Pre-Prosthetic Surgical Alterations in Maxillectomy to Enhance the Prosthetic Prognoses as Part of Rehabilitation of Oral Cancer Patient

HISHAM ABDEL FATTAH, M.D.D.S.* and ASHRAF ZAGHLoul, M.D.S.**

The Department of Oro-Dental & Maxillofacial* and Surgical**, National Cancer Institute, Cairo University

ABSTRACT

After maxillectomy, prosthetic restoration of the resulting defect is an essential step because it signals the beginning of patient's rehabilitation. An obturator used to restore the defect should be comfortable, restore adequate speech, deglutition, and mastication, and is acceptable cosmetically. Success will depend on the size and location of the defect and the quantity and integrity of the remaining structures, in addition to pre-prosthetic surgical preparation of the defect site.

Preoperative cooperation between the surgeon oncologists and the maxillofacial surgeon may allow obturation of a resultant defect by preservation of the premaxilla or the tuberosity on the defect side and maintaining the alveolar bone adjacent to the defect of an abutment tooth.

This study was carried out to evaluate the importance of Pre-prosthetic surgical alterations at the time of maxillectomy on the enhancement of the prosthetic prognoses as part of rehabilitation of the oral cancer patient.

The present study was carried out on 66 cancer patient, 41 males 25 females ages ranging from 33 to 72 years, seeking treatment between 2003-2008 at The National Cancer Institute, Cairo university they underwent immediate prosthetic rehabilitation after maxillectomy surgery to remove the malignant tumor as apart of cancer treatment. Patients were divided into groups according to pre-prosthetic surgical preparation before prosthetic restoration.

Group (A): Resection of maxilla followed by preprosthetic surgical preparation 24 cancer patients (13 males - 11 females).

Group (B): Resection of maxilla without any preprosthetic surgical preparation. 42 cancer patients (28 males and 14 females).

Outcome variables measured included facial contour and aesthetic results, speech understandability, ability to eat solid foods, oronasal separation, socializing outside the home, and return-to-work status. Flap success and donor site morbidity were also studied.

This study concluded that the cornerstone to improve the prosthetic restoration of the maxillary defect resulting maxillary resection as part of the treatment of maxillofacial tumor depend on the close cooperation between the prostho-dontist and the surgeon, this can be achieved by combination of surgical and prosthetic technique which can be controlled by pre-prosthetic surgery during maxillectomy.

Key Words: Maxillary re-construction – Pre-prosthetic surgery – Oral cancer

INTRODUCTION

In the past 25 years, head and neck surgery has subjected to rapid progression in surgical technique and technology that has led to resectability of larger and more extensive cancers tumors of the head and neck region and led to a larger number of patients with extensive postsurgical defects and subsequent physiological consequences that, without the field of maxillofacial rehabilitation, would lead to decreased patient satisfaction and poorer post-operative outcomes. The blind goal of curing cancer should not be allowed to obscure the importance of the quality of the patient's life. How successfully rehabilitation is accomplished depends upon both the judgment and skill of the therapist, and the post-treatment anatomic, physiologic, and psychological makeup of the patient. Treatment of the patient with cancer of the maxilla and hard palate is complex [1-3]. Results in significant functional and aesthetic sequelae. These may include collapse of the cheek and infraorbital soft tissues, loss of hemi palate and oral phase of deglutition, difficulty with articulation, and orbital complications. In maxillectomy including the orbital floor, the lack of infraorbital rim and floor support can result in hypophthalmos, enophthalmos, and often diplopia [4].

This study highlights the salient principles and discusses the different types of pre-prosthetic surgery after following maxillectomy
that may be indicated for the management of maxillary defect resulting from maxillectomy as part of cancer treatment.

