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Autologous dermis-fat grafts in head and neck patients: Indications and evaluation in reconstructive surgery

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Summary

Purpose: The aim of this study was to examine the indications and results of autologous dermis-fat grafts in the reconstruction of maxillofacial soft-tissue defects.

Materials and Methods: A total of 93 patients with dermis-fat graft reconstruction due to a soft tissue defect in the head and neck region were enrolled in this retrospective clinical study between March 2002 and January 2017. They were classified into the subgroups ‘parotid surgery’, ‘orbital surgery’, and ‘facial surgery’. All the patients were evaluated for wound complications, and the general indications were discussed.

Results: In all, 96 dermis-fat grafts were performed in 93 patients. A total of 34 complications that arose in 30 patients were assessed. The dermis-fat graft was primarily transplanted in 50 cases and secondarily in 46. Of the patients, 90 showed well-integrated dermis-fat grafts. A major complication occurred in three patients.

Conclusion: Dermis-fat grafts for the reconstruction of maxillofacial soft-tissue defects represent a reliable method with a low rate of major complications. The graft can be used as a primary as well as secondary transplant. Especially in parotid and orbital surgery, the dermis-fat graft appears to be a transplant of choice. It can also be used as an alternative in facial surgery, lip enhancement, and special individual cases.

Keywords: dermis-fat graft; transplant; soft-tissue defect; reconstruction; indications; facial contour

INTRODUCTION

Soft-tissue defects in the field of oral and maxillofacial surgery arise from different causes, including congenital, post-traumatic, post-surgical, and degenerative diseases *(Davis et al., 1995)*. These can therefore be both congenital and acquired and thus can occur at any age. Consequently, this results in functional and esthetic problems with asymmetry, a decrease in self-esteem, as well as a reduction in the patient's quality of life *(Bhattacharjee et al., 2014)*. Therefore, many patients wish to have esthetic facial profiling with a perfection of symmetry. Due to the complex anatomy and various functional units in the head and neck area, a uniform therapeutic concept does not exist. In addition, the initial situations appear to be highly individual so that demanding and patient-adapted concepts are necessary. That is why reconstructive surgery is becoming increasingly important nowadays. It provides a variety of restorative procedures by means of constantly refined techniques. Thus, it is not surprising that the question about secondary corrections is steadily increasing to improve existing facial asymmetries.

The principal goals of maxillofacial reconstruction are: 1) closing the defect, 2) restoring symmetry, 3) restoring function, 4) hiding the scar, 5) choosing the simplest method and approach, and 6) reaching the best and satisfying patient-adapted results. Different techniques, grafts, and implants are used to reconstruct soft-tissue defects. These should be biocompatible, relatively inexpensive, always available, non-infectious, non-allergenic, non-toxic, variable in size, and able to avoid resorption as far as possible.

On the one hand, it is possible to use a variety of local flaps, such as advancement flaps, transposition flaps, and rotation flaps. In the case of major defects, the nasolabial flap *(Rahpeyma and Khajehahmadi, 2016)*, forehead flap *(Menick, 2002)*, and cheek rotation

flap *(Moretti et al., 2005)*, in particular, are to be emphasized. On the other hand, regional pedicled flaps, such as deltopectoral flaps *(Ma et al., 2017)* or pectoralis major myocutaneous flaps *(Liu et al., 2017)*, can be used. Third, a free tissue transfer is possible. Here, skin grafts *(Tsur et al., 1991)*, free-fat grafts *(Chan et al., 2014)*, dermis-fat grafts *(Hawtof, 1975)*, cartilage grafts *(Lopes et al., 2011)*, composite grafts, or bone grafts *(Krastinova et al., 2001a)* are applied, although bone transplants are especially used in combined soft tissue and bony defects. Fourth, all types of microvascular anastomosed grafts, such as the radial forearm flap *(Li et al., 2008)* or latissimus dorsi flap *(Kosutic et al., 2008)*, are transplanted. Other possibilities are allografts, such as AlloDerm® *(Govindaraj et al., 2001)*. This acellular dermis is processed from a human cadaver skin after the removal of the epidermis and the cellular components of the dermis through a freeze-drying process, which is utilized particularly in parotid surgery. Alloplastic materials or implants can also be used. In particular, patient-specific implants *(Toso et al., 2015)* are increasingly inserted even if the main indication is a bony defect.

It is obvious that not all forms of facial contour defects can be treated with the same surgical technique, graft, or implant. On the other hand, more and more autologous dermis-fat grafts are being used in reconstructive surgery. These fulfill most requirements for an ideal graft. Thus, the aim of this study was to evaluate the indications of dermis-fat grafts in head and neck surgery, whether they can lead to esthetic corrections in the context of facial rehabilitation, the complications that may appear due to this operation and their frequency, and the possible applications described in the medical literature.

