Clinical applications of Fat Graft transfer in Plastic surgery

Essay

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By

Haitham Shoaib Alnagar
Resident doctor of plastic surgery Nasr City insurance hospital
M.B., B.CH

Under Supervision of

Prof. Dr. / Ahmed Alaaeldin Abdelmaged
Professor of General Surgery
Faculty of Medicine -Ain Shams University

Prof.Dr. / Ayman Aboalmakarem Shaker
Professor of plastic surgery
Faculty of Medicine -Ain Shams University

Dr. / Yaser Abdallah Abdelaziz
Lecturer of plastic Surgery
Faculty of Medicine -Ain Shams University

Faculty of Medicine
Ain Shams University
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Haitham Shoaib Alnagar

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INTRODUCTION

The first report for the usage of autologous fat graft from liposuction for contouring and filling defects was published by Illouz in 1983. At the same year Johnson extended the use of autologous fat injection for contouring defects of the buttocks, anterior tibial area, lateral thighs, coccyx area, breasts, and face. ***(Illouz et al 1986).***In 1987 The American Society of Plastic and Reconstructive Surgery Committee (ASPRS) reported that autologous fat injection has a historical and scientific basis yet, it is still an experimental procedure and achieved varied results. Long-term controlled clinical studies are needed before firm conclusions can be made regarding its validity**.**

Most of ideas concerning fat transfer procedures are done for augmentation of tissues, filling defects, filling furrows (wrinkles) and refill lost supportive tissue (aging). Fat graft is used for cosmetic purposes as facial rejuvenation, acne scars, face lift, nasal augmentation and breast augmentation. Also there has been a surge for the use of fat graft for non-cosmetic purposes such as hemi-facial atrophy and treatment of ulcers ***(Berdeguer, 2004).***

Fat cells survival depends on many factors including vascularity, technique and diameter of the used cannula. Concerning vascularity, graft success is favored with low vascularity of donor site and high vascularity for recipient site. Techniques that improve fat cells survival include low pressure technique of aspiration of fat, filtering and washing harvested

adipocytes and the use of wide cannula for injection minimizing adipocyte injury. Multilayered deposition technique for fat injection gives better results. Overcorrection of the recipient site is preferred to overcome expected resorption ***(McCurdy, 1995).***

Fat harvesting should be a traumatic using blunt harvesting cannula to preserve maximum amount of adipocytes. Aspiration should be low pressure aspiration system by syringe. No true consensus as to donor site or anesthesia used. Processing of aspirated fat for reinjection have wide range starting from basic technique of washing and concentration up to more complex measures such as adding of various additives and extensive centrifugation. Injection is better done using 1 ml syringe and no greater than 18 gauge injection needle or cannula to precise small amount .Sub-dermal injection is important for long-term results .Thin layer or strands of fat with multiple passes if necessary is considered the standard care ***(shiffman, 2010).***

Complications of fat grafting are not so harmful. Infection is uncommon if sterility of fat retrieval and injection maintained .Bruising, temporary swelling, and tenderness may result from fat transplantation. Calcifications have only been reported in fat transplantation to the breast for augmentation. The most common complication of autologous fat graft is resorption of about 30-50% of injected fat cells ***(skouge et al, 1992).*** For this reason 30–50% over-injection is ordinarily used ***(Asadi and Haramis, 2003).***

There has been a controversy concerning the manner of collecting, injecting and cleansing the fat and the effectiveness of the fat transfer. The process of fat transplantation has not yet been standardized, and there is a need to analyze some of the methods and results Long-term results of fat grafting are still unpredictable and for this reason many physicians have been disappointed with

the procedure. Long-term results of fat grafting are still unpredictable and for this reason many physicians have been disappointed with the procedure ***(Shiffman, 2010).***

Aim of the Work

The aim of this study is to illustrate the clinical application of autologous fat graft in the different aesthetic and reconstructive procedures.

Fat cell histology

ADIPOSE TISSUE

Adipose tissue is specialized connective tissue that functions as the main storage site for fat in the body. Adipose tissue in mammals is found in two main forms: white adipose tissue and brown adipose tissue. The presence and distribution of each type depends upon the species and most of it is of the white type ***(Van Dielen et al., 2002).***

Body fat molds the external appearance of the body and its contouring around the musculoskeletal system. White adipose tissue serves three main functions: heat insulation, mechanical cushion and as a source of energy. Subcutaneous fat is found directly below the skin and serve as an important heat insulator in the body as it conducts only one third as readily as other tissues. The degree of insulation depends on the thickness of this layer. Adipose tissue surrounding internal organs provides protection for internal organs from jarring ***(Huang et al., 2001).***

As the major source of energy storage, fat provides buffer for energy balance in case of imbalance between energy intake and output. It is an efficient way to store excess energy because it is stored with little amount of water. Consequently, more energy can be provided per gram of fat (9 kcal) than per gram of carbohydrate (5 kcal) or protein (4kcal). In addition if human stored excess energy as carbohydrate it would interfere with mobility ***(Van Dielen et al., 2001).***

Brown adipose tissue derives its color from rich vascularity and densely packed mitochondria. It is found in various locations depending on species and/or age of the animal. In the rat, brown adipose tissues found primarily in the inter-scapular region and

axilla, minor amounts are found near the thymus and in the dorsal midline region of the thorax and abdomen. During maturation in non-hibernating animals, brown adipose tissue is metabolically less active, although cold exposure can activate it. In hibernating animals and neonates, brown adipose tissue is important for regulating body temperature via non-shivering thermogenesis ***(Pitman,1993)***.