Removal of extensive segments of hard and soft palate as well as the regional lymphatics usually mandates extensive rehabilitative management [5-7]. Up till now the debate about Prosthetic obturation and surgical reconstruction of maxillary defects had never stopped. Recently, multiple surgical approaches have been advocated to address some of the problems associated with traditional reconstructive approaches. Free flaps including rectus abdominis, radial forearm, lateral arm, fibula, iliac crest, and scapula have been used to reconstruct the maxilla and defects following maxillectomy and in many centers are considered the standard of care for primary reconstruction [1,5,8]. Up till now the debate about Prosthetic obturation and surgical reconstruction of maxillary defects had never stopped. Recently, multiple surgical approaches have been advocated to address some of the problems associated with traditional reconstructive approaches. Free flaps including rectus abdominis, radial forearm, lateral arm, fibula, iliac crest, and scapula have been used to reconstruct the maxilla and defects following maxillectomy and in many centers are considered the standard of care for primary reconstruction [1,5,8].

As the maxillectomy patient requires maximal distribution of forces, the cheek will be an area of contact with the obturator. The thick squamous epithelium of a split-thickness skin graft will resist the wear and tear applied by the obturator [6,25]. Eric M. Genden et al. [23] illustrated that soft tissue flaps are effective for relining the oral cavity and separating the oral and nasal cavities. However, placement of a soft tissue flap obliterates the maxillectomy cavity and eliminates the retentive properties of the mucocutaneous scar band and the medial palatal shelf, thereby adversely affecting the prognosis for a stable tissue-borne dental prosthesis. Furthermore, the absence of bone will prevent the placement of osseointegrated implants.

Many authors described the importance of preserving the premaxillary segment by the fact that the residual premaxillary segment generally provides adequate volume and density of bone for the placement of implants [5,14,17,26,28]. Alternative sites include the posterior alveolar ridge, maxillary tuberosity, and the zygoma. However, poor quality of the bone in the maxillary tuberosity may compromise initial implant anchorage and a predictable long-term result. The residual zygoma is also unfavorable because the location and angulations of implants limit hygiene access and compromise retention and support for the prosthesis. The combination of zygomatic and standard endosseous implants also have also been reported as an alternative option to reconstruct patients after extensive resection of the maxilla [28].

Removing the inferior turbinate, the prosthesis can be contoured to fit into the nasal cavity. This vertical height will resist the rotational forces applied during mastication. In addition, by adding the nasal cavity, a larger surface of bone will be utilized to distribute force during mastication [25].

The removal of coronoid process can be considered as another surgical modification to prevent displacement of the obturator or causing mucosal irritation. In resections that extend posterior into the soft palate, it may be advisable to remove the coronoid process. Otherwise, as the mandible moves downward and forward the coronoid process may displace the distolateral aspect of the obturator resulting in mucosal irritation [5]. Postoperative pain and limitation
of mandibular movements were observed in cases if coronoid process was not removed [18].

If more than a small area of the floor of the orbit is resected, it should be repaired to prevent enophthalmos. Epiphoria is uncommon; when it occurs, it is related to scarring of the nasolacrimal duct or due to traumatic blockage of lymphatic drainage of the area [24,29].

PATIENTS AND METHODS

This study was carried out on 66 patients whom were treated at the National Cancer Institute, Cairo University, between 2003 and 2008 whom under went immediate prosthetic reconstruction after maxillectomy surgery to remove a malignant tumor as apart of cancer treatment.

Patients were divided into two groups according to Pre-prosthetic surgical preparation before prosthetic restoration.

Group (A): Resection of the maxilla followed by preprosthetic surgical preparation 24 cancer patients (13 males and 11females).

Group (B): Resection of the maxilla without any preprosthetic surgical preparation with. 42 cancer patients (28 males and 14 females).

Patients with tumor extending to globe or skull base and who received pre-operative radiotherapy before surgery were excluded from this study. Patients were followed up for period ranging from 18 to 30 months

Surgical procedure:

A complete head and neck clinical examination was performed, beginning with an assessment of the overall facial symmetry and any areas of swelling or fullness and by taking photography for each patient to document changes and assess the response of the lesion to treatment. Ophthalmic examination was performed to check the range of extra-ocular motion, visual acuity, pupillary response, and signs of globe displacement. The nasal mucosal lining or fullness in the lateral or superior nasal cavity wall was also carefully assessed. Neck examination was performed to detect palpable lymph node metastases.