MATERIALS AND METHODS

Patients

From March 2002 to January 2017, a total of 104 patients were treated for a soft-tissue defect in the head and neck region in our Department of Oral and Maxillofacial Surgery in this retrospective study, and 107 autologous dermis-fat grafts were performed. The patients were classified into the subgroups of ‘parotid surgery’, ‘orbital surgery’, and ‘facial surgery’. Two patients were excluded from the study due to a follow-up period of less than 6 months, two due to non-compliance (non-appearance) during aftercare, four due to additional corrections (2x free-fat grafts, 2x local flaps) in the context of intubation, and three due to missing records. The remaining cohort consisted of 44 female and 49 male patients, in whom 96 autologous dermis-fat grafts were performed.

Staging and operation

Parotid surgery

In addition to a clinical examination, standardized ultrasonography (Siemens Acuson Antares) and magnetic resonance imaging were performed in all patients preoperatively. The dimension of surgery depended on the origin and extent of the tumor. A superficial (lateral) parotidectomy with removal of the parotid gland lateral to the plane of the facial nerve was performed in benign tumors and superficial malignant tumors. A radical parotidectomy with a total removal of the parotid gland and the facial nerve was performed in all other malignant tumors.

Orbital surgery

In addition to a clinical examination, a standardized ophthalmological examination was preoperatively performed on all patients. Individual advanced diagnostics were then initiated depending on the clinical findings, the initial situation, and the medical question. This included a patient-adapted ultrasonography, computed tomography, or magnetic resonance imaging. The dimension of surgery depended on the preoperative evaluation. Within the scope of primary reconstruction, enucleation, or tumor removal, the preparation of a transplant bed, and, as far as possible, the detection and attachment of the extra-ocular muscles were performed. In the case of secondary reconstructions, the transplant bed was prepared and, if available, the previously inserted orbital implants or expanders were explanted.

Facial surgery

In addition to clinical examination, standardized ultrasonography and magnetic resonance imaging were performed in all patients preoperatively. In some cases, computed tomography was performed to exclude bony defects. The surgery was done with a coronal, pre-auricular, or extra-oral approach, depending on the localization (infraorbital, temporal, supraorbital or nasal region) and pre-existing scars.
In all patients, a reconstruction was carried out with a dermis-fat graft (all authors). These were harvested from a low abdominal incision around a pre-existing abdominal scar, or, in the absence of pre-existing scars, gluteal, sacral, or iliac. In the cases of parotid or facial surgery, an elliptical incision of the epidermis with a maximum length-to-width ratio of 3:1 was carried out, followed by de-epithelisation with a scalpel. In the cases of orbital surgery, a circular incision of the epidermis with a maximum diameter of 25 mm was performed. Then, the graft was harvested with a desired overcorrection of

about 10–30% due to the expected resorption, and the donor site was closed in two layers. The dermis-fat graft was then tailored to the defect and sutured precisely to the capsule of the parotid gland, the Tenon capsule, or around the facial tissue. The extra-ocular muscles were sutured, if possible, precisely to the edge of the dermis-fat graft. Finally, the wound was closed in layers with the insertion of drainage (parotid/facial surgery) or gauze into the socket (orbital surgery).

Clinical course

The postoperative management included physical rest and local cooling, as well as a peri-operative prophylactic antibiotic therapy over 5 days. The orbital tamponade was changed every 3 days. In the absence of a wound dehiscence, an orbital conformer was inserted for the first time after a week. Complications and their management were recorded during hospitalization and follow-up care. The complications were divided into hematoma, seroma, infection, sialocele/fistula, liquefaction of the transplant, cyst formation, graft loss, hair growth, ulceration, granuloma formation, facial palsy, manifestation of Frey syndrome, persistent over- or undercorrection, hypertrophic scar, and excessive growth of the transplant. In addition, resorption or persistent undercorrection, persistent overcorrection, and chronic or recurrent pain were examined. The presence of Frey syndrome was assessed from the subjective point of view of the patients as well as by clinical examination using lemon juice. An objective exploration, for example, with the help of the minor test, did not take place. Furthermore, a questionnaire was handed out to patients as part of the follow-up. The scar, the facial contour, and the overall result were evaluated based on a 10-point Likert scale. A score of 0 corresponded to a nonvisible scar, a perfectly symmetrical face contour and overall

result, whereas a score of 10 corresponded to a maximum visible scar, asymmetrical facial contour, and dissatisfaction. In addition, patients were asked whether unusual sweating or moisture appeared in the operated area while eating, whether they had been restricted in everyday life since surgery, and whether their lifestyle had changed permanently by the operation.

As part of the follow-up, all patients were examined after 3, 6, and 12 months and then annually. In patients with malignant tumors, follow-up care took place every month in the first year, every 2 months in the second year, and every 3 months after that. Two independent oral and maxillofacial surgeons assessed success.

Photographic documentation and Ultrasonography

Preoperatively, intraoperatively, and postoperatively, a standardized photographic documentation (frontal facial, lateral facial, bird's-eye view, worm's-eye view, as well as close-ups of the operation area) was performed. These photographs were also used to assess success. The same maxillofacial surgeon (first author) carried out standardized sonographic controls in all patients for recurrence control, exclusion of the possibility of a second tumor, as well as to review the dermis-fat graft.

