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Autogenous abdominal fat transplantation into temporomandibular joint following removal of osteochondroma

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ABSTRACT

Background: An osteochondroma (OC) of the condylar process is a rare condition which primarily affects the mandibular condyle. There are several surgical treatment protocols of OC. As effective hemostatic agents and space fillers, autogenous free-fat grafts prevent scar formation and helps to hinder the accumulation of blood and serum, which otherwise, may be replaced by a dense collagen (scar), osteoid or bone. We report the autogenous abdominal fat transplantation, following the removal of a condylar OC.

Methods: A 42-year-old man presented with the one-year history of progressive facial asymmetry and deviation of the chin, cross-bite to the contralateral side, and difficulty in mastication. Radiographic and clinical findings confirmed the diagnosis of an OC. Computed tomography (CT) showed lateral and inferior displacement of the right mandibular condyle due to the presence of a bone lesion from the medial aspect of the condylar head.

Results: The OC was removed; the remaining portion of the condyle was re-shaped and smoothened. Abdominal fat harvesting was done 2–3 cm below the umbilicus and 3–5 cm length on the transverse midline. The defective area was filled with a harvested autogenous abdominal fat.

Conclusion: Our results suggest that autogenous abdominal fat graft placement after the removal of OC with condyloplasty is yielded satisfactory treatment outcomes.

1. Introduction

An osteochondroma (OC), also called osteocartilaginous exostosis, is the most common primary benign bone tumor, which accounts for 10–15% of all bone tumors and >30% of all benign bone tumors. It is mostly considered as a hamartoma, rather than a true neoplasm. Usually, it occurs as a solitary lesion and less commonly as a hereditary multiple OC [1].

Despite its benign nature, malignant transformation has been reported in 1–2 of patients [2]. An OC mostly involves the tibia (43%) and humerus (30%), has been rarely reported on the mandibular condyle [1]. To the best of our knowledge, a total of 152 condylar OC cases has been reported in the literature. In these cases, various surgical procedures such as total condylectomy, condylectomy and coronoidectomy, excision of the lesion with or without condylectomy or condyloplasty, intraoral endoscopic surgery were performed [3–5]. For the treatment of asymmetry, temporomandibular joint (TMJ) reconstruction with vertical ramus sliding osteotomy, free autogenous bone grafts, costochondral grafts, sternoclavicular grafts, local pedicle osseous grafts, total joint prostheses or orthognathic

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Fig. 1. Preoperative extraoral views shows facial asymmetry with chin deviation to the left side.

Fig. 2. Preoperative intraoral view reveals midline deviation to the left and occlusal discrepancy in the closed position.

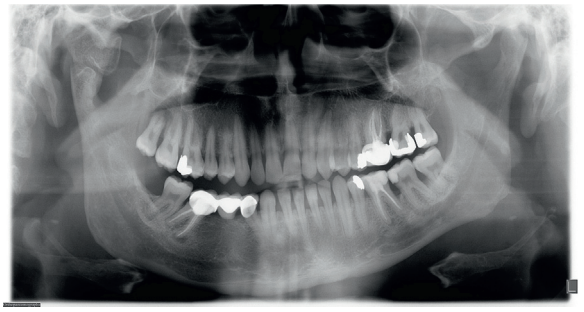

Fig. 3. Preoperatif panaromic radiograph shows nature of deviation and jaw deformity.

surgery can be done [3,5–7].

Virtual 3D planning of surgical procedures with tumor-like lesions of TMJ provides accurate pre-surgical planning and virtual surgical 3D planning of condylar resection [8].

Autogenous abdominal fat transplantation is a procedure which can be carried out in the maxillofacial region. The main advantages of an autogenous abdominal fat include its cost-effective and safe-to-use nature [9,10]. Also, autogenous fat transplantation lacks a host immune response, which facilitates an easy manipulation in the surgical site [10].

Surgery of a condylar OC challenging difficult, due to the complexity of approach and local anatomical structures, such as the maxillary artery, internal carotid, and base of the skull. Preauricular approach can be also preferred by clinicians for its ease and accessibility [4].