A comprehensive pre-surgical dental and oral examination was performed to determine the number, location and integrity of the remaining teeth, the status of the dentition in the opposing arch and the size and arch form of the maxilla. Dental impressions were made for diagnostic casts of both arches. If time was available, the restoration of carious lesions, extraction of hopeless and prosthetically useless teeth and establishment of good periodontal status and oral hygiene procedures were done pre-prosthetically.

Intraoral inspection of the hard palate, gingiva, and anterior maxillary wall were also assessed for fullness, signifying an expanding mass within the maxillary sinus or nasal cavity. Mandibular excursion was assessed for trismus and any possible sign of pterygoid musculature invasion.

Preoperative antibiotics were prescribed and continued until nasal packing was removed postoperatively.

General anesthesia with muscle relaxation was used for all types of maxillectomy. Either orotracheal or nasotracheal intubation was selected depending on the surgical approach. In some cases skin incisions were marked before the endotracheal tube was taped in place to avoid distortion of facial structures and skin lines. The patient was put in supine position in a 20° reverse. The eyes were protected carefully.

Surgical approach:

The choice of the surgical approach was determined by the location, size, type, and aggressiveness of the tumor, the extent of the planned resection and by the preferences of the patient and the surgeon. Lesions were usually accessed via a facial approach in conjunction with the transoral approach. If the lesion was located primarily anteriorly, maxillectomy was performed transorally without splitting of the lip. If there was any difficulty with exposure and resection, or if the lesion was located laterally or far posteriorly, the extraoral approach (Weber-Ferguson approach) was adopted to allow better access to the tumor. Complete exposure of the maxilla was obtained through splitting the lip, extending the incision around the nose up to the orbit and along the eyelid. The mucosal incisions were outlined to give a 5 to 10mm margin around the tumor depending on the histopathology of the biopsy. These incisions were made through the periosteum. The periosteum was elevated to expose sufficient bone to permit cutting with an osteotome and/or oscillatingsaw.
After resection was completed the bony edges were smoothed and contoured then covered with periosteum (Figs. 1,2).

Resection:

The cut along the infraorbital rim and superior anterior maxillary wall was made with a high-speed oscillating saw with a fine blade. The level at which this superior cut was made was determined by the extent of the resection. The line of transection was continued through the nasal process of the maxilla medially and downward through the piriform aperture. Laterally, the cut extends to the zygomatic process of the maxilla and around the posterolateral aspect of the sinus.

The line of transection in the maxillary alveolus could run between two teeth if a suitable gap was evident, otherwise the tooth was extracted, and the cut was made through the extraction site. A power saw was used, and the cut was connected to the transaction line through the nasal process of the maxilla and the piriform aperture. The hard palate mucosa was then incised lateral to the proposed cut in the hard palate bone to preserve a flap of mucosa that could be used to cover the raw cut bony edge of the palate.

An osteotome was used to cut horizontally through the lateral nasal wall inferiorly at the level of nasal floor (inferior meatus).

The hard palate was then cut with a power saw. Once all the bone cuts were complete, an osteotome may be used to connect them if necessary. Bleeding was initially controlled with large lap packs initially, then with bipolar cautery and figure-of-eight suture ligatures through pterygoid muscles. The surgical defect was packed to control bleeding. Bleeding from the internal maxillary arte was controlled by ligatures or legating clips.

All surgical specimens were sent for histopathological examination to assess the tumor free resection margins and also to confirm the preoperative histological diagnosis.

Alternative surgical procedures (pre-prosthetic surgical procedure):

• The horizontal incision of Weber Ferguson (from the lower eye led to the outer acanthus) was made 2mm close to the eye lash. The oral cavity was exposed with cheek retractors. An incision was made in the gingivobuccal sulcus and the mucosa of the hard palate maintaining adequate margin and using monopolar electrocautery. Incisions were made circumferentially through all the soft tissues up to the anterior wall of the maxilla and the hard palate. The infraorbital nerve was preserved if not affected with the disease process. An attempt was made to retain as much as possible of the hard palate consistent with adequate tumor free margin (Fig.1).

• The cut of hard palate mucosa was made lateral to the planned cuts in the hard palate bone to create a mucosal flap, which will be used to cover the cut bony edge of the hard palate. The palatal mucosa was saved and used to cover the margins of the cut palatal bone (Fig.1).