RESULTS

In the 15-year study, 93 patients (44 women and 49 men) met the inclusion criteria. In them, 96 autologous dermis-fat grafts were performed. The average age was 42.8 years with a range of 3 to 87 years (median 43 years). The mean follow-up period was 22 months with a range of 6 to 145 months. The clinical evaluation revealed 34

complications in 30 patients (32.3%). Nine patients (9.7%) showed a hematoma at the recipient site and five patients (5.4%) at the donor site. Five patients showed a seroma (5.4%) and a granuloma formation (5.4%) each, two patients a liquefaction of the transplant (2.2%), sialocele/fistula (2.2%), cyst formation (2.2%), and graft loss (2.2%) each, and one patient showed an infection (1.1%) and a hypertrophic scar (1.1%) each. In addition, 12 patients reported a recurrent itching or pain (12.9%). No patient had any permanent pain. Hair growth, ulceration, facial palsy, manifestation of Frey syndrome (parotid surgery), and excessive growth of the transplant were not observed. The dermis-fat graft was harvested from a low abdominal incision around a pre-existing scar in 54 cases, gluteal/sacral in 16 cases, iliac in 22 cases, and in the thigh in four cases. Reconstruction was primarily carried out in 52 cases and secondarily in 44 patients.

Parotid surgery

Overall, 37 patients underwent a standardized superficial parotidectomy with intra-operative facial nerve neurolysis, whereas four patients underwent a radical parotidectomy. The average age was 53 years with a range of 6 to 83 years. The right side was affected in 16 patients and the left in 25. A lymph-node dissection was performed in seven patients. Histopathological examination revealed that a pleomorphic adenoma was most common in 18 patients (44%) and an adenolymphoma in eight (20%). Table 1 gives a detailed overview of the patients, all histologies and complications. During the postoperative follow-up and the tumor follow-up, sonographic controls were performed regularly. All patients showed well-integrated (albeit reduced, partly by absorption) dermis-fat grafts. These were well distinguishable from the surrounding tissue. A local recurrence or second cancer was not verified in any

patient. The mean value of patient satisfaction with symmetrical facial contour was 1.98 (range 0-7). The mean value of the assessment of scars by patients was 1.99 (range 0-5). Satisfaction with the overall result was, according to the questionnaire, 0.71 (range 0-4). No patient showed abnormal sweating or moisture while eating. No operation led to a change in lifestyle. Four patients, however, reported restricted activity in everyday life; one patient attributed this to a temporary lack of facial nerve function. None of the patients expressed the wish for a surgical intervention.

Orbital surgery

A total of 40 patients (18 female and 22 male) met the inclusion criteria and underwent 43 autologous dermis-fat grafts. The average age was 32 years, with a range of 3 to 87 years. The dermis-fat graft was primarily transplanted in nine patients, and secondarily in 34 patients. The right side was affected in 19 patients, the left in 20, and both sides in three patients. At the time of surgery, seven patients underwent irradiation in the orbital region beforehand, and another patient received radio-chemotherapy. None of the patients took an immunosuppressive drug, and diabetes mellitus was not present in any patient. The underlying disease was trauma in 12 patients (28%; with mechanical trauma in eight cases, and chemical burn in four cases), a congenital malformation in 16 (37%; with clinical anophthalmia in 11 cases, and microphthalmia in five cases), and post-surgical in 15 patients (35%). A malignant disease was present in 11 patients. Table 2 gives a detailed overview of the patients, etiologies, and complications. An ocularist treated all the patients with an artificial eye prosthesis. The postoperative cosmetic results were ‘very good’ or ‘good’ in 28 cases (65.1%), ‘satisfactory’ in 11 patients (25.6%), and ‘poor’ in four cases (9.3%).

Facial surgery

Twelve patients (six female and six male) were analysed. Five dermis-fat grafts were transplanted to the temporal area (above the zygomatic arch), four to the infraorbital region, two to the supraorbital area, and one graft to the nasal area. Grafts between six (supraorbital) and 18 cm^3 (temporal) were used. The average age was 46 years, with a range of 16 to 73 years. The dermis-fat graft was primarily transplanted in four patients and secondarily in eight patients. The right side was affected in nine cases and the left in three cases. At the time of surgery, one patient underwent irradiation in the facial region beforehand. Immuno-suppression was not present in any patient. The underlying disease/condition was trauma in four patients (33%), a degenerative disease in one patient (8%), and post-surgical complications in seven patients (58%). Table 3 gives a detailed overview of the patients, localizations, etiologies, and complications. All patients showed well-integrated dermis-fat grafts. The postoperative cosmetic results were ‘very good’ or ‘good’ in all cases. A local recurrence or second cancer was not verified in any patient.