We report the autogenous abdominal fat transplantation, following the removal of a condylar OC.

2. Case report

2.1. Clinical findings

A 42-year-old man presented with the one-year history of progressive facial asymmetry and deviation of the chin, cross-bite to the contralateral side, and difficulty in mastication (Fig. 1). The mandibular midline was deviated 17 mm to the left with cross-bite (Fig. 2). The maximum interincisal opening was 35 mm.

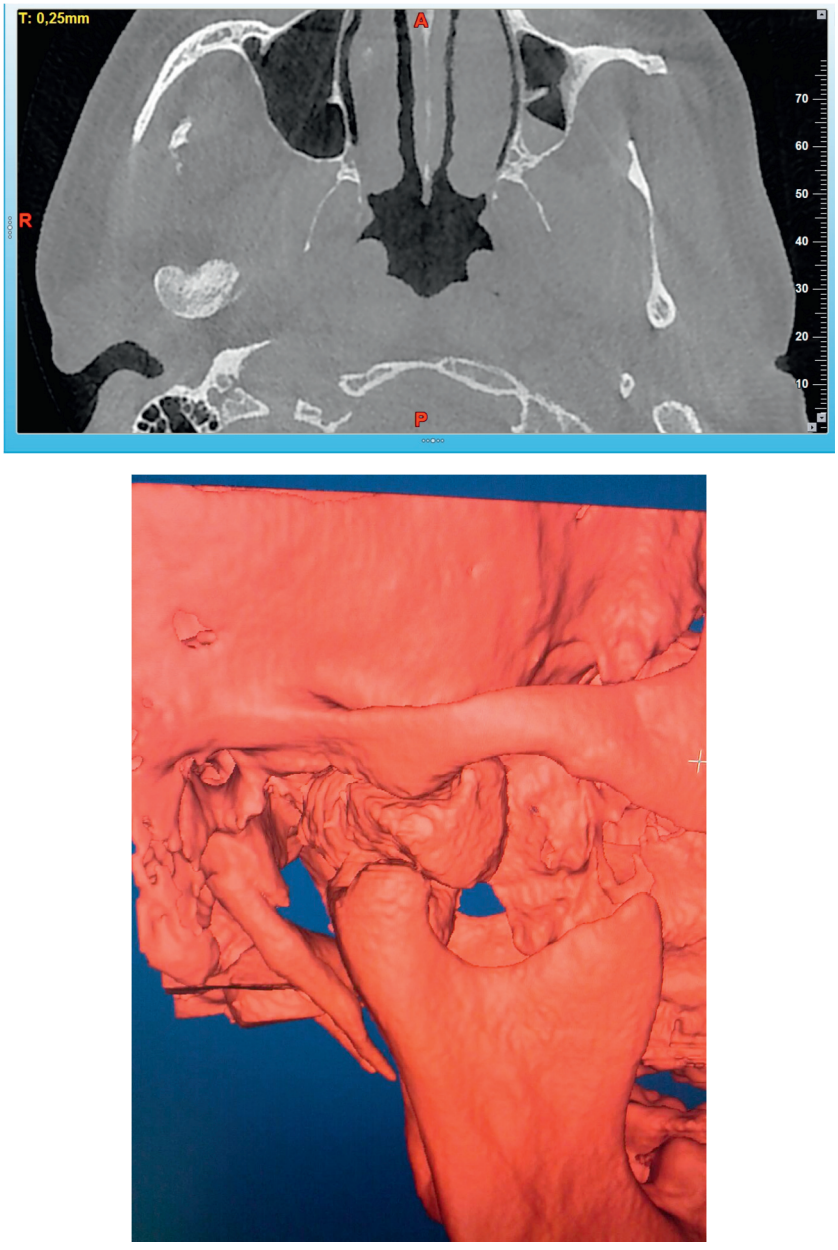

Fig. 4. A: Preoperative Cone-beam computed tomography (CBCT) confirming bony expansion of the right condyle in axial section. B: CBCT 3D images demonstrate the well-defined margin of the radiopaque mass on the anteromedial and medial surface of the condylar neck.

