Fat Graft with Growth Factors

Farzin Sarkarat, DMD*, Roozbeh Kahali, DMD

KEYWORDS

• Fat grafting • Autogenous fat transplantation • Maxillofacial

KEY POINTS

- One of the challenges facing maxillofacial surgeons is the correction of the facial soft tissue volume and contour defects.
- Today, numerous facial fillers and implants are available.
- Autogenous fat grafting has several advantages: it is biocompatible, versatile, abundant, easily harvested, natural looking, nonimmunogenic, and readily obtainable.

Introduction

One of the challenges facing maxillofacial surgeons is the correction of the facial soft tissue volume and contour defects.[1] Facial volume loss, static and dynamic rhytids (Fig. 1), and folds that are caused by skin laxity, facial muscle movements, and gravity are major causes of facial aging process. Today's cosmetic patients are increasingly desirous of minimally invasive procedures that require minimal recovery time. These patients are looking for maximal improvement with minimal recovery time, risks, and cost. Several methods are available for this purpose.

Today, numerous facial fillers and implants are available. One of the popular techniques, which is considered a gold standard technique for small to medium-sized defects, is autogenous fat transplantation. This technique is widely used for the correction of facial soft tissue defects, both congenital or acquired.[2,3]

Autogenous fat grafting has several advantages: it is biocompatible, versatile, abundant, easily harvested, natural looking, nonimmunogenic, and readily obtainable. Fat can be harvested in large amounts with low donor site morbidity and low cost. Autogenous fat grafting also has favorable physical characteristics.[2,4–6]

Using autogenous fat grafting instead of allograft or xenograft materials reduces the foreign body chronic inflammation reactions and the risk of infection.[2] This technique has become an effective option for treating facial lipodystrophy and depressed scars, augmenting nasolabial fold, and lip enlargement for more than a century.[7,8] However, the unpredictable resorption rate of fat grafts is its major drawback.[9–11] Resorption rates even up to 80% with low graft survival are reported.[12–14] Other disadvantages such as fat necrosis, calcifications, and oil cyst formation are reported.[2,15,16]

One of the most popular methods used to overcome the high resorption rate of fat grafts is overcorrection during the initial surgery. Sometimes several repeated surgeries for volume correction are also performed.[17] These additional procedures further increase the risk of graft infection and graft failure because of damaging the recipient site vascularity and blood supply, resulting in ischemia and graft necrosis.[18]

The most important factors playing role in fat graft survival include recipient site anatomy, immobility of the graft, vascularity of the recipient site, method of graft harvesting, and postharvesting treatments.[19,20] Fat graft should be harvested atraumatically with low pressure suction (Fig. 2).[21,22] Avoidance of contact with room air also increases the chance of graft survival (Fig. 3).[22] Washing the graft (Fig. 4) may also be an effective method in decreasing the resorption rate by removing the inflammatory mediators.[23]

In recent years, several attempts were made to identify agents that increase the fat graft viability and survival rate.[1] One of these agents is growth factors. Growth factors may increase graft survival rate and maintain fat graft volume.[24–27] In addition to fat grafts, several growth factors have been proposed, including basic fibroblast growth factor (bFGF), insulinlike growth factor (IGF), platelet-derived growth factor (PDGF), and vascular endothelial growth factor (VEGF).[18,27,28] This article reviews the effects of different growth factors on fat graft survival.

Platelet-derived growth factor

PDGF is one of the many growth factors that regulate cell growth and division. It is a potent mitogen of several cell types. PDGF is released from platelets during clot formation. PDGF acts on PDGF receptors, which have important functions in the regulation of growth and survival of certain cells.

PDGF is able to stimulate growth of preadipocytes in vitro.[29] Also PDGF has an antiapoptic effect on adipocytes in serum-free culture conditions.[30,31]

Several mechanisms are described that explain the role of PDGF on increasing the fat graft survival rate. First of all, PDGF promotes the maintenance of the adipocyte architecture. It also inhibits fat graft degeneration into cysts and fibrous

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Department of Oral and MaxilloFacial Surgery, CranioMaxilloFacial Research Center, Buali Hospital, Islamic Azad University of Medical Sciences, 10th Neyestan Street, Pasdaran Street, Tehran 1946853813, Iran

* Corresponding author.

