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Autologous fat graft as treatment of post short stature surgical correction scars

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ABSTRACT

Introduction: Surgical limb lengthening is undertaken to correct pathological short stature. Among the possible complications related to this procedure, painful and retractile scars are a cause for both functional and cosmetic concern. Our team has already shown the efficacy of autologous fat grafting in the treatment of scars with varying aetiology, so we decided to apply this technique to scars related to surgical correction of dwarfism. A prospective study was conducted to evaluate the efficacy of autologous fat grafting in the treatment of post-surgical scars in patients with short-limb dwarfism using durometer measurements and a modified patient and observer scar assessment scale (POSAS), to which was added a parameter to evaluate movement impairment.

Patients and methods: Between January 2009 and September 2012, 36 children (28 female and 8 male) who presented retractile and painful post-surgical scars came to our unit and were treated with autologous fat grafting. Preoperative and postoperative mean durometer measurements were analysed using the analysis of variance (ANOVA) test and POSAS parameters were studied using the Wilcoxon rank sum test.

Results: There was a statistically significant reduction in all durometer measurements (p-value <0.05) and in all but one of the POSAS parameters (p-value <0.05) following treatment with autologous fat grafting.

Discussion: Surgical procedures to camouflage scars on lower limbs are not often used as a first approach and non-surgical treatments often lead to unsatisfactory results. In contrast, our autologous fat grafting technique in the treatment of post-surgical scars has been shown to be a valuable option in patients with short-limb dwarfism.

Conclusion: There was a reduction of skin hardness and a clinical improvement of all POSAS parameters in all patients treated. Moreover, the newly introduced POSAS parameter appears to be reliable and we recommend that it is included to give a more complete evaluation of patient perception.

Introduction

Dwarfism is defined as a disproportionate shortness of stature with normal body proportions [1]. Limb deformities are prevalent in short-limbed dwarfs, such as achondroplastics or pseudoachondroplastics, whereas other conditions can severely affect the axial skeleton, producing neurological sequelae. Achondroplasia is the most common form of short-limb dwarfism in humans, affecting more than 250,000 individuals worldwide [2]. Children affected by these pathological conditions undergo surgical limb lengthening to increase stature [3,4].

Orthopaedic procedures involve a progressive staged bilateral limb lengthening supported by external fixation of the femur, tibia and humerus. As much as 15–30 cm lengthening can be achieved; however, these procedures can lead to several complications, such as non-unions, axial deviations, re-fractures and deep or superficial skin infections. There are also cosmetic issues associated with

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these procedures: metal pins and K-wires used in external fixators to stabilise osteotomies and to enable lengthening always lead to important and sometimes painful scars; these scars are the consequence of the stretching of soft tissues during limb lengthening [5–9].

Our team has already shown the efficacy of autologous fat grafting in the treatment of scars with varying aetiology and reported an important improvement in tissue features and pain [10–14]. In our clinical experience, this treatment is associated with amelioration in scar quality from an aesthetic and functional point of view. We were also able to relieve symptoms caused by scar contraction in different anatomical areas in numerous cases treated. Following on from this experience, we decided to treat scars related to surgical correction of pathological short-limb dwarfism with autologous fat grafting. An interventional study was conducted to investigate the efficacy of autologous fat grafting in the treatment of post-surgical scars in patients with short-limb dwarfism using durometer measurements and a modified patient and observer scar assessment scale (POSAS).

Patients and methods

Patients

Between January 2009 and September 2012, 36 children (28 female and 8 male) affected by short-limb deformity syndrome who presented retractile and painful scars in both thigh and leg caused by surgical correction of short stature came to our unit and were treated with autologous fat grafting. The mean age of the patients was 16.54 ± 1.2 years (range 14–18 years). All scars treated were in the lower limbs. Scars above bony prominences were excluded because the hardness of the underlying tissue could influence durometer measurements [15]. Patients were excluded from the study if they had diabetes, a metabolic condition that is rather common particularly in achondroplastic children and affects wound healing. Inclusion and exclusion criteria are shown in Table 1. All patients gave their informed consent to participate in the study.

