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Calf and Leg Augmentation: Autologous Fat or Silicone Implant?

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ABSTRACT

Thin leg in our culture causes body image problems, this deformity can be corrected either by inserting silicone calf prosthesis or using autologous fat transfer.

Methods: 22 patients with thin legs were treated in this study, 15 of them treated using autologous fat transfer, and 7 patients treated by inserting a silicone calf prosthesis. Regarding the 15 patients who were treated using autologous fat transfer, thin and asymmetric parts are marked while the patient is standing; fat cells are harvested under local anesthesia, using syringe and 2mm cannula. The harvested solution is centrifuged to eliminate blood and lipids. The isolated fat grafts are injected into the thin legs in different layers using 2mm cannula. Regarding the other 7 patients, a silicone calf prosthesis of different sizes are implanted under general anesthesia into the subcutaneous tissue over the gastrocnemious muscle through transverse incision in the popliteal fossa.

Results: Between 2005 and 2009, 22 patients underwent calf augmentation. Follow-up ranged from 1-4 years. The outcome was satisfactory in most cases. In cases of fat transfer group, good improvement was achieved in 10 cases, and moderate improvement in 5 cases. In cases of silicone gel prosthesis group, 4 cases had good improvement, 2 cases had moderate improvement, and one case developed infection at one side and the implant was removed bilaterally.

Conclusion: Leg augmentation using either autologous fat transfer or silicone prosthesis offers good, long lasting results with the possibility of future touch up.

INTRODUCTION

Aesthetics is the study of beauty, and beauty can be seen but difficult to be described or defined, as the perception of beauty is subconscious. Ricketts **[1]** analyzed structure, harmony, balance, and proportions of the human body, applying mathematical and geometric calculations. The aesthetically ideal, golden proportions were known to the ancient Egyptians and were applied in the art and architecture in the ancient Greece **[2]**. Recently, legs have become very important secondary gender characteristics in both men and women. Patients may be unhappy with their thin or asymmetric legs which may cause body image problems. Many patients now are seeking help from plastic surgeons to correct their leg deformity. Patients know that there will be no restoration of impaired function, but would like to have beautiful legs **[3]**.

Causes of calves' deformities include:

1- Sequel of club foot and or cerebral palsy and spina bifida.

2- Congenital hypoplasia and/or aplasia or reduction of subcutaneous cellular adipose tissue, muscular hypotrophy or atrophy.

3- Poliomyelitis and osteomylitis.

4- Trauma following fractures of femur and contracture resulting from burns **[4]**.

Howard **[5]**, described the ideal length proportions of the calves and used drawings by Leonardo Davinci as the basis for this analysis. The golden ratio of calf aesthetics was defined as the distance between the ankle and the lower border of the gastrocnemius muscle, being equal to the distance between the knee and the most prominent point over the medial curvature of the gastrocnemius muscle. The entire length of the gastrocnemius muscle is 1.6 times the former value. Szalay **[6]** determined an attractive range for the female calf circumference to be between 33 and 36cm and a much thinner or thicker calf was considered aesthetically unacceptable.

PATIENTS AND METHODS

Preoperative planning: First, standard photographs of the legs are taken; the thin, asymmetric parts of the legs to be augmented are marked while the patient is standing. The depressed area is observed at the anteromedial aspect of the tibia from the knee to the ankle.

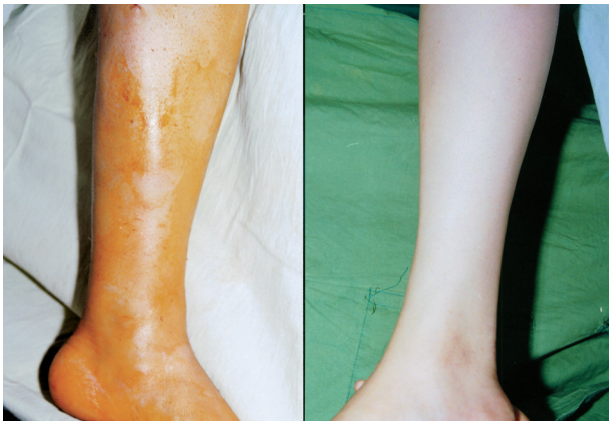

Fig. (1): Fat injection under local anesthesia.