• All sharp spicules of bone were debrided. The flap of hard palate mucosa was then incised lateral to the proposed cut in the hard palate bone to preserve a flap of mucosa that could be used to cover the raw cut bony edge of the palate.

• A split thickness skin graft was applied under the soft tissue flap to line the surgically produced cavity especially the cheek raw area. A split-thickness skin graft, 0.35 to 0.4mm in thick, was harvested from the anterolateral thigh and used to reline the raw buccal mucosa area. The graft is sutured to the cut edge of the buccal mucosa with 4-0 chromic catgut. Xeroform and strip gauze coated with antibiotic ointment were gently packed into the defect to secure the skin graft. The previously fabricated dental obturator is wired to the remaining teeth to hold the packing in place (Fig. 3).

• Removal of any exposed inferior turbinate, regardless of oncologic necessity. Prohibited the potential for subsequent inferior turbinate edema and descent into the oral cavity. (Fig. 4).

• If any tooth was chosen to be extracted to allow the surgeon to make bone cuts through tooth sockets the adjacent teeth was preserved. If the mucosa covering the maxillary antrum was not diseased, it was removed.

• The premaxillary anatomy was preserved provided the preservation did not compromise
the oncologic objective to provide greater prosthetic support and stability.

- Coronoidectomy was performed to transect the coronoid process on the operated side of mandible. In dentulous patients, (Fig. 5). Transalveolar bony cuts should be made as distant as possible from the tooth adjacent to the palatal defect.

- A number of implants (in the case of request) were inserted after tumor surgery and before insertion of immediate surgical obturation that will be used later as anchorage for the prosthesis (Fig. 6).

- Three obturators were delivered for the overall period of treatment and rehabilitation. Obturators include three classes: Surgical obturator (placed at the time of surgery). An interim surgical obturator (fabricated to aid in the healing of tissues during the recovery period 2-3 weeks following surgery). The definitive obturator was delivered to the patient After three month following surgery.

- Every maxillectomy patients must be instructed about the importance of regaining his/her normal mouth opening to improve chewing efficiency and regain speech sound.

**Obturation of surgical defect:**

The fabricated surgical obturator was inserted immediately after removal of the neoplasm and fitted in place followed by modeling of the gutta percha after repositioning of the cheek flap to regain normal contour of the face. Tension on the cheek flap was avoided. A gauze pack was placed with its end emerging through the nose to facilitate its removal and allow irrigation through the nose during the period of initial healing. The obturator was ligated with an 18-gauge wire to the remaining teeth and the zygomatic process to provide a stable prosthesis. In dentulous patients, a combination of stainless steel wire clasps, interdental wires or transalveolar ligation was used to stabilize the obturator. However, in the edentulous patient stabilization was attained with a transalveolar ligature wire and/or zygomatic arch suspensors wires. In edentulous patient or after bilateral maxillectomy, bilateral suspension through the zygomatic bone or supra-orbital rim was done.

**Postoperative care:**

A nasogastric tube was placed at the end of the surgery. Most of the patients were able to begin a liquid diet and advance to a soft diet within a few days following surgery. A soft diet was continued for at least 2 weeks. Oral rinses and flushes with normal saline or half-strength hydrogen peroxide were performed at least four times daily and after meals. Facial incisions were cleaned twice daily and coated with antibiotic ointment. Facial sutures were removed 5 to 7 days following surgery.

The obturator and the packing were removed from the cavity in 10 to 14 days by cutting and removing ligature wires with a wire cutter and the wound was irrigated with saline. The interim obturator was placed to maintain oral competence. A final obturator was placed once healing was completed and the cavity was stabilized.

All patients were instructed for jaw muscle training through physiotherapy to regain normal mouth opening, improve chewing efficiency and speech sound.

**Outcome measures:**

Outcome variables measured included facial contour and aesthetic results, speech understandability, ability to eat solid foods, oronasal separation, socializing outside home, and return-to-work status. Flap success, donor site morbidity, and orbital complications were also observed.

Facial contour and aesthetic results were assessed by the authors through postoperative photographs using a modified scale originally described by Laney [29].

