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Reconstruction of Orbital Walls with Bone Cement in a Maxillectomy Patient

Case Report
Olgu Sunumu

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Abstract

Orbital wall defects occur because of trauma and secondary to oncologic surgery. Reconstruction of orbital bones is of most importance to ensure normal eye functions and cosmesis. Acrylic resin materials can be used instead of a bone in orbital wall defects that are secondary to the resection of tumors invading the orbita. Polymethyl methacrylate is one of the acrylic resin materials. In this study, the orbital wall reconstruction technique with bone cement after maxillectomy and results are reported.

Keywords: Orbital neoplasms, maxillary sinus carcinoma, polymethacrylate, bone cements

Introduction

Orbital bone defects can occur due to trauma or as the result of tumor surgery. Therefore, the reconstruction of orbital bone structures is important to protect normal eye function and esthetics. The use of many autogenous and alloplastic materials has been proposed to close defects. Synthetic materials such as silicone, teflon, marlex, tantalum, vitallium, and polyethylene; alloplastic materials such as calcium phosphate, calcium sulfate, methyl-methacrylate, and bone cements; and autogenous grafts such as iliac bone, costa grafts, calvarial bone grafts, septal, and costal cartilage can all be used (1-3). Each method has its own advantages and disadvantages. In this article, the usage of poly-methyl methacrylate (PMMA) bone cement has been defined for the reconstruction of the orbital inferior and the medial wall in the same session in a patient with the eyeball displaced due to orbital inferior and medial wall defects resulting from maxillary carcinoma.

Case Report

Our patient, aged 63 years old, applied to our clinic with a complaint of nasal obstruction steadily increasing for three months. The findings of mouth and throat examination and otoscopy were normal in patient examination. The septum was deviated to the right, and the conchae were hypertrophic in anterior rhinoscopy. In the endoscopic nasopharyngeal examination, a vegetating mass filling the middle meatus of the right nasal cavity and pushing the septum was observed; no pathological lesions were observed in the nasopharynx. Findings of the endoscopic examination of the larynx were normal. There was no palpable mass in the neck.

In maxillofacial magnetic resonance imaging (MRI), a mass lesion showing malignant properties, extending into the nasal cavity from the right maxillary sinus roof, invading ethmoidal cells on the right, having an intraorbital spread by invading the orbital inferior and medial wall, extending into the subcutaneous adipose tissue by passing through the anterior maxillary sinus wall, extending into posterior periantral fat tissue, and partially extending into the right sphenoid sinus was detected (Figure 1). In the positron emission tomography-computed tomography (PET-CT) image, a mass lesion showing hypermethabolic characteristics; filling the maxillary sinus in the right; and extending into medial nasal cavity, toward the lateral infratemporal fossa, into the ventral skin, underneath the skin, and cranially into the orbital cavity as well as extending into the lamina papyracea at the level of nasal cavity and toward the extrachoanal region by eroding the medial orbital wall was found (Figure 1).

