermolysis performed within these deemed microscopic treatment zones completely destroys the epidermis and dermis, but the necrotic injury heals rapidly and adverse effects are few (*Laubach and Manstein, 2007*).

Finally, treatments of scars will still one of the big challenges that annoy both plastic surgeons and patients in order to find the best successful and satisfied treatment options.

Aim of the Work

The aim of this assay is to discuss different types of scars, pathogenesis and different modalities of treatment and to clarify the role of the new laser modalities in the management of different types of scars.

Skin Anatomy

The skin is the outer covering of the body. It is the largest organ of the integumentary system made up of multiple layers of epithelial tissues, and guards the underlying muscles, bones, ligaments and internal organs. Skin plays a very important role in protecting the body against pathogens. Other functions include insulation, temperature regulation, sensation, synthesis of vitamin D, and the protection of vitamin B folates.

In all areas of the body it has the same basic structures; the epidermis, the dermis and the subcutaneous layer (*Veiro and Cummin, 1994*).

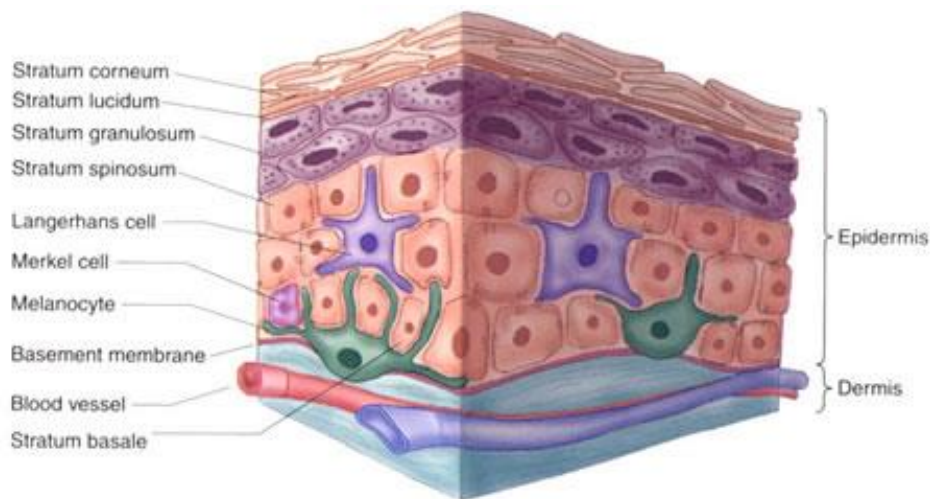


Figure (1): Diagram of the layers of human skin (*Karen, 2006*)

The epidermis:

The epidermis is the outermost part of the skin. It is approximately 0.04mm to 1.5mm in thickness. The epidermis consists of keratinized squamous epithelium that is supported and nourished by the dermis. The epidermis is formed of four types of cells: keratinocytes, melanocytes, langerhans cells and Merkel cells (Fig.1) (*Veiro and Cummin, 1994*).

I- Keratinocytes

Keratinocytes contain monofilaments in their cytoplasm and form desmosomes or modified desmosomal junction with adjacent cells. Keratinocytes are arranged in four layers in the epidermis. These different layers represent different stages of differentiation and functional activity.

a) Stratum Basalis (Germinatum) consists of a single layer of columnar or cuboidal cells that lie in a perpendicular plane to the epidermal-dermal junction. They are basophilic cells with melanin pigments transferred from adjacent melanocytes. The extent and distribution of these pigments correlates with skin color. Most of mitotic activity in normal epidermis occurs in the basal layer (*Paul and Melissa, 2003*).