DISCUSSION

The reconstruction of soft-tissue defects is becoming increasingly important to patients in today’s world. Therefore, many patients wish to have a holistic concept at the beginning of the treatment. Reconstructive surgery has made tremendous progress in recent decades. Hence, more and more autologous dermis-fat grafts are being used to reconstruct facial contour defects. The first description in the literature goes back to Figi

in 1931. He was able to reconstruct an impressed frontal sinus fracture. Decades later, in 1978, Smith and Petrelli established a procedure for the augmentation of orbital defects with dermis-fat grafts *(Smith and Petrelli, 1978)*. Subsequently, the application of these grafts was further expanded in the facial area *(Guerrerosantos et al., 2007, Heher et al., 1998)*. Due to multiple differential therapies, a detailed description of the application of dermis-fat grafts seems to be useful.

Although the present cohort, with 96 cases, was relatively large compared to those in other studies, it was composed of three collective groups. Thus, these should be considered individually.

Parotid surgery

Compared to our previous study, the patient population could be increased from 19 to 41 *(Baum et al., 2016)*. The clinical evaluation revealed 14 complications in 13 patients (34.1%). In contrast, Chandarana reported a complication rate of 50% after parotidectomy without reconstruction *(Chandarana et al., 2009)*, Dulguerov 16.7% *(Dulguerov et al., 1999)*, and Govindaraj 9.4% *(Govindaraj et al., 2001)*. In addition, Govindaraj reported a complication rate of 46.9% with AlloDerm® grafts as part of the reconstruction. In the study by Dulguerov, who transplanted or implanted different materials (lyophilized dura, 14,3%; Ethisorb®, 71,4%; and polytetrafluoroethylene), a complication rate of 41.3% was calculated. In the present study, seven patients (17%) showed a hematoma, four a seroma (10%), and one patient (5%) a liquefaction (2%), which were aspirated in each case. No major complication occurred. No patient complained of any abnormal sweating or moisture while eating (Frey syndrome). The literature shows a wide incidence in this respect *(Baum et al., 2016)*. This is because it

is necessary to distinguish between a subjective and an objective observation of symptoms. The latter is based on a chemical reaction of the sweat with an iodine-starch solution using the 'minor test'. Dulguerov et al. described the objective incidence of Frey syndrome after parotidectomy without a defect augmentation as 86% *(Dulguerov et al., 1999).* In contrast, the average subjective incidence (38%) was at a significantly lower value. An objective exploration with the aid of the minor test did not take place in this study. Wang et al. evaluated the effectiveness of free fat grafting in preventing Frey syndrome and facial depression after parotidectomy compared with acellular dermis *(Wang et al., 2016).* They concluded that both techniques were effective in preventing Frey syndrome, with an equal rate of postoperative complications. In contrast, patients undergoing free fat grafting had a significantly higher esthetic score and lower cost than those undergoing acellular dermis grafting. Thus, free-fat grafts should also be taken into account as an alternative.

Another problem is that at the time of the operation, the postoperative resorption of the dermis-fat graft is not predictable. The extent of resorption is very diverse in the literature, from 0% *(Nosan et al., 1991)* to 100% *(Conley and Clairmont, 1978).* Sawhney et al. reported a resorption rate of 33% in pigs 8 weeks after operation *(Sawhney et al., 1969).* This was attributed to a reduction of the fat, whereas the dermis was preserved. This was also reflected in the present patient cohort, in which we found three overcorrections and two undercorrections. Nevertheless, an overcorrection of 20% to 30% should be recommended due to the expected resorption. Finally, in conclusion, it can be said that a relapse-oriented follow-up is certainly possible by an experienced colleague despite a dermis-fat transplantation. All in all, dermis-fat grafts for the reconstruction of facial contours after parotidectomy represent a reliable method with a

low complication rate. In addition, from a functional point of view, dermis-fat grafts can certainly prevent Frey syndrome. The stable long-term results and high patient satisfaction lead to a recommendation to transfer this operation method into the daily routine.

Orbital surgery

The reconstruction of orbital defects or malformations is complex and difficult, due to the expectations, different etiologies, and anatomical conditions. In addition, the initial situations appear to be highly individualistic, so that multimodal and patient-adapted concepts are necessary. Thus, a uniform therapeutic concept does not exist. The literature describes possible therapies with conformers *(Chen and Heher, 2004)*, orbital implants *(Karcioglu et al., 1998)*, tissue expanders *(Schittkowski and Guthoff, 2006)*, dermis-fat grafts, free micro-fat *(Quaranta-Leoni, 2011)*, orbital floor implants, mucous membrane grafts *(Bowen Jones and Nunes, 2002)*, skin grafts , and bone grafts *(Krastinova et al., 2001b)*. Although our cohort of 43 cases seems to be relatively small, similar collectives have been used in other studies as well *(Nunery and Hetzler, 1985)* (36 patients), *(Aryasit and Preechawai, 2015)* (41 patients). Nonetheless, a general conclusion seems to be difficult due to the different etiologies and age distribution (3 to 87 years) in this study. For the evaluation of long-term complications and functionally and esthetically stable results, a minimum follow-up period of 18 months was chosen. However, long-term results in children can usually be reasonably assessed after years; so longer follow-up periods are necessary. Clinical evaluation revealed 16 complications in 13 cases (30.2%). Five patients (14%) showed abdominal hematoma, which was aspirated in two cases and handled without any treatment in three cases. A