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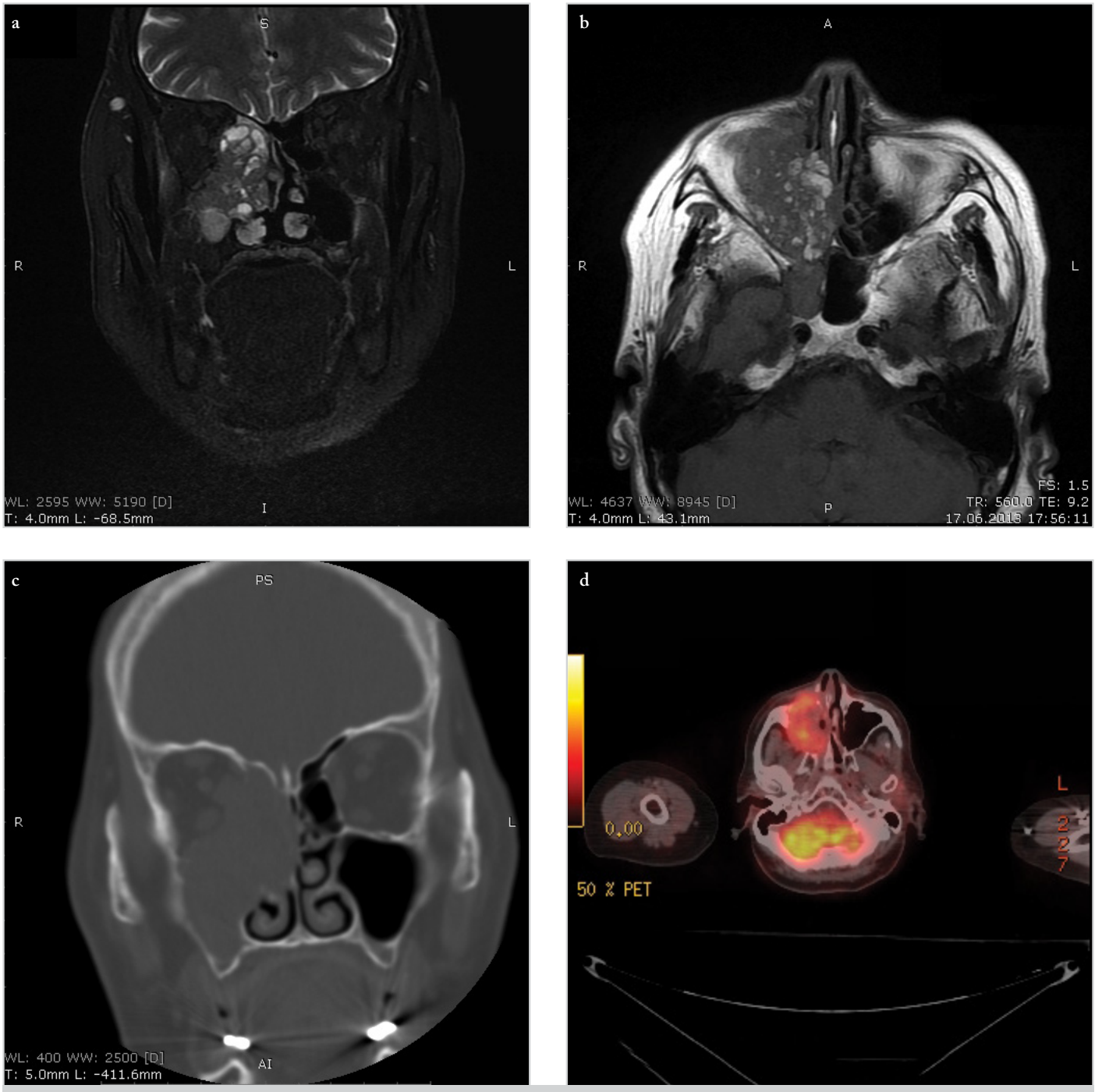

Figure 1. a-d. A mass lesion showing malignant properties, extending into the nasal cavity from the right maxillary sinus roof, invading ethmoidal cells on the right, and having an intraorbital spread by invading the orbital inferior and medial wall is seen in the axial–coronal MRI, CT, and PET-CT sections.

Histopathological examination of the incisional biopsy performed from the mass in the right nasal cavity revealed adenocarcinoma.

The patient was operated under intratracheal general anesthesia. The right maxillary bone was exposed with the Right Weber Ferguson incision, and it was observed that the mass eroded the bone in the anterior surface of the maxilla. When the maxillary bone was excised, it was observed that the mass penetrated the pterygopalatine fossa and sphenopalatine foramen and extended to the orbital floor but did not involve the eye and eye muscles. After subtotal maxillectomy, PMMA bone cement was used for the reconstruction of defects that occurred in the medial and inferior orbital wall.