Study protocol

A clinical assessment of the study population was conducted using a modified POSAS, to which a new item had been added, and durometer measurements. At time zero, two areas of the scar were chosen, one as the case area and the other as the control area, and in both areas three measurements of skin hardness were taken using a durometer (REX GAUGE type 00; Rex Gauge Durometer Buffalo Grove, IL).

The harder part of the scar was chosen as the case area because this is the scar tissue that mostly needs treatment; a softer part of the scar was chosen as the control area. To further improve the accuracy of measurements a complete photographic documentation of all preoperative areas was collected.

Table 1
Inclusion and exclusion criteria.

Inclusion criteria
Painful and retractile scars
Age patient ≥8 years
Age scar ≥1 year
Received previous treatment
Exclusion criteria
Keloids
Pathological conditions that alter wound healing (e.g. diabetes)
Therapies that alter wound healing (e.g. steroids, chemotherapy)
Scars above bony prominences

The area to be evaluated was located with a measuring tape. The distances from the borders were measured to ensure the same scar points were used in the postoperative follow-up control; this is fundamental to reduce any source of bias.

Before durometer measurements were taken, the scar was evaluated using the POSAS. Scar evaluation and durometer measurements were conducted by the same observer. The order of assessment was kept constant, with POSAS first then durometer measurements, to prevent objective measurements from influencing the observer.

The correlation between each item of the subjective part of the POSAS and the patient's overall opinion of the scar was calculated to evaluate which parameter was most closely related to overall patient satisfaction.

Finally, the reproducibility of the new item of the subjective part of the POSAS was assessed by repeating the questionnaire on two different and temporally distant occasions. Postoperative follow-up control was 3 months after surgery (mean 95 ± 16 days) for both POSAS evaluation and durometer measurements. No patients were lost at the postoperative follow-up.

Patient and observer scar assessment scale (POSAS)

The POSAS consists of two scales: the observer scale and the patient scale [16]. The former contains five items: scar vascularisation, pigmentation, relief, thickness and pliability. The latter comprises six items regarding the characteristics of the scar: colour, stiffness, thickness, shape, itching and pain. Each item on both scales has a 10-step score, with 10 indicating the worst imaginable valuation. Both scales contain an overall 10-step score that assesses the overall opinion of the observer and patient. Again, the value 10 corresponds to the worst imaginable scar.

We decided to add an item to the patient section of the POSAS to investigate scar-related movement impairment. The main concern related to retractile post-surgical scars in patients who have undergone short stature surgical correction is limitations to movement (Fig. 1). For this study, we used the translated Italian version of the POSAS.

Durometer measurements

The durometer is a spring instrument to measure skin pliability in terms of skin hardness; it has a 5-mm-diameter round, non-invasive gauge head and a value range between 0 and 100. The measurements of each area were taken perpendicularly to the plane of the scar for 10 s after leaning the instrument to make the reading accurate; measurements were taken three times in the same point to get an average value. The measurements were conducted at 25 °C room temperature and 50% humidity with air conditioning, according to manufacturer's instructions.

Surgical procedure

All patients selected for the autologous fat graft procedure underwent clinical assessment and routine preoperative examinations. The surgical procedure was performed under local anaesthesia and sedation assisted with sterile technique. Abdomen and/or trochanteric areas were preferred donor sites.

Following preliminary skin incision, donor areas were infiltrated using a blunt cannula filled with anaesthetic solution (100 mL saline solution, 10 mL levobupivacaine 7.5 mg/mL, 20 mL mepivacaine 10 mg/mL and 0.5 mL epinephrine 1 mg/mL). Infiltration provides good haemostasis and adequate operative and perioperative analgesic action. Adipose tissue is harvested through the same incision by infiltration of anaesthetic solution using a blunt cannula. The cannula used for sampling is connected with a