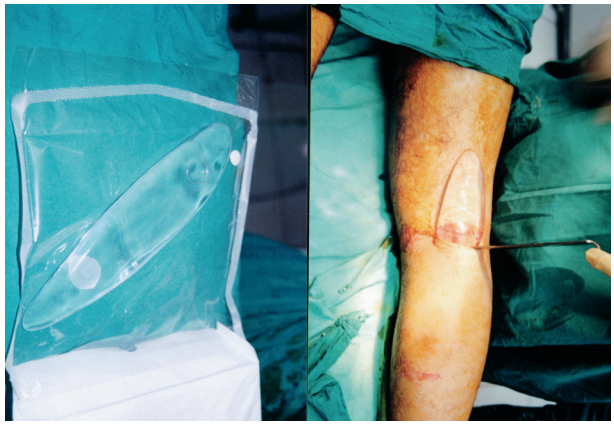

Fig. (2): The silicone calf implant introduced into its pocket.

Figs. (3,4): Pre and post-operative results of fat injections.

Fig. (5): Pre and post-operative results of silicon calf implantation.

In cases of autologous fat transfer, the patients were interested with their lower parts of the legs. Fatty tissue was obtained under local anesthesia mainly from the abdomen and the flanks. In few cases we used fat from the buttocks and the trochantric regions. 0.5% lidocaine with epinephrine (1: 200,000) were used to the donor and the recipient areas using an insulin needle. Epinephrine will reduce postoperative ecchymoses and create vasoconstriction of vessels to reduce risk of embolism. The fatty tissue was collected using a syringe and 2mm cannula then washed with Ringer's solution. The harvested fat is then centrifuged for 3 minutes at 3000 rpm. The extracellular lipids and blood are discarded and one gram of third generation cephalosporin is added. A total of 100cc of fat is injected into each leg. Small amounts of mini grafts are injected into different layers using 2mm cannula. No over correction is performed to ensure maximum vascularization as it was found that vascularization of small grafts is much better than for larger ones (Fig. 1). Injections are repeated as touch ups for 7 cases using small amounts of stored frozen fat 3 months post-operatively.

In cases of silicone calf prosthesis, patients were mainly concerned with the upper part of their legs. The procedure is performed under general anesthesia. Local epinephrine is injected (1: 200,000) to reduce the incidence of hematoma. 3rd generation cephalosporin is given one hour

prior to surgery. A 7cm length incision is done at the lowest transverse crease in the popliteal fossa; the incision is deepened till the deep fascia. The deep fascia is then cut transversely and the dissection under the deep fascia goes caudally using plunt dissector down till the lower limit of the gastrocnemius muscle. After finishing dissection, bilateral release of the deep fascia is then done longitudinally using long scissor to prevent muscle compression. After securing the pocket and complete haemostasis achieved, silicone calf prosthesis (size from 250cc to 350cc) is implanted into the pocket (Fig. 2). The deep fascia is then closed using monocryl 3-0 sutures and the wound is then closed in 2 layers. An external crib bandage is applied to prevent hematoma collection.

Evaluation: Clinical assessment of the patients was performed by three persons (the patient, the physician and an independent person who might be a relative or friend of the patient). They asses the preoperative and postoperative digital pictures of the patient. They rated the improvement in overall clinical appearance using the following scale: 0 = No improvement, 1 = Minimal improvement, 2 = Moderate improvement, 3 = Good improvement.