The liquid monomer and powder polymer materials of the bone cement were stirred in a vessel with a tongue depressor until it reached a putty consistency. The cement was allowed to stand for 1 to 2 minutes to lose its adhesiveness, and then, the phase

Figure 2. a-c. Stirring of the liquid monomer and powder polymer materials of PMMA in a vessel with a tongue depressor and its application.

where the cement was applied to the bone started. After the bone cement was placed in the defect that occurred in the floor and medial of the orbita (and corrected with hand), it was allowed to stand for 2 to 4 minutes for the cement to harden and the thermal energy due to polymerization to be released; thus, the reconstruction was completed (Figure 2, 3).

The postoperative histopathologic specimen examination of the patient was reported as sinonasal adenocarcinoma. In the postoperatively demanded consultation for ophtalmology, it was noted that the eye movements were free, the visual rate in both eyes was 80%, and a test of the objective visual field was normal (Figure 4). Adjuvant radiochemotherapy was proposed to the patient who was evaluated in the Council of Head and Neck Malignancies of our hospital in terms of postoperative radiochemotherapy. The patient received a total of 63 Gy adjuvant radiotherapy for 32 days and 5 courses of cisplatin and 5-Fluorouracil combination chemotherapy.

In the postoperative 6th month during the follow-up of the patient, cellulitis that was thought to be associated with PMMA developed in the right infraorbital region and an improvement was observed in the clinic of the patient after medical treatment. Control examinations of the patient are still being performed in 2-month intervals. Written informed consent was obtained from the patient.

Discussion

Various autogenous and alloplastic materials were used in the reconstruction of the orbital floor defect that occurred after the tumor surgery. Bone cements are among the alloplastic materials used instead of bone in dentistry, brain surgery, orthopedic surgery, and facial deformities due to trauma or tumor surgery (1-3).

PMMA as a bone cement is an effective and safe material that is inexpensive, resistant, easily molded, shockproof, adapts to the surrounding tissues, has mechanical properties similar to bone when hardened, and can be accepted by the body. In addition to space-filling and load-bearing properties in tumor surgery, it also has a property to kill tumor cells with the help of the heat that it releases while hardening. Hardening quickly, being robust and radiopaque, and the ability for it to be used in revision surgery are the main advantages of PMMA. If not careful about the heat that is released after PMMA application, and if not cooled, the following may be caused: damage to the surrounding tissues, irritation in the mucosa, tension and pain sensations in the skin, material leakage out of the skin, and migration. These are the main disadvantages of PMMA. The reason for the right infraorbital cellulitis that developed in the postoperative 6th month can be thought of as mucosa irritation caused by the bone cement and the resulting skin tension. Additionally, radiotherapy may have disrupted blood circulation (4, 5). Because PMMA causes intraoperative hypotension, care should be taken while using PMMA in this regard (6). In long-term use, problems such as loosening, corrosion, and breakage may occur in vivid and variable tissue, at attachment points, and in within the PMMA (7). It can be left permanently in the body as well as removed after the problems associated with the tumor have ended and biological methods may be applied instead (8).

The necessity of long dissection time, pain in the donor site, risk of hematoma development, the lengthy and difficult process to