granuloma was found in five patients (14%) and a cyst formation in two cases. These were excised under local and general anesthesia respectively, without any complications. All in all, a major complication occurred in four cases: two patients (5%) showed a transplant loss, so that subsequent therapy was necessary. Both had radiations in their history. In this regard, we recommend a complete wound closure in patients who have previously undergone irradiation. In contrast, Vagefi et al. reported that the complication rates did not differ between irradiated and non-irradiated patients *(Vagefi et al., 2007)*. However, the patient population in this study consisted of only nine individuals. Another patient showed extreme scarring (2%), which called for an oral mucosa transplant. In this case, an alkali burn was the reason for the previously performed enucleation. One patient showed an infection (2%), which needed an operative revision with drainage. Finally, an ocularist could treat all the patients with artificial eye prosthesis. Long-term adequate prosthetic cavity (>18 months after dermis-fat graft transplantation) was achieved in 40 cases (93.0%). In addition, six patients showed a partial resorption of the dermis-fat graft with a resulting enophthalmos (14%). None of the patients required any intervention. Thus, an overcorrection of 10% to 20% should be recommended due to the expected resorption, if possible. All in all, dermis-fat grafts for the reconstruction of an ophthalmic orbit represent a reliable method with a low rate of major complications. All the patients showed an improvement in the orbital volume and facial symmetry. That is why we recommend dermis-fat grafts as primary and secondary implants.

Facial surgery

Facial soft-tissue defects arise from various causes and usually result in an asymmetry of facial proportions. Therefore, many patients wish to undergo esthetic facial profiling with a perfection of symmetry. Hence, almost all reconstructive techniques are used. In particular, free fat grafts show excellent results with low complication rates *(Newman, 2009)*. So these grafts are regarded as the gold standard, especially in secondary cases. However, several sessions are necessary due to the expected resorption *(Belyea et al., 2010)*. In some cases, therefore, a dermis-fat graft can be considered as a differential therapy. In addition, an open resection of the scar is sometimes necessary, so that the approach can also be used for a dermis-fat graft in some cases. The age distribution and the etiologies of our cohort are very different. Even the number (only 12 patients) is very small, so generalized conclusions cannot be made. It should also be noted that, to our knowledge, comparable collectives are not described in the literature. The clinical evaluation revealed four complications in four patients (33%). Two patients (17%) showed one hematoma each, one patient a seroma (8%), and one patient a liquefaction of the transplant (8%). These were aspirated in each case. No major complication occurred. In particular, none of the patients showed a facial palsy. Since most operations are secondary interventions, as in the present cohort, the detection of the facial nerve can be markedly hindered in the case of preoperative scars. Thus, the preservation of the facial nerve is certainly the first priority in reconstructive surgery. Due to the expected resorption, an overcorrection of 10% to 30% should be recommended. Undercorrections may be compensated for by another free fat graft. All in all, dermis-fat grafts for the reconstruction of facial contours represent a reliable method with a low complication rate in the cases in which a free-fat graft does not appear to be reasonable or possible (e.g., larger defects). The preservation of the facial nerve is of paramount importance.

Other indications

Patel and Hall used free dermis-fat grafts to correct whistle deformities in patients with a cleft lip *(Patel and Hall, 2004)*. The cohort consisted of 10 cases. All had at least one procedure in the past to correct the vermilion notching. One of the patients had a partial graft loss, and another had an undercorrection that needed a second graft. All in all, the authors recommended dermis-fat grafts to correct whistle deformities in patients with cleft lips. It should be noted that even in these cases, free-fat grafts can be used for the correction of vermilion notching *(Baum et al., 2017)*. The minor effort and low complication rates of free-fat grafts should be taken into account when choosing the reconstruction method.

In his study, Niechajev also described surgical alternatives to enhance the lip in 86 cases *(Niechajev, 2000)*. He used various techniques and materials, such as silicone microparticles, hydrophilic polyacrylamide gel, expanded polytetrafluoroethylene, free-fat grafts, dermis-fat grafts, and local plasties. In all, 27 patients were enhanced with a dermis-fat graft; 35 transplantations were performed in these patients. Complications did not occur. In summary, the author concluded that dermis-fat grafting was the most reliable method. From our point of view, a free-fat graft should also be taken into account as an alternative because of the reasons mentioned above.

In his study, Dimitroulis reported changes in the condylar morphology after a temporomandibular joint discectomy with interpositional dermis-fat grafts *(Dimitroulis, 2011)*. In all, 28 patients who had undergone discectomy received 33 transplants (five bilateral). They were evaluated using an orthopantomograph. Nine out of 33 joints (27%) were found to be normal in postoperative radiographs. A remodeling was found

in 14 joints (42%), and a resorption was found in 10 (30%). The authors concluded that dermis-fat grafts have a protective effect on the mandibular condyle after discectomy, even if it is not an ideal transplant.