2.2. Radiologic findings

Preoperatif panaromic radiograph showed panoramic radiograph reveals an irregular and large bony mass extending from the anterior portion of the right condylar head (Fig. 3). Computed tomography (CT) showed lateral and inferior displacement of the right mandibular condyle due to the presence of a bony lesion from the medial aspect of the condylar head. A well-defined exophytic bony mass was observed on the anterolateral surface of the condylar head (Fig. 4A and B). Measurements and virtual surgery planning were done on a custom-made diagnostic model which is prepared using the CT scans (Fig. 5).

2.3. Surgical procedure and findings

The lesion was removed under general anesthesia using the extra-oral and pre-auricular approach. Following the incision, vital structures were dissected with caution until the tuberculum articulare. Condyle and the lesion were reached with following the articular

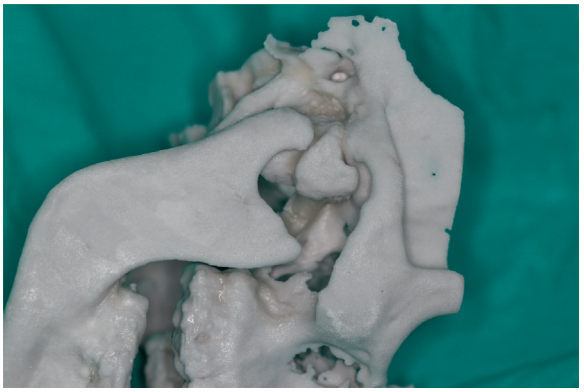

Fig. 5. Custom-made diagnostic model.

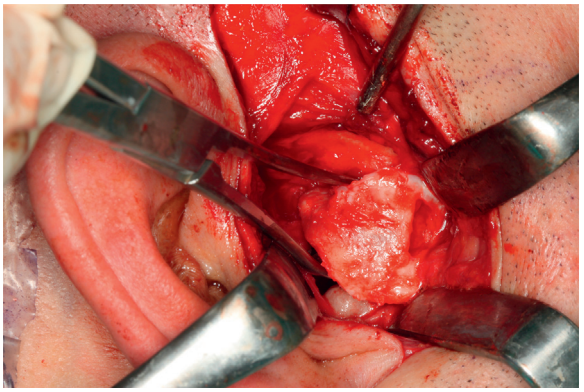

Fig. 6. A pre-auricular approach was used for removal of the OC.

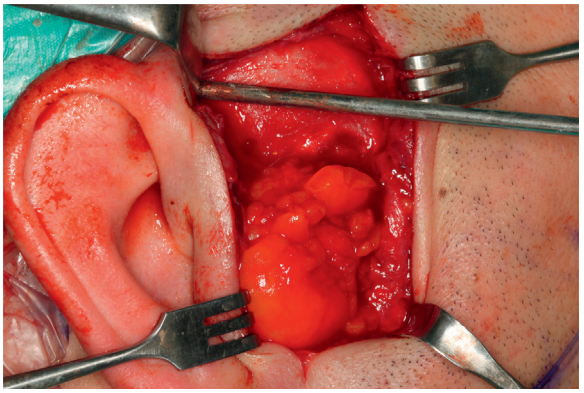

Fig. 7. Filling the abdominal fat into the operation site.

anatomy. The OC was removed; the remaining portion of the condyle was re-shaped and smoothened (Fig. 6). Abdominal fat harvesting was performed 2–3 cm below the umbilicus and 3–5 cm length on the transverse midline. After the fat exposure, fat harvesting was performed. The defective area was filled with a harvested autogenous abdominal fat (Fig. 7). TMJ disc was preserved during the surgery. After hemostasis, the wound was closed layer by layer. For the correction of the malocclusion and facial asymmetry, maxillomandibular fixation (MMF) was maintained immediately following the operation for 10 days. After the MMF releasing, minimal premature contacts were equilibrated with the burr. Mouth-opening exercises were started 10 days after the operation, which consisted of active and passive exercises for 6 months.

