



Prosthetic rehabilitation of orbital defects: A review of 110 cases

Sita Thaworanunta¹, Binit Shrestha², Theerathavaj Srithavaj³

¹ DDS, MS, MSc, Maxillofacial Prosthetic Service, Faculty of Dentistry, Mahidol University.

² BDS, MSc, Maxillofacial Prosthetic Service, Faculty of Dentistry, Mahidol University.

³ DDS, BSc, MS, Maxillofacial Prosthetic Service, Faculty of Dentistry, Mahidol University.

Abstract

Objective: Debilitating orbital defects can arise as a part of tumor management, trauma, and congenital malformations. Due to limitations in surgical reconstruction, ideal aesthetic results may not be achieved. The reconstruction of orbital defects mostly comprises of placement of a skin graft or rotational flaps to close the area. Facial prosthesis is a preferred alternative, where a more controllable and predictable aesthetic outcome can be obtained.

Materials and methods: In this retrospective study, a group of 110 patients who had been rehabilitated with silicone orbital prostheses in the Maxillofacial Prosthetic Service, Mahidol University between 2000-2011 was taken into consideration. The most common defect etiologies, surgical and prosthetic treatment employed, and frequently encountered problems following rehabilitation were evaluated.

Results: Out of 98 patients eligible for the study, 88 patients were treated with adhesive retained prostheses and 10 were treated with implant-retained prostheses. The etiologies that resulted in orbital defects were tumor (86.7%), fungal infection (7.1%) and trauma (6.1%). Tumors with the highest incidence were retinoblastoma (29.4%), squamous cell carcinoma (25.9%), adenocystic carcinoma (11.8%), and others such as basal cell carcinoma, malignant melanoma, etc. Orbital defects established following removal of the tumor by exenteration (71.4%), enucleation (24.5%), and trauma (4.1%). Commonly encountered problems after rehabilitation were discoloration of the prosthesis, open or torn margins, and acrylic housing dislodgment.

Conclusion: The use of silicone prosthesis can be a safe, predictable and aesthetic treatment option for rehabilitation of orbital defects. However, focus on patient awareness, early detection, and intervention should be emphasized so that the individuals can be spared from these debilitating conditions.

Keywords: facial Prosthesis, orbital defect, retrospective study, craniofacial implant, exenterated defects, silicone prosthesis

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Corresponding Author:

Binit Shrestha
Maxillofacial Prosthetic Service,
Department of Prosthodontics,
Faculty of Dentistry, Mahidol University,
6 Yothi Rd., Rajathevi, Bangkok 10400.
Fax : 02-2007735
Email : binit_shrestha@hotmail.com

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Introduction

Facial defects secondary to the treatment of neoplasms, congenital malformations, and trauma result in multiple functional and psychosocial difficulties.¹ Any reconstruction or rehabilitation carried out on the mid-face, such as the orbit, is easily perceived by an observer due to its' location.² Moreover, reconstructive surgeries are limited to closure of the defect by a flap or graft.³ Despite advances in surgical techniques, the restoration of orbital defects is considered as one of the most difficult procedures due to the risk of complications and the final aesthetic outcome may not be as desired.

Alternatively, the defects can be rehabilitated with the help of a prosthesis, which mimics the normal anatomy. In many situations, the esthetic result of the prosthetic rehabilitation may be superior to that of surgical reconstruction. These prostheses are usually held in place with the help of adhesives, frameworks, and implants. Silicone elastomers are the most widely acceptable material due to acceptable color integration and texture.⁴ The choice of retention is selected based on patient preference, defect dimensions, and materials available.

Currently, there has been no information on the treatment outcome of patients with orbital defects rehabilitated with facial prosthesis from Thailand. Therefore, the aim of this study was to review the treatment data of 110 patients with orbital defects who had been rehabilitated with silicone prostheses. The most common defect etiologies, surgical and prosthetic treatment employed, and frequently encountered problems following prosthetic rehabilitation were evaluated.

