



Evaluation of the efficacy of Polydioxanone threads versus autologous plasma gel for infraorbital rejuvenation

Thesis

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قالوا

سبحانك لا علم لنا
إلا ما علمتنا إنك أنت
العليم العليم

صدق الله العظيم

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List of Abbreviations

Abb.	Full term
ANOVA	Analysis of variance
DEC	Dark eye circle
DEJ	Dermal-epidermal junction
DNA	Deoxyribonucleic acid
ECM	Extracellular matrix
EGF	Epidermal growth factor
FDA	Food and Drug Administration
FGF	Fibroblast growth factor
GAGs	Glycosaminoglycans
HIV	Human immunodeficiency virus
IGF-1	Insulin-like growth factor-1
IOA	Infraorbital artery
IOF	Infraorbital foramen
ION	Infraorbital nerve
MMP	Matrix metalloproteinase
PCA	Poly-caprolactone
PDGF	Platelet-derived growth factor
PDO	Polydioxanone
PLLA	Poly-L-lactic acid
POH	Periorbital hyperpigmentation
PPP	Platelet poor plasma
PRFM	Platelet- rich fibrin matrix
PRP	Platelet rich plasma
ROS	Reactive oxygen species
RPM	Rotations per minute
SD	Standard deviation
TCA	Trichloroacetic acid
TGF-β1	Transforming growth factor-beta
TTRS	Tear trough rating scale
UV	Ultraviolet
VEGF	Vascular endothelial growth factor

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INTRODUCTION

Infraorbital dark circle refers to the darkness of infraorbital area below the lower eyelids. It is a significant cosmetic problem, and many individuals try to find a treatment for this condition (*Mehryan et al., 2014*)

Actually, infraorbital dark circle is a complex facial cosmetic problem with multiple causes, such as melanin deposition, venous stasis with hemosiderin deposition, and orbital structural problems such as infraorbital eye bags, infraorbital grooves, and loss of fat or soft tissue volume with bony prominence. Dark eye circle can be classified in to:

- P type: brown hue, combined facial pigmented lesions.
- V type: blue, pink, or purple hue, periorbital puffiness.
- S type: shadow hue, infraorbital bags, infraorbital grooves, blepharoptosis.
- M type: PV, PS, VS, PVS (*Huang et al., 2013*).

Histological characteristics of infraorbital darkening suggest that they are caused by multiple etiologic factors that include dermal melanin deposition, post inflammatory hyperpigmentation secondary to atopic or allergic contact dermatitis, periorbital edema, superficial location of vasculature, and shadowing due to skin laxity (*Freitag and Cestari, 2007; Sarkar and Das, 2018*).

The therapeutic approach of infraorbital dark circle must be varied according to the cause; in cases of excessive pigmentation, topical bleaching agents and chemical peeling are considered the classical therapies in infraorbital dark circle (*Nofal et al., 2018*). Complication of chemical peeling is postinflammatory hyperpigmentation (*Sarkar et al., 2016*).

Lasers, fillers, and autologous fat transplantation have been used with varying degrees of success. Although different modalities are available for the treatment of infraorbital dark circle, the outcomes of most of them are unsatisfactory (*Nofal et al., 2018*). Complication of filler injection in the lower eyelid; contour irregularities, bluish-discoloration or Tyndall effect, inflammatory reactions, and infection; Ischaemic complications, such as soft tissue necrosis and visual compromise (*Hwang, 2016*)

Studied the efficacy of platelet rich plasma in infraorbital circles is also tried. Improvement was noted so far as colour homogeneity of the region is concerned, but larger studies are required for external validity of the results (*Sarkar and Das, 2018*).

In fact, plasma gel has proved to reverse the ultraviolet light-derived skin photoaging, also known as solar elastosis, by inducing dermal fibroblast proliferation, preventing cellular apoptosis and promoting the neo-angiogenesis, which is translated into a thickened dermis with newly synthesized collagen and elastic fibres (*Fedyakova et al., 2018*).

An injectable autologous plasma gel-based 3D formulation has been recently described. This new gel-like formulation provides long-term shape and volume stability while delivering bioactive molecules thus enhancing tissue regeneration (**Fedyakova et al., 2019**). For correction of the aging face, surgeons are devising more procedures with fewer incisions and shorter postoperative recovery periods. Many of these procedures use absorbable and nonabsorbable sutures (**De Masi et al., 2016**).

Polydioxanone threads differ from the other biostimulators because they gradually induce a minimal foreign body reaction. This granulation tissue forms a scaffold which supports the sagging tissue and tightens the skin. It also improves skins vitality and elasticity (**Khalili, 2015**).

Upon collagen formation activation, the collagen fibres of the dermis thickened, and the elastic fibres were prolonged. These changes in collagen persisted for up to 12 months (**Yoon et al., 2018**).

PDO thread insertion was reported to not only tighten and lift the face but also to improve skin texture with brightened complexion and skin elasticity. However, the mechanism underlying these positive skin changes remained unclear. There was a study reporting increased collagen production around inserted PDO thread (**Yoon et al., 2018**).

AIM OF THE WORK

To compare between the efficacy and safety of threads versus autologous plasma gel for infraorbital rejuvenation

Chapter 1

INFRAORBITAL REGION ANATOMY, PATHOGENESIS OF DARK CIRCLE & SKIN AGING

I-Anatomy

The infraorbital region is a component of the midface and can be defined as the anatomical area between the nasal aperture and the zygomatic bone below the inferior rim of the orbit and above the roots of the maxillary canine and premolars. This area contains several clinically important structures including the infraorbital foramen (IOF), the infraorbital nerve (ION) and artery (IOA), and their various branches to the adjacent anatomical structures (*Ilankovan, 1991*).

Multiple fields of medicine operate in the infraorbital region including dentistry, dermatology, maxillofacial surgery, ophthalmology, plastic surgery, and rhinology. The neurovascular bundle of the IOF is therefore frequently encountered in a host of procedures in the infraorbital region including closure of simple lacerations, biopsies, scar revisions, cosmetic cutaneous procedures, oral and maxillofacial surgical interventions, and endoscopic maxillary sinus surgery. The identification and preservation of the ION in maxillofacial trauma, although at times challenging, are laudable goals. The most certain way to avoid damage to the ION is to understand

the structures and spatial relationships in the region contiguous with the IOF (*Cutright et al. 2003*).

The infraorbital space has been delineated as the area below the infraorbital foramen. The space is bounded by four facial muscles, i.e., medially by the levator labii superioris alaeque nasi, laterally by the levator anguli oris, at its superior margin by the origin of the levator labii superioris, and at its inferior margin by the orbicularis oris. The infraorbital space is covered by the levator labii superioris muscle (Chap. 2) (*Hu et al., 2006*).

Tear trough:

The tear trough was defined anatomically as the medial lower eyelid depression that is bounded medially by the anterior lacrimal crest and inferiorly by the inferior orbital rim (**Figure 1**). Biometric measurement of the tear trough depth was made with calipers using the following landmarks: one point of the caliper was placed on the bony prominence of the anterior lacrimal crest (the superior border of the tear trough), and the other was placed on the surface of the skin in the deepest portion of the tear trough (*Wong et al., 2012*).