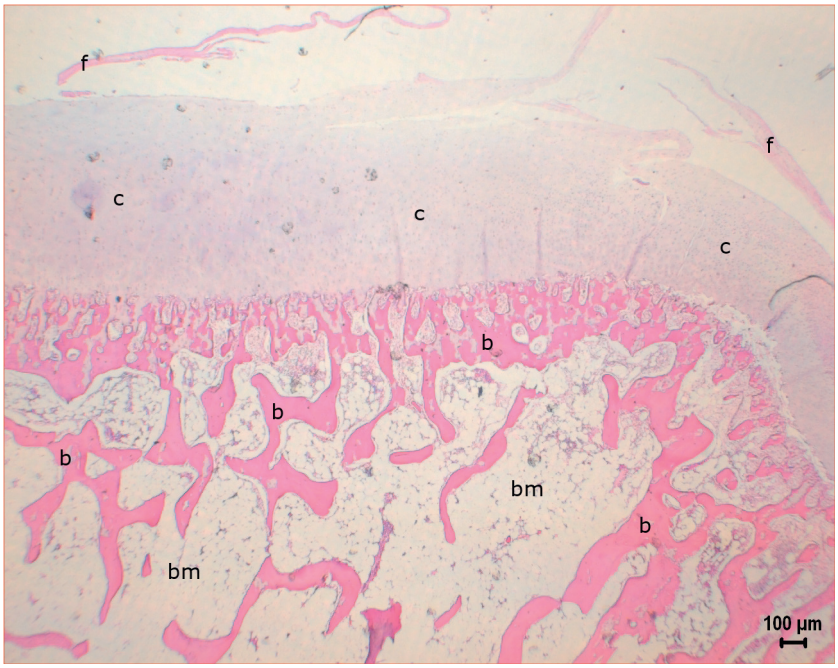

Fig. 8. The lesion consists of chondroid cap (c) beneath the outer fibrous layer (f), overlying normal-appearing mature bone trabeculae(b) containing large fatty marrows (bm) (Hematoxylin& Eosin, A:x20).

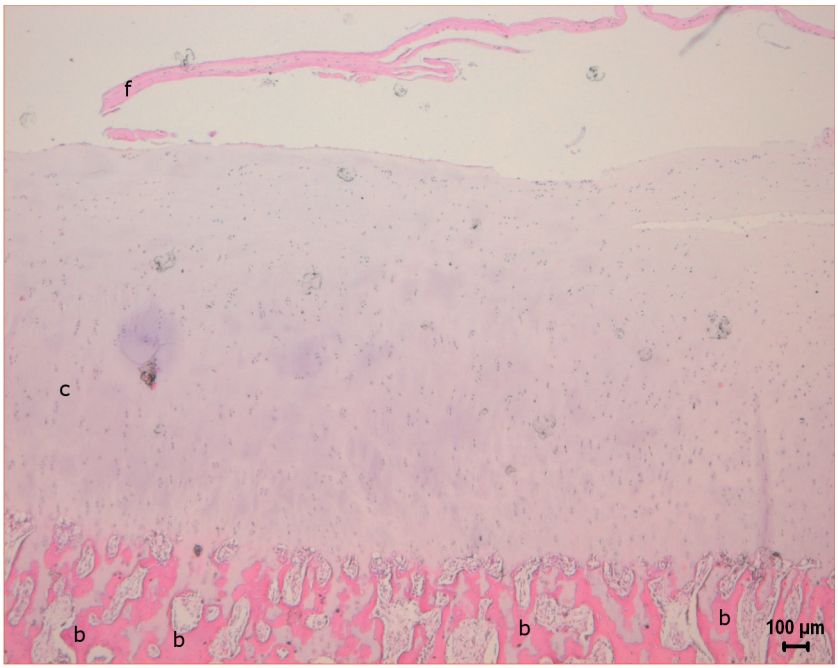

Fig. 9. The lesion consists of chondroid cap (c) beneath the outer fibrous layer (f), overlying normal-appearing mature bone trabeculae(b) (Hematoxylin& Eosin, B: x40).