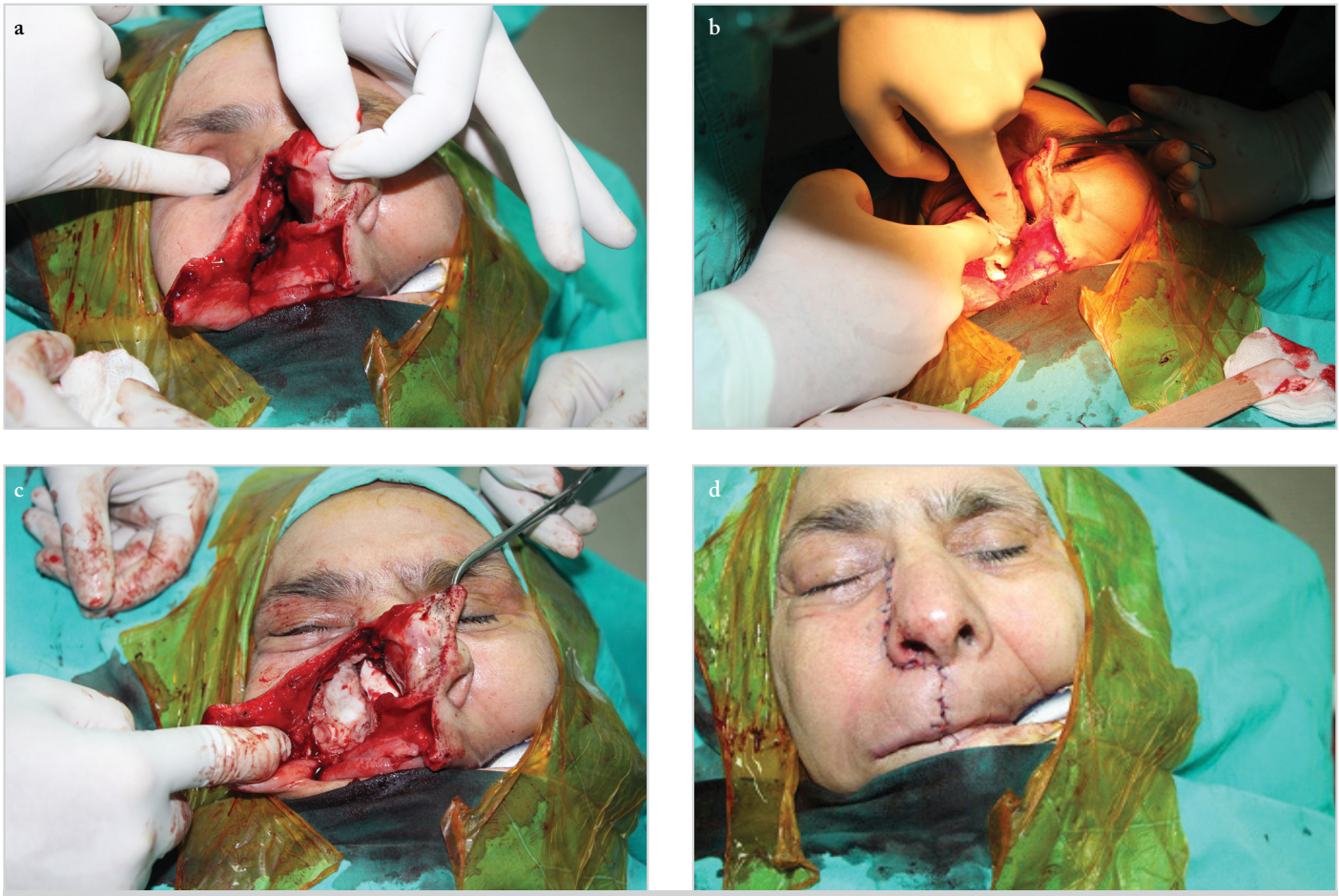

Figure 3. a-d. Inward collapse of the eyeball and the implementation of the bone cement after tumor resection.

Figure 4. a-d. Eye movements in the 3rd postoperative month.

shape the bone tissue, resorption of the bone graft, and inadequate reconstruction can be considered to be the major disadvantages of autogenous grafts (9).

With regard to radiotherapy, there is no advantage or disadvantage to using bone cement (10).

Exothermic effects that occur during the polymerization of PMMA cement causes the death of localized nerve cells in the interosseous and/or periosteal nerve endings. Attempts to explain this are related to the chemotoxicity developing in intraosseous pain receptors and the neurotoxicity induced by the monomeric phase of the cement (11).

Because this patient had an advanced stage tumor, we preferred bone cement in order to make it possible to remove it again (in case of recurrence), to correct the defect after the tumor was removed, and to fill in the gap.

Conclusion

Reconstruction of the orbital bone structures carries importance for ensuring normal eye function and esthetics. Bone cements that are made of alloplastic materials can be used in the reconstruction of orbital bone wall defects induced by tumor surgery.

Informed Consent: Written informed consent was obtained from the patient who participated in this study.

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