Materials and methods

In this retrospective study, a group of 110 patients who had been rehabilitated with

silicone orbital prosthesis in the Maxillofacial Prosthetic Service, Mahidol University, Bangkok, Thailand between 2000-2011 was taken into consideration. These patients had been referred for rehabilitation from various hospitals in the central as well as provincial regions of Thailand. After obtaining permission from the Head of the Clinics, the patient database was thoroughly analyzed, and the most common defect etiologies were investigated along with the most common employed surgical and prosthetic treatment. Following prosthetic rehabilitation with the orbital prosthesis, the most frequently encountered problems were also evaluated.

The age of the patient was determined as the age at which the patient first visited the Service following surgical treatment of the disease. The defect side was listed as left, right, or bilateral. The etiology of the diseased state was verified by evaluating patient records along with assessment of surgical referral reports, and it was classified according to origin into tumor, trauma, or infection. The surgical procedure employed to control the diseased state was grouped as exenteration, enucleation, or when no additional treatment or trauma was involved. Adjunctive therapies employed in addition to the surgery, such as chemotherapy and radiotherapy, were also noted.

The treatment provided to these patients was either fabrication of an adhesive retained prosthesis or an implant-retained prosthesis; both forms of retention utilized anatomic undercuts for additional retention when present. Following rehabilitation the patients were recalled for maintenance visits on the 1st, 3rd, 6th month, and then on yearly. The most frequently observed complications during the recall visits were also evaluated.

Results

Although 110 patients were treated during

the time period, only 98 were eligible for the study. 12 patients were excluded from the study due to lack of information regarding the etiology of the disease or the type of surgery employed.

The study consisted of 53 men and 45 female. The age distribution of the patients was widely varied, ranging from 4 to 84 years old, with the mean age of 41 years. The left side and the right side was affected 51% and 49% respectively. No bilateral orbital defects were observed. The etiologies that resulted in orbital defects were tumor (86.7%), fungal infection (7.1%), and trauma (6.1%) (Figure 1). Tumors with the highest incidence were retinoblastoma (29.4%), followed by squamous cell carcinoma (25.9%), adenocystic carcinoma (11.8%), and others such as basal cell carcinoma, malignant melanoma, etc. (Figure 2). Orbital defects arising from surgical excision of squamous cell carcinoma were most prevalent in the 7th decade of life, where as adenocystic carcinoma was most prevalent in the 3rd and 4th decade of life. In some patients, a combination of surgical and radiation therapy for the treatment

of retinoblastoma led to orbital defects. Due to continual contraction and fibrosis of the ocular tissues, these defects could no longer be restored with an ocular prosthesis. These defects were mostly prevalent in the 2nd decade of patients' life and required rehabilitation with an orbital prosthesis.

In the study, orbital defects established following removal of the tumor by either exenteration (71.4%), enucleation (24.9%) or following trauma (4.1%) (Figure 3). An open communication with the nasal cavity, i.e. open defect, was observed in 15.3% of the exenterated defects. In 4.08% of the defects that when exenteration, a modified eyelids sparing technique was employed. All cancerous lesions underwent exenteration, expect retinoblastoma in which the surgical procedure varied between exenteration and enucleation depending on the spread of the lesion. A combination of post-operative radiotherapy and chemotherapy as adjunctive therapies was administered in 20.4% of the patients, whereas 34.69% had received only post-operative radiotherapy and 4.08% had received chemotherapy.