2.4. Histologic findings

Histopathological examination revealed a chondroid matrix forming a cap beneath the outer fibrous layer, overlying normal-appearing mature bone trabeculae containing large fatty marrows (Figs. 8 and 9). Chondroid matrix containing mature chondrocytes

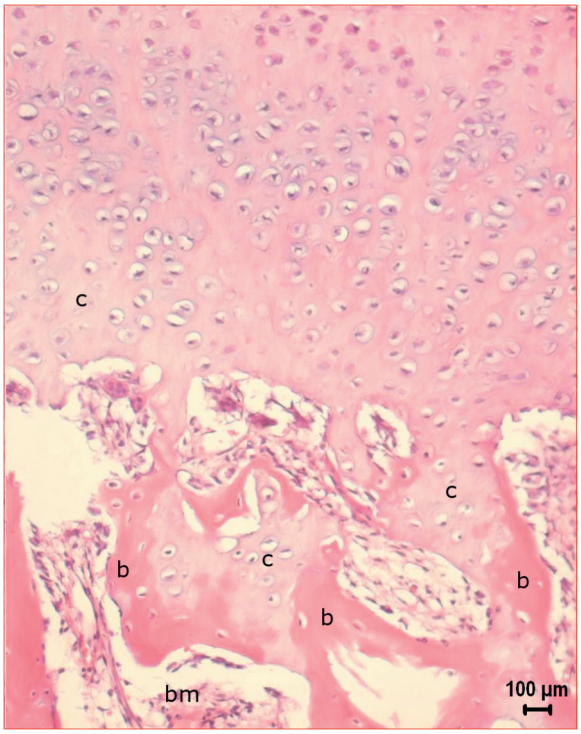

Fig. 10. Chondroid matrix (c) containing mature chondrocytes in their lacunae and focal osteoid differentiation (b) (Hematoxylin& Eosin, C:x200).

Fig. 11. Postoperative extraoral view. Corrected facial asymmetry.

Fig. 12. Postoperative intraoral view that shows normal occlusion.

in their lacunae and focal osteoid differentiation were noted. Chondrocytes were arranged perpendicular to the surface at the osteochondral junction. Histopathological features of the lesion were confirmed of an OC (Fig. 10).

Fig. 13. Postoperative panoramic view that shows normal occlusion.

Fig. 14. Postoperative axial CBCT view reveals fat retention.

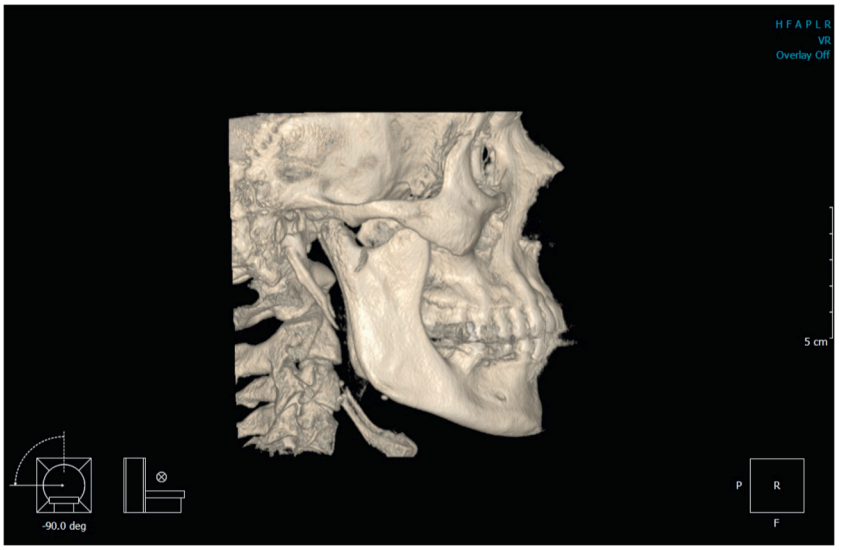

Fig. 15. CBCT 3D images show that no evidence of tumor recurrence.