The lipid in brown adipose tissue releases energy directly as heat and is, therefore, used in heat production for non-shivering thermogenesis and for utilization of excess caloric intake via diet-induced thermogenesis. The mechanism of heat generation is related to the metabolism of the mitochondria ***(Huang et al., 2001).***

Anatomy of the adipose tissue

There are three layers of subcutaneous fat: apical, mantle, and deep layers (figure 1)

1. Apical layer

This layer lies beneath reticular dermis. It surrounds superficially sweat gland and hair follicles. Slightly deeper, the apical layer surrounds vascular and lymphatic channels and it tends to be yellow in appearance. Because of its vascular, neural and lymphatic content, this layer should be avoided in liposuction. Extensive disruption of this layer and its elements can lead to seroma, erythema, hyperpigmentation and even full thickness dermal necrosis. This problem can be avoided using narrow bore cannula during liposuction ***(Lalikos et al,. 1997).***

2. Mantle layer

This layer lies beneath the adipocytes investing dermal structures. It is a part of superficial fat layer. It is separated from the deep layer of fat by a fascia-like layer of fibrous tissue. This layer is absent in the eyelids, nail bed, bridges of nose and the penis. Significance of this layer is contribution of the skin ability to resist trauma and to distribute external pressure across a large field like mattress absorbing sitting pressure ***(Lalikos et al,. 1997).***

3. The Deep Layer

This layer extends from the undersurface of the mantle layer to the muscle fascia below. Its shape and thickness depend on sex, genes and diet of the individual. This layer is best suited for lipo-sculpture. Fat cells in this layer are arranged in pearls, and the pearls are arranged in globules. These globules are then packaged like egg crate between fibrous septa and are arranged between tangential and oblique fibrous planes ***(Kessel, 1998).***

Histologically tangential planes are thicker and run parallel to the underlying muscle fascia, but they are of little consequence when performing liposuction. Oblique planes are thinner and interconnect the tangential fibrous layers. They hold fat globules in their relative positions. Though thinner, they are of cosmetic consequence because the vertical arrangement of subcutaneous fat from the skin to the muscle fascia is the cause of cellulite ***(Kessel, 1998).***

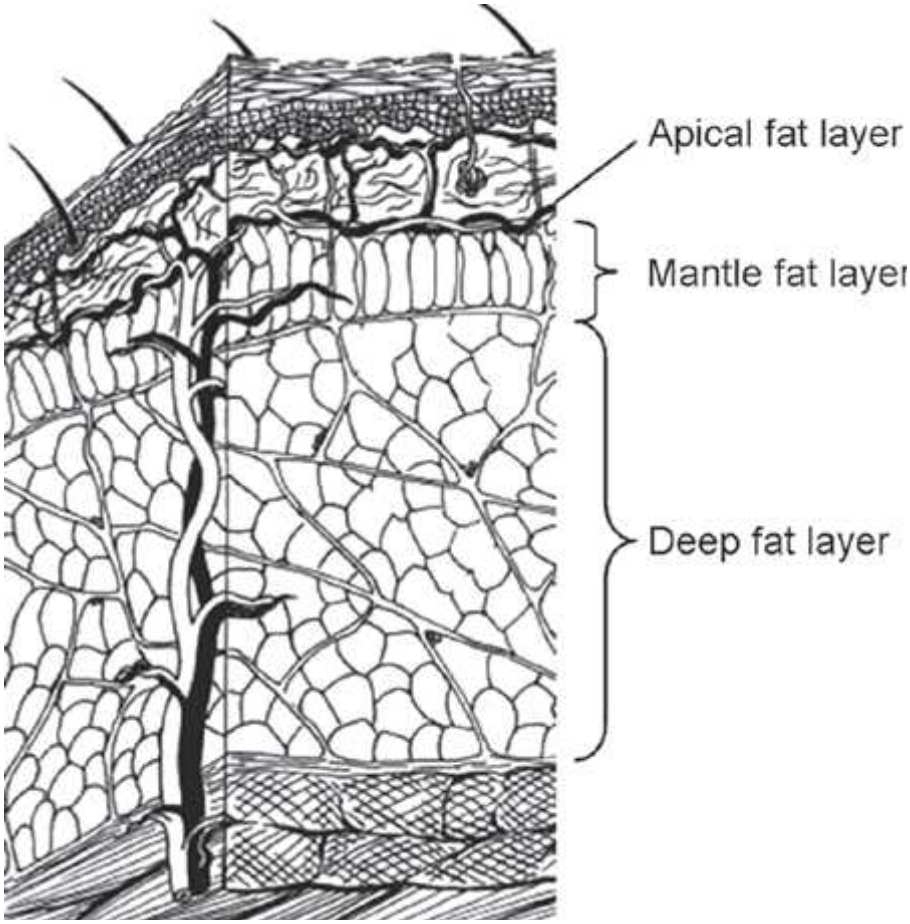

Figure (1) general structure of adipose tissue

Anatomy of adipose tissue in different regions of surgical importance:

1. Deep fascia of the neck

A wattle is produced by accumulation of excess fat between platysma and superficial layer of deep cervical fascia, which is superficial to the anterior bellies of the digastric muscle. The fat beneath the platysma is amenable to liposuction. However, the fat between the digastric muscles and beneath the superficial layer of the deep, or the investing fascia of the neck