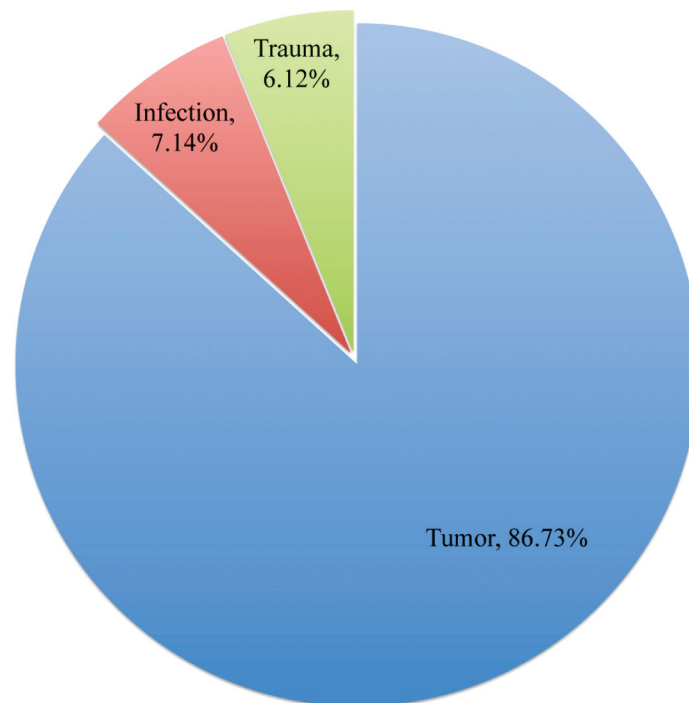


Figure 1 Common etiologies resulting in orbital defects.

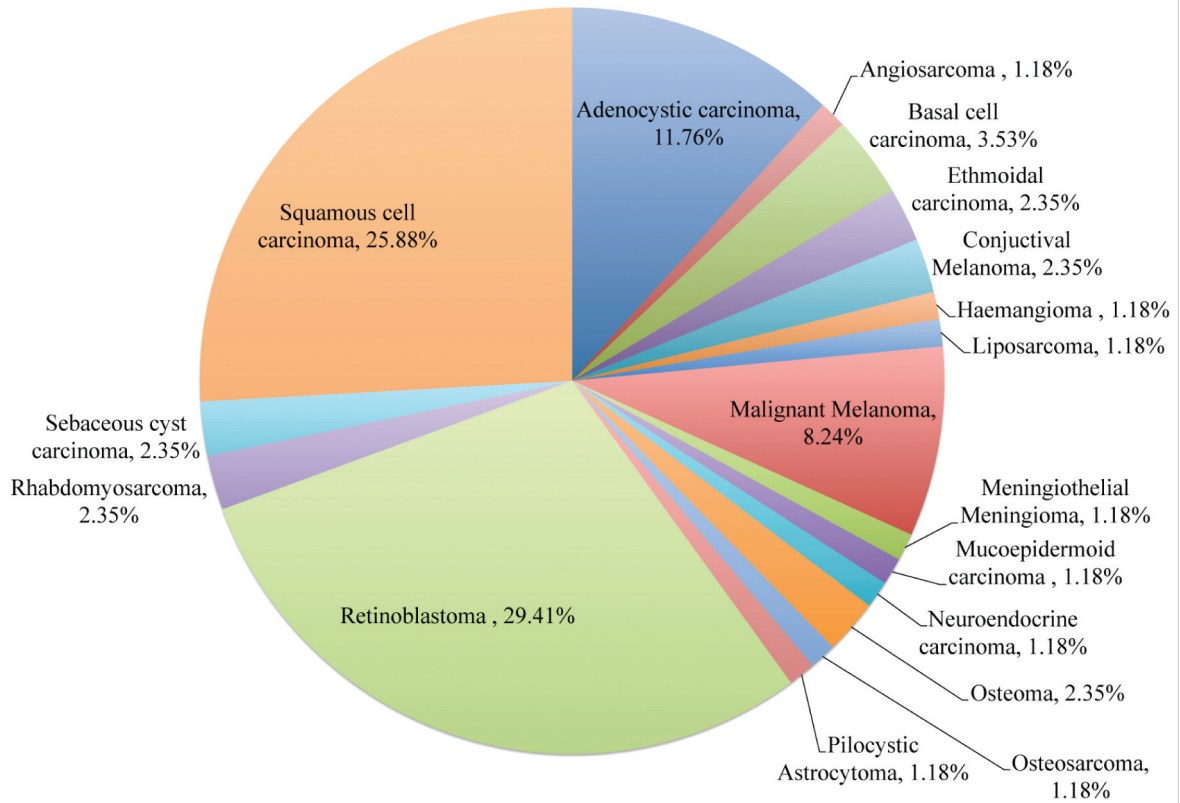


Figure 2 Tumors associated with orbital defects.