2.5. Follow-up

During the two-year follow-up, the patient had a 35 mm interincisal opening without mandibular shifting, cross-bite or facial asymmetry (Fig. 11). In the follow-up period the patient had no pain with normal function. Occlusion was sTable as well (Figs. 12 and 13). Postoperative CT showed no recurrence with a preserved fat graft into the TMJ (Figs. 14 and 15).

3. Discussion

An osteochondroma, which is more common in females, tends to occur at a later age in the jaws than the long bones. The clinical presentation is usually with TMJ pain/dysfunction symptoms or facial asymmetry [10]. The usual signs of facial deformity are related to the displacement of the chin point to the contralateral side from the lesion with an ipsilateral open bite [3,11]. Axial and coronal CT scans are the best methods for diagnosis and surgical planning. The connection between the cortex and medulla of the jaw bone with the tumor is specific for the diagnosis of OC [12]. Various surgical approaches were described in the literature such as intra-, trans- or extra-oral [5]. However, there are several controversies for the surgical approaches [13–15]. In our case, we used an extra-oral approach.

Actually, operator can simulate for the operation with 3D model, to easily and deeply understand and operate safely. The use of 3D models provides a realistic pre-processing simulation, making it easier to work with shorter and more precise operation. The amount of bone to be removed and allows for a more ideal occlusion. In the presented case pre-surgical 3D model was used for surgical planning.

OC which is the protruding expansion often causes to mandibular asymmetry without an obvious occlusal plane canting. The local resection of the mass with the condylar head and disc preserving can be done, which is of a good outcome for facial symmetry. In the literature, occlusal discrepancy may still persist after osteochondroma resection. The suggested treatment methods of occlusal discrepancy is ipsilateral orthognathic surgery or the orthodontic traction technique which is a quicker, easier, and less invasive method for occlusal adjustment. But in the presented case no need further orthodontic traction and/or orthognathic surgery [16,17].

The main goal of the use of autogenous abdominal free fat grafts is to prevent adhesion related to several TMJ surgeries. The use of an autogenous abdominal free fat was first introduced by Georgiade in 1957 on TMJ ankylosis patients [1]. To date, abdominal fat graft transplantation has been described in total joint reconstruction, gap arthroplasty, discectomy, disc anchor, and other TMJ arthrotomies [10]. Some authors hypothesized that autogenous free fat grafts could be used as dead space fillers after the removal of failed TMJ prosthesis or pathologies. It may also prevent hematoma formation, which may eventually cause ankylosis. On the other hand, fat graft acts as an isolation material for residual condyle and fossa from the reactive tissue and as a hemostatic agent in the surgical site [9,10]. Tekin et al. reported that the use of autogenous abdominal free fat grafts after removing the failed alloplastic TMJ prosthesis yielded excellent long-term clinical outcomes [8].

Furthermore, the autogenous free fat graft may sustain various degrees of resorption. Pei et al. reported that the survival rate of autogenous abdominal free fat grafts used in modified TMJ disc anchor surgery was 48.44% during two-year follow-up [7]. In another study, fat graft retention after the removal of the failed alloplastic TMJ prosthesis was utilized and CT scans revealed that fat graft retention in the wide space between the residual bone and fossa [9]. Slow turnover rate of the fat graft also reduces the amount of potential scar tissue formation.

Fat is the closest material to an ideal filler. Advantages; cheap and safe. Because it is autogenous, it does not cause immune reaction, it is not carcinogenic and can easily be obtained by a minimally invasive procedure. Autologous free abdominal fat graft around the TMJ can minimize occurrence of fibrosis and heterotopic bone formation, leading to improved range of motion. Free abdominal fat has been used during the treatment of TMJ disorders [18]. As it known there is no case that shows autologous free abdominal fat graft placement after benign TMJ tumor removal.

Limitation of these study, the biopsy was not performed before the surgery due to rejection by patient.

In conclusion, our results suggest that autogenous abdominal fat graft placement after the removal of OC with condyloplasty is yielded satisfactory treatment outcomes. During follow-up, our treatment protocol seems to be effective and successful in terms of the recurrence and functional limitation. However, further large-scale long-term studies are needed to evaluate the routine use of autogenous abdominal fat graft placement.

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