Finally, Tan and Ergen presented a case in which they encased a gold weight with a dermis-fat graft in the management of paralytic lagophthalmos caused by facial palsy *(Tan and Ergen, 2008)*. The gold weight was extruded through the initial incision 2 months after the operation. The dermis-fat graft was then inserted between the orbicularis muscle with the gold weight as a barrier. The authors concluded that the esthetic outcome was acceptable despite a mild ptosis; other complications did not occur.

Volumetric evaluation

An objective three-dimensional volumetric evaluation was not performed. Although a volumetric measurement would be desirable, it has only a subordinate role. From our point of view, esthetics are the most important thing (besides the graft loss), and a volumetric measurement cannot provide any ascertainment in this respect. Nevertheless, larger studies with additional three-dimensional volumetric assessment are necessary and will be performed.

CONCLUSION

Dermis-fat grafts for the reconstruction of maxillofacial soft tissue defects represent a reliable method with a low rate of major complications. These grafts also offer all the advantages of autologous transplants compared to alloplastic implants or allografts. The

graft can be used as a primary and a secondary transplant. In addition, excellent esthetic and functional long-term results can be achieved. Especially in parotid and orbital surgery, the dermis-fat graft appears to be a transplant of choice. In addition, it can be used as an alternative in facial surgery and lip enhancement in individual cases, as well as in special indications after a comparison with other techniques.

Conflict of interest

The authors declare that they have no conflicts of interest.

Ethics considerations

This work has been carried out in accordance with the Code of Ethics of the World Medical Association.

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Figure 1. (A) Pleomorphic adenoma as seen on magnetic resonance imaging (arrow). (B) Sutured dermis-fat graft (*) after superficial parotidectomy. Note the tight closure of the dermis to the residual margins of the parotid gland capsule. (C) Photographic documentation 6 months postoperatively after dermis-fat transplantation: frontal facial view; (D) lateral facial view.

Figure 2. A 47-year-old man with a post-enucleation socket syndrome consisting of enophthalmos, deep superior lid sulcus with retraction, a shallowing of the lower fornix and ptosis. (A) Frontal facial view (preoperative). (B) Close-up view (preoperative) with extreme scarring;the patient could not wear an artificial eye. (C) Sutured dermis-fat graft (arrow) after the excision of scars and reconstruction of the lower fornix. (D) Frontal facial view 6 months postoperatively after rehabilitation with an artificial eye.

Figure 3. A 33-year-old woman with temporal hollowing on the left side after trauma. (A) Frontal facial view (pre-operative). B) Sutured dermis-fat graft (arrow) to the temporal fascia (*) after the excision of scars through a coronal approach. (C) Frontal facial view 6 months postoperatively with a symmetric temporal contour.

Table 1. Parotid surgery: Patients, histologies, and complications (Ø = mean)

	Female (n=20)	Male (n=21)	Total (n=41; 100%)	
Age (years)	Ø 56	Ø 50	Ø 53	
Follow up (months)	Ø 13	Ø 15	Ø 14	
Parotidectomy				
- Superficial	18	19	37 (90%)	
- Radical	2	2	4 (10%)	
Lymph-node dissection	3	4	7 (17%)	
Reconstruction				
- Primarily	18	21	39 (95%)	
- Secondary	2	0	2 (5%)	
Radiation therapy				
- Preoperative	0	0	0	
- Postoperative	1	0	1 (2%)	
Histology				
- Pleomorphic adenoma	9	9	18 (44%)	
- Adenolymphoma	2	6	8 (20%)	
- Cavernous hemangioma		1	1 (2%)	
- Abscess-forming reticular lymphadenitis	2		2 (5%)	
- Basal cell adenoma	1		1 (2%)	

- Acinar cell carcinoma	1		1 (2%)	
- Adenocarcinoma	2		2 (5%)	
- Malignant fibrous histiocytoma		1	1 (2%)	
- Metastasis of a squamous cell carcinoma	1	1	2 (5%)	
- Lymphoma	1	1	2 (5%)	
- Well-differentiated liposarcoma		1	1 (2%)	
- Chronic sialadenitis		1	1 (2%)	
- Mucoepidermoid carcinoma	1		1 (2%)	
Complications				Treatment
Preauricular				
- Hematoma	3	4	7 (17%)	Aspiration
- Seroma	3	1	4 (10%)	Aspiration
- Infection				
- Sialocele/fistula	2		2 (5%)	None
- Liquefaction	1		1 (2%)	Aspiration
- Cyst formation				
- Graft loss				
- Facial palsy				
- Frey syndrome				
- Hypertrophic scar				
- Excessive growth				
- Overcorrection	1	2	3 (7%)	None
- Undercorrection	2		2 (5%)	None
- Recurrent pain	4	2	6 (15%)	None

- Chronic pain Donor site - Hematoma - Hypertrophic scar - Recurrent pain - Chronic pain	2		2 (5%)	None