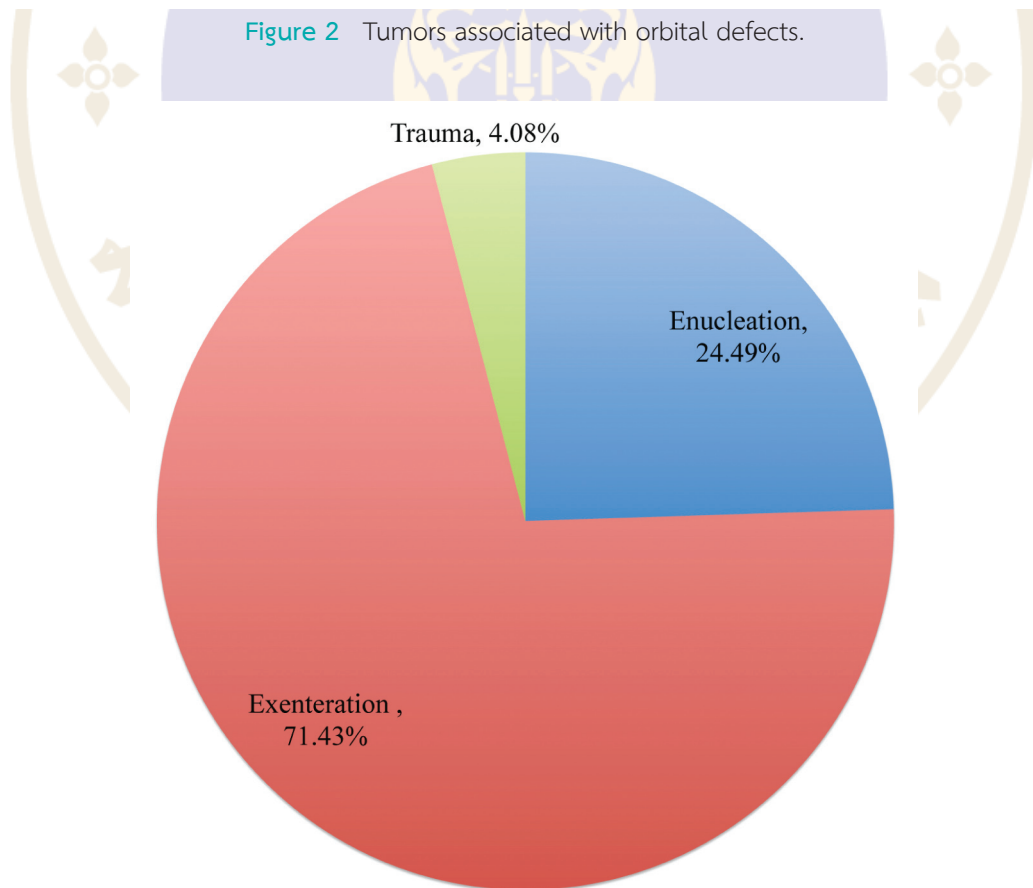


Figure 3 Orbital defects established following trauma or following removal of the tumor by exenteration or enucleation.