E-mail address: sarkarat@hotmail.com

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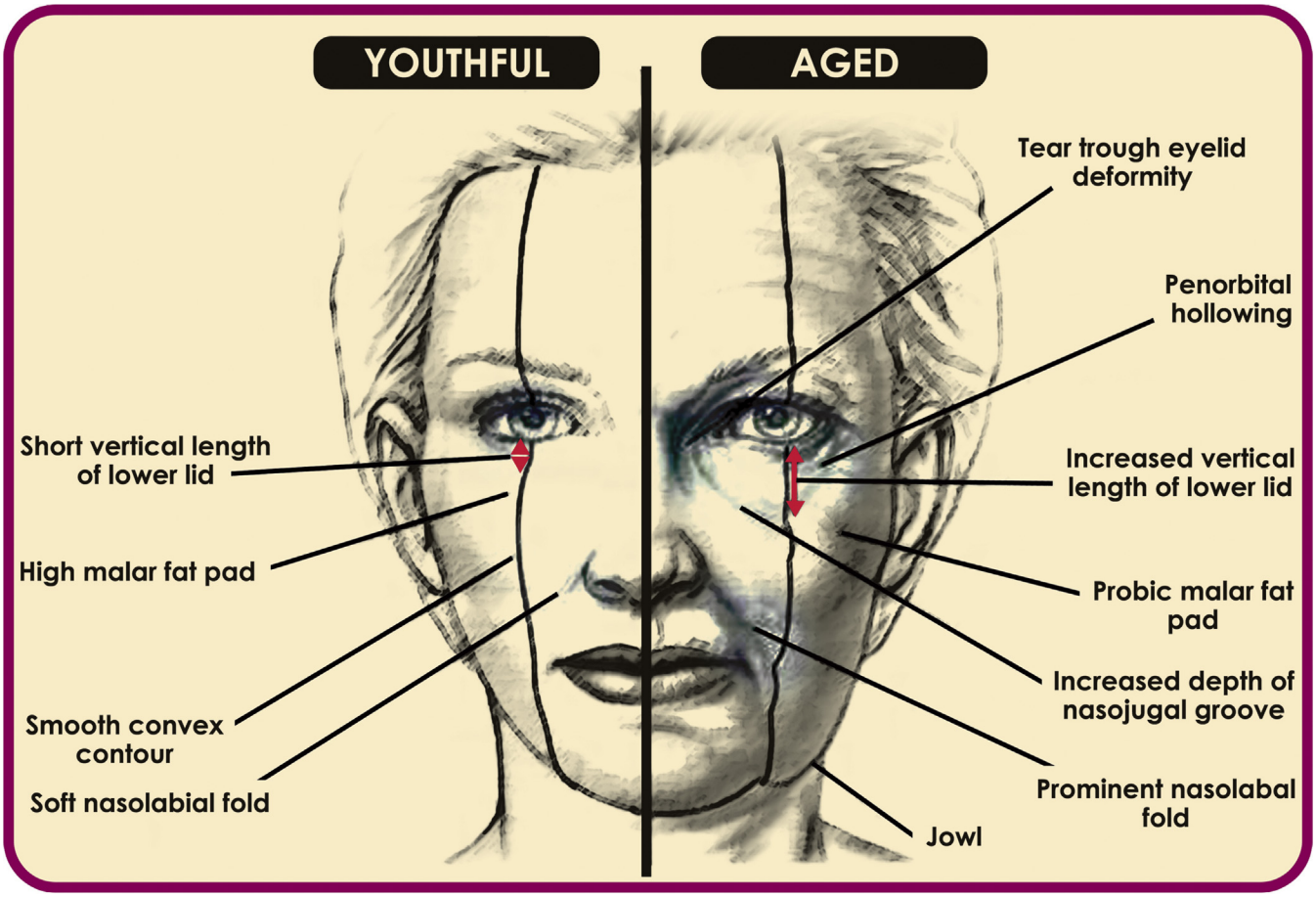

Fig. 1 Comparison of youthful features and aged features.

tissue. Finally PDGF increases the area of fat graft cellular infiltration around small cysts.[3]

Insulinlike growth factor

The IGFs are proteins with high sequence similarity to insulin. IGF, formerly called *somatomedin*, is one of any of several peptide hormones and function primarily to stimulate growth.

Many distinct tissue types express the IGF receptor. IGF acts as a neurotrophic factor. It also catalyzes skeletal muscle hypertrophy by blocking muscle atrophy. It is protective for cartilage cells and activates osteocytes. IGF receptors are also

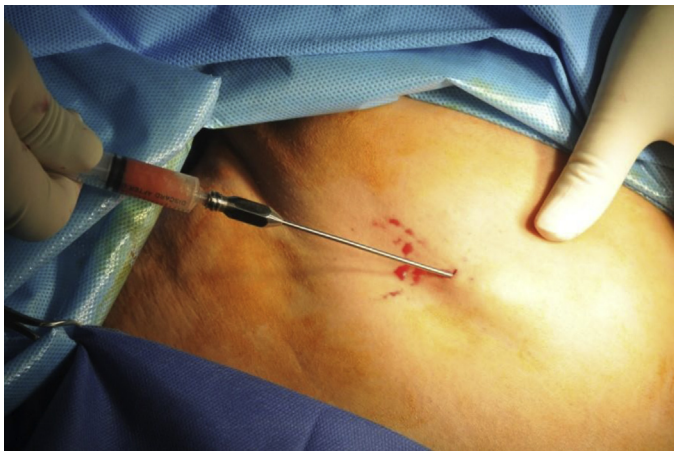

Fig. 2 Fat graft should be harvested atraumatically with low-pressure suction.

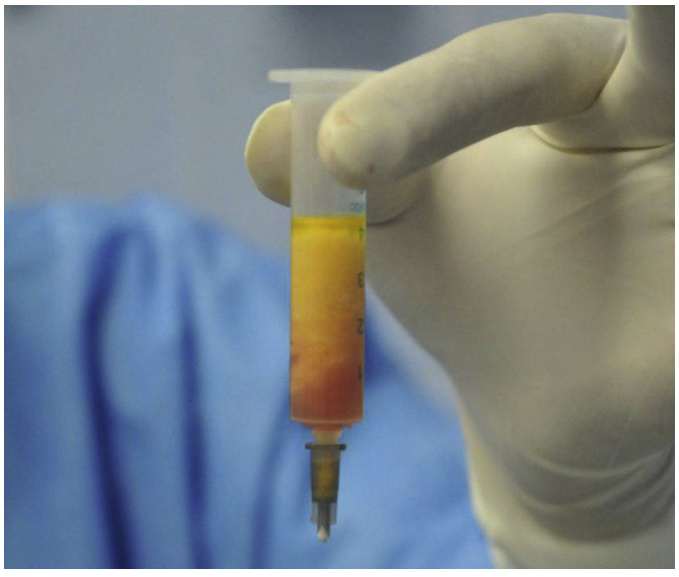

Fig. 3 The chance of fat graft survival decreases when in contact with room air.