Table 2. Orbital surgery: Patients, etiologies, and complications (Ø = mean)

	Female (n=20)	Male (n=23)	Total (n=43; 100%)	
Patients (n)	18	22	40	
Age (years)	Ø 32	Ø 33	Ø 32	
Follow up (months)	Ø 26	Ø 36	Ø 31	
Reconstruction				
- Primarily	7	2	9 (21%)	
- Secondary	13	21	34 (79%)	
Radiation therapy				
- Preoperative	5	2	7 (16%)	
- Postoperative	0	0	0	
Etiology				
Trauma	3	9	12 (28%)	
Congenital malformation	6	10	16 (37%)	
Postsurgical				
- Retinoblastoma	2	2	4 (9%)	
- Uveal melanoma	4		4 (9%)	
- Malignant melanoma		1	1 (2%)	
- Squamous cell carcinoma	1		1 (2%)	
- Rhabdomyosarcoma	1		1 (2%)	
- Optic nerve glioma	1		1 (2%)	

- Orbital pseudotumor	1		1 (2%)	
- Endophthalmitis	1	1	2 (5%)	
Complications				Treatment
Orbit				
- Hematoma				
- Seroma				
- Infection		1	1 (2%)	Revision/Drainage
- Sialocele/fistula				
- Liquefaction				
- Cyst formation		2	2 (5%)	Excision
- Graft loss	2		2 (5%)	Corrective surgery
- Hair growth				
- Ulceration				
- Granuloma	2	3	5 (14%)	Excision
- Scarring	1		1 (2%)	Corrective surgery
- Excessive growth				
- Overcorrection				
- Undercorrection/enophthalmos	3	3	6 (14%)	None
- Recurrent pain				
- Chronic pain				
Donor site				
- Hematoma	2	3	5 (12%)	Aspiration (2x)
- Hypertrophic scar				
- Recurrent pain	2		2 (5%)	None

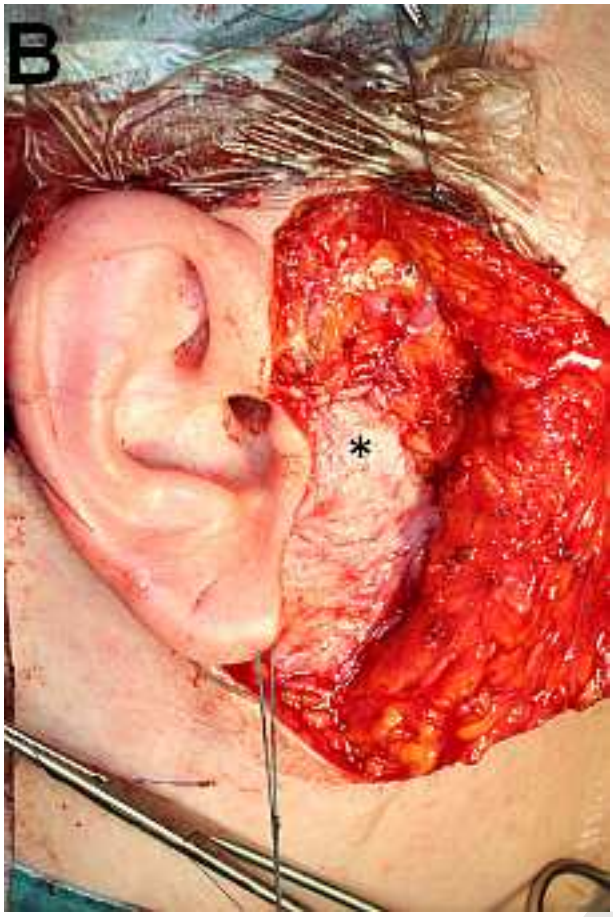
- Chronic pain				

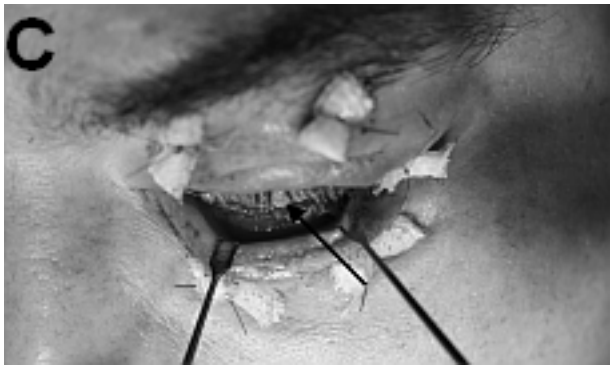
Table 3. Facial surgery: Patients, etiologies, localizations, and complications (Ø = mean)