The results revealed 88 patients were treated with adhesive retained prosthesis and 10 patients were treated with implant-retained prosthesis. A total of 34 craniofacial implants were placed in this group of patients (Flange Fixture, Entific Medical Systems, Goteberg, Sweden) utilizing a two-stage technique. The number of implants placed was either 3 or 4 depending on the retention requirement of the facial prosthesis, and a waiting period of 4-6 months was employed between the two surgeries. Out of these 10 patients, 7 had a history of radiation therapy or a combination of chemotherapy and radiation therapy. Within the irradiated patient group, the success rate of craniofacial implants was 92%, where 2 implants failed among 25 that were placed. The failures occurred in two patients, one had a history of radiation therapy and another had a history of chemotherapy and radiation therapy. However, the overall success rate of craniofacial implants was observed as 94.1%. All implant retained orbital prosthesis were held in place utilizing magnetic attachments (Magna-Cap, Technovent, South Wales, UK) attached to the prosthetic abutment. Then, an acrylic framework was used to house all the attachments, and it was adhered to the silicone prosthesis using a primer agent.

Common problems seen after rehabilitation were discoloration of the prosthesis, open or torn margins, and acrylic housing dislodgment. There was a rare occurrence when one of the patients was reported to have had allergic reactions to adhesives. The allergic reaction was confirmed with a patch test, and the patient was later rehabilitated with implant retained orbital prosthesis.

Discussion

The treatment employed for the management of neoplasm depends on the type, severity, and the spread of the lesion. Acquired orbital defects mostly arise from

surgical management of tumors originating from the orbital contents, or due to spread of tumors originating from paranasal sinus, palate, nasal cavity, overlying skin, and intra-oral mucosa. Most series point out 40-50% of the exenterations were required for tumors originating in the eyelid or periocular skin.⁵ In the study, 88.6% of the exenterations were carried out due to tumors. Furthermore, a large percentage of the patients (71.4%) had undergone exenteration, which may have been due patient negligence of the disease, delayed diagnosis, or delayed treatment as there may be no sign of orbital invasion in the initial stages of neoplasm. Fixation to the bone, limitation in ocular motility, and globe displacement may occur as the disease progresses,⁶ establishing the need to seek medical attention.

In this review of 98 patients, the tumors with the highest rate of incidence were retinoblastoma (29.4%), squamous cell carcinoma (25.9%), adenocystic carcinoma (11.8%), and followed by others such as malignant melanoma (8.2%), basal cell carcinoma (3.5%), etc. (Figure 2). A 20 years retrospective study involving 32 patients with exenterated orbital defects reported the incidence of tumors as basal cell carcinomas (53%), malignant melanomas (19%), sebaceous carcinomas (13%), squamous cell carcinomas (9%), and adenocarcinoma (6%).⁷ Similarly, another study reported incidence of orbital tumors as 99% basal cell carcinoma and 4-6% squamous cell carcinoma or sebaceous gland carcinoma.⁶ The genetic predisposition of the individuals and the habitual or environmental risk factors could have led to this variance.

Although surgical reconstructions by radial forearm graft or rectus abdominalis free flap had been performed, the procedures mostly comprised to obtain closure of the defect. In these situations, the aesthetic results may vary from fair to good due to poor color match and variability in texture.² Surgical techniques have also involved creating functional eyelids to

provide space for ocular prosthesis, but they have not yielded desired aesthetic results, thereby, indicating prosthetic rehabilitation.³ At times an open defect may be preferred for prosthetic rehabilitation, as bulky flaps may leave little space for prosthesis fabrication.²

In this study, only a limited number of patients had attempts at surgical reconstruction by the mentioned techniques. Orbital defects with preserved posterior wall were usually allowed to heal by granulation tissue formation⁶ or by lining the defect with a split thickness skin graft. Defects with communication with the nasal cavity were left open. A study reported 56 exenterations with eyelid sparing in 44.4% of skin tumors, 91.67% conjunctival tumors, and 100% orbital tumors.⁸ Similarly, 34 exenterations were reported with 38.2% subtotal, 41.2% total, and 2.05% extended.⁵ In this study, lid sparing exenteration had been carried in only 4.08% of the patients; the difference may have been due to the staging and the nature of the tumor. Tumors that have spread into the adjacent bone require aggressive treatment.