RESULTS

Between 2005 and 2009, 44 calf augmentations was performed in 22 patients. 15 of them used autologous fat transfer with an average age of 27 (range from19-39 years) all were females. The average time for the procedure of harvesting and injection of fat was 45 minutes. A total of 60cc to 130cc (mean, 100cc) of fat was injected into each leg. Repeated injections of 50cc of fat after 3 months were performed in 7 patients as touch ups. Follow-up ranged from 1 to 36 months.

Visible improvement was obtained in all of the patients. The outcome was satisfactory in most of our patients, none of them showed minimal or no clinical improvement, moderate improvement achieved in 5 patients (33%), and good improvement in 10 patients (66%). Asymmetries were observed in 6 patients after the 1st injection, but these were corrected with a second injection. No infection was seen in any of the fat injection cases (Figs. 3,4).

Seven patients were treated using silicone calf prosthesis, six patients were males and one patient was female. The average age was 24 years (range 21 to 29 years). The implant size ranged from 250cc to 350cc. The average time for the procedure of implantation was 110 minutes. Follow-up ranged from 1 to 48 months. The results of silicone implant was good in 4 patients (57%), moderate in 2 patients (28%) (Fig. 5). In one case (7%), infection developed at one side, the patient decided to remove implant bilaterally, and he refused to do anything more. Two patients were complaining of palpable lower edge of the implant and this was treated later by lipofilling around that area.

DISCUSSION

Recently, legs have become very important secondary gender characteristic in both women and men. Female patients and young male athletes may be unhappy with slim calves, which may causes body image problems. Calf augmentation is indicated for cosmetic reason or to reconstruct lower leg deformity caused by trauma, disease or congenital underdevelopment **[7]**. The shape of the calf is determined by the development of gastrocnemius muscle and soleus muscle, the length and orientation of bones, and subcutaneous fat distribution **[8]**.

The principle of restoring volume and shape with the insertion of silicone implants is well known and has proven reliability over years. Calf implants are made of semisoft silicone which can be customized by carving, or of a thick shell of silicone containing cohesive silicon **[9]**. Calf augmentation can be achieved by the insertion of the implant below the deep fascia of the calf. Problems associated with silicone implants include infection (as we have one case in our study), extrusion, and visible capsular contracture. Although we used in our study the soft implants with cohesive silicone, some patients were complaining of palpable edges of the implant (2 patients) and this problem was solved by lipofilling around the implant edge. Calf prosthesis desired mainly by young athletic men who were unhappy with their slim calves (6 males out of 7 cases). But these prosthesis are unable to correct deformities at the ankle region and has the disadvantages of displacement, extrusion, and having abnormal consistency of the leg **[10]**; as the implant itself is considered as foreign material for the body. The last disadvantage is that the need for general anesthesia for all the patients as this technique can't be done under local anesthesia.

Autologous fat transfer was developed to overcome the drawbacks of silicone injections and implants **[11]**. Many literatures found that the use of fat injections for correction of calf contour

deformities demonstrated excellent results [12]. Muscle mass can be changed with sports and physical activity, but the subcutaneous mass can be changed easily by lipofilling. Autologous fat injection offers the advantage of being able to add tissue where one chooses. It's very effective, easy to perform under local anesthesia, long lasting and associated with short postoperative recovery time. The outcome was satisfactory in most of our patients with moderate improvement in 33% and good improvement in 66% of patients. The only disadvantage of fat injection is some resorption and thus the requirement for repeated injections, or touch-ups. One or two injections are sufficient to obtain suitable and permanent results.

Conclusions:

Calf augmentations were performed in 22 patients with 44 slim calves. Seven patients were treated with silicone calf implants and 15 were treated with autologous fat transfer. Silicone implants were more suitable for young athletic males as it improves mainly the upper part of the leg. On the other hand it doesn't fit the lower part of the leg. Fat injection offers many advantages including the use of local anesthesia, no scarring, less complications. On the other hand it may need touchups injections.

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