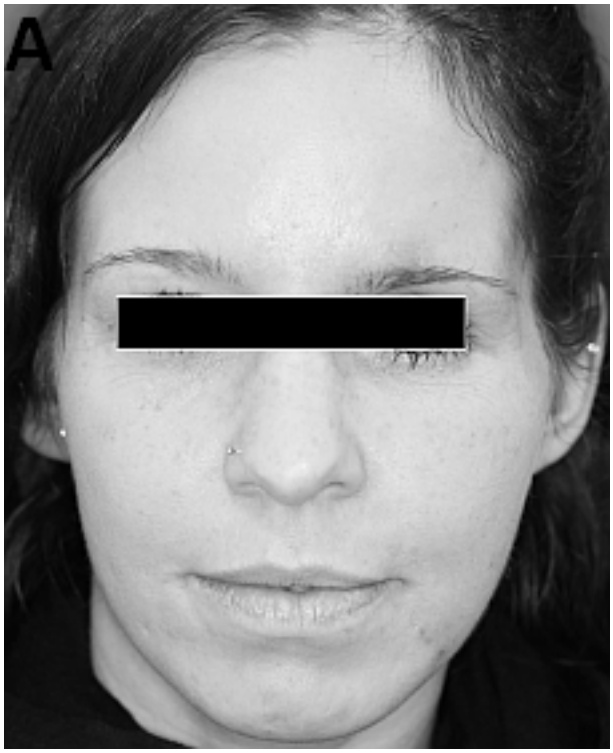
	Female (n=6)	Male (n=6)	Total (n=12; 100%)	
Age (years)	Ø 50	Ø 42	Ø 46	
Follow up (months)	Ø 11	Ø 16	Ø 13	
Reconstruction				
- Primary	2	2	4 (33%)	
- Secondary	4	4	8 (67%)	
Radiation therapy				
- Preoperative	1	0	1 (8%)	
- Postoperative	0	0	0	
Etiology				
Trauma	3	1	4 (33%)	
Degenerative		1	1 (8%)	
Post-surgical				
- Hemangioma		2	2 (17%)	
- Uveal melanoma	1		1 (8%)	
- Malignant melanoma		1	1 (8%)	
- Adenocarcinoma		1	1 (8%)	
- Neurofibromatosis	1		1 (8%)	

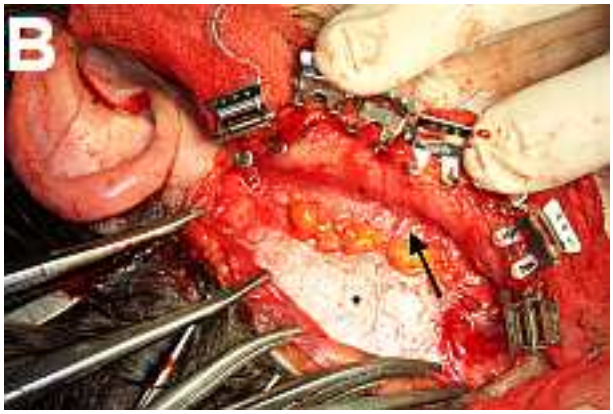
- Tenosynovial giant cell tumor	1		1 (8%)	
Localization				
- Temporal	4	1	5 (42%)	
- Infraorbital	1	3	4 (33%)	
- Supraorbital	1	1	2 (17%)	
- Nose		1	1 (8%)	
Complications				Treatment
Face				
- Hematoma		2	2 (17%)	Aspiration
- Seroma		1	1 (8%)	Aspiration
- Infection				
- Sialocele/fistula				
- Liquefaction		1	1 (8%)	Aspiration
- Cyst formation				
- Graft loss				
- Facial palsy				
- Hypertrophic scar				
- Excessive growth				
- Overcorrection		2	2 (17%)	None
- Undercorrection		1	1 (8%)	None
- Recurrent pain		1	1 (8%)	None
- Chronic pain				
Donor site				
- Hematoma				

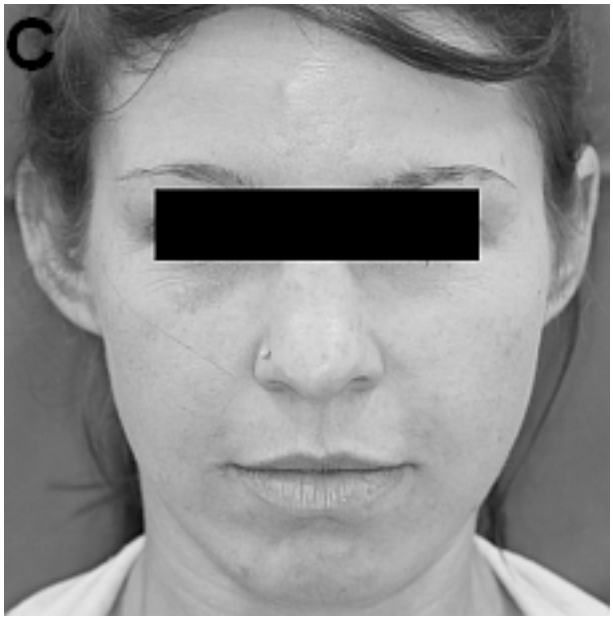
- Hypertrophic scar - Recurrent pain - Chronic pain	1		1 (8%)	None











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