In subtotal exenteration with open and functional eyelids, ocular prosthesis did not yield aesthetic results due to its inability to completely restore the lost tissue volume or it could not be fabricated at all due to lack of space. When the eyelids were left open, movement of the tissue bed during functioning of the orbicularis oculi muscles decreased the prosthetic prognosis. The movements created an unstable tissue base leading to open margins of the orbital prosthesis. The prosthetic rehabilitation had a better prognosis when the remaining eyelids, if left intact, were sutured together.

The study also showed that a cumulative 55.1% of the patients received post-operative radiation therapy (radiation therapy along or radiation therapy in conjunction with chemotherapy) in the orbital region. One of the side effects following external beam radiation therapy (EBRT) is the retardation of bone

growth. The effects were more profound in growing patients, which were partly seen as facial hypoplasia on the irradiated side.⁹⁻¹¹ Scarring and fibrosis of the tissues, especially of the eyelids, also complicated the rehabilitation procedure. The study also showed that some patients who had undergone enucleation along with EBRT at an early age required rehabilitation with an orbital prosthesis. It was primarily due to progressive delayed growth of the irradiated side and facial asymmetry that became more prominent as the patients reached 2nd decade of life. Side effects of radiation can be observed intraorally as abnormal tooth development, in the form of microdontia or anodontia.¹¹ Studies have also pointed out overall stunted or abnormal growth in patients when pituitary glands were involved in the radiation field.¹² However, these side effects to the growth and development of orofacial structures are mostly seen with EBRT. High precision radiation therapy techniques, such as Intensity Modulated Radiation Therapy (IMRT) and 3D-IMRT, have significantly minimized these radiation-related complications.

Although some patients may prefer to wear an eye patch,⁶ silicone prosthesis remains a preferred treatment for the restoration of orbital defects. In most situations, the use of anatomic undercuts along with adhesives provides adequate retention. Endosseous craniofacial implants can also be utilized for retention of larger prosthesis, or when the patients are allergic to skin adhesives. Unlike the mastoid or temporal bones, placement of implants parallel to each other can be difficult due to the anatomy and natural curvature of the orbital bones. A custom-fabricated semi-precision attachment, such as a Doder or Hader bar over the implants can help to obtain a uniform path of insertion and to obtain the desired level of retention, but they are difficult to fabricate due to high technical skills involved. Console abutments with magnetic attachments have also been used to retain orbital prosthesis.¹³

Although retention obtained from craniofacial implants are significantly higher than adhesives, placement of implants in the orbital bone requires careful treatment planning. Success rate of implants in orbital bones is shown to be lesser compared to mastoid and nasal bone, and the risk increases by 3 to 12 folds in irradiated bone as compared to non-irradiated bone.⁴ From the results of the study, an overall success rate of 94.1 % was observed. The success rate of craniofacial implants on irradiated bone was 92%, but further information regarding the dosage or the field of radiation could not be obtained.

Most of the maxillofacial prosthesis, including orbital prosthesis, needs to be made every 1.5 – 2 years on an average.⁴ Environmental factors such as UV radiation, smoke, and weathering of silicone can also lead to discoloration of the prosthesis, requiring restaining of the prosthesis approximately every 6 months. Furthermore, hygiene maintenance protocols have to be strictly followed to prevent inflammation of the implant abutment interface.¹⁴ The effects of these factors on the patient's quality of life and perception towards the treatment should be considered for future investigations.

In conclusion, the rehabilitation of patients with orbital defects has been successfully carried out with the help of silicone prosthesis, and it has exhibited good aesthetic outcome with patient satisfaction. However, focus on awareness, early detection, and intervention should not be neglected such that the individuals are spared from these debilitating conditions.

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Ethical Approval: Retrospective study with permission from Head of Maxillofacial Prosthetic Service.

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