*The speech understandability scale was modified from list et al. [37] always:*

1- Understandable,
2- Understandable most of the time with occasional repetition necessary,
3- Usually understandable but face-to-face contact necessary,
4- Difficult to understand, and
5- Never understandable with written communication necessary.

**Ability to eat solid foods was scored using the following criteria:**

1- Full range of solids with no restrictions,
2- Minimally restricted solids with few specific exclusions (e.g., bread crumbs),
3- Variety of solids taken but facilitated by increased moisture or liquid chasers,
4- Minced, moist, or soft diet;
5- Pureed solids, and 6-no solids.

Oronasal separation was scored as follows:
1- No evidence of velopharyngeal incompetence or nasopharyngeal reflux or nasal regurgitation of liquids,
2- Mild inconsistent nasal emission, nares constriction, hypernasality, or nasal regurgitation or reflux,
3- Moderate and consistent nasal emission, nares constriction, inappropriate nasality, or reflux or regurgitation,
4- Severe or frequent nasal emission, nares constriction, and inappropriate nasality,
5- Constant and continuous nasal emission, nares constriction, hyper nasal resonance.

Hospital stay or days spent postoperatively was recorded for each patient.

Socialization: We also noted if the patient socialized outside the home frequently, occasionally, rarely or never with a score between 1-3 (1=frequently and 3=never).

Statistical analysis:
Statistical Package for Scientific Studies SPSS version for Windows (SPSS Inc, Chicago, Ill) was used for analysis. Frequencies and basic descriptive statistics were conducted including means, standard error of the means, and ranges to illustrate characteristics of the patients and postoperative complications such as length of hospital stay, contour deformity, follow-up, survival, speech, diet, and oronasal separation. Student’s t-test, Mann-Whitney test and Pearson’s Chi square were performed to examine differences in outcome measures between patients with and without preprosthetic surgical intervention.

Fig. (1): The cut in the hard palate mucosa should be made lateral to the planned cuts in the hard palate bone to create a mucosal flap, which will be used to cover the cut bony edge of the hard palate.

Fig. (2): All sharp spicules of bone were debrided. The flap of the hard palate mucosa was brought up over the cut bony edge of the palate.

Fig. (3): A split thickness skin graft was applied under the soft tissue flap to line the surgically produced cavity especially the check raw area.

Fig. (4): Removal of any exposed inferior turbinate, regardless of oncologic necessity.
RESULTS

Frequencies and basic of data on sex, age, hospital stay, contour deformity, follow-up, survival, speech, diet, and oronasal separation were calculated, including means, standard error of the means, and ranges and were tabulated. Tables (1,2) summarize the outcome score function.

Tables (1,2) show the differences between group A and B. Patients in Group (B) had significantly longer hospital stays 10.26±3 days) when compared with patients in Group (A) (7.5±2.09 days), p=0.001. Group B patients reported better eating solid foods, speech understandability and oronasal separation when compared with Group A (p<0.001). However, both facial contour and socialization scores were borderline statistically significant where Group A patients had lower scores denoting better outcome.

Facial contour and aesthetic results:

Assessment of facial contour and aesthetic results was performed using postoperative photographs and medical records (Table 3). The mean ± SEM facial contour score (Table 1) of this patient population was (2.38±0.88) for Group (A) and (2.76±0.82) for Group (B). Subgroup analysis demonstrated that there was no significant impact facial contour scores Table 3 (p<0.001). B. 12.5% in Group (A) and 7.1% in Group (B) had an operative side that resembled the appearance of the non-operative side in contour and symmetry with no ectropion or enophthalmos. Moderate deformity involved a closed orbit without a nasocutaneous fistula, no exposed plating, moderate ectropion or enophthalmos, and moderate soft tissue asymmetry or skeletal deformity as compared with the nonoperative side was reported in 25% and 50% of Group (A) and (B) respectively. Severe deformity (12.5% in Group (A) and 16.7% in Group (B) consisted of gross soft tissue asymmetry, gross skeletal deformation, nasocutaneous fistula, exposed plating, or severe ectropion or enophthalmos.

The speech understandability:

The speech understandability scale is depicted in Table (4). Importantly, patients in Group (B) had speech scores less than those in Group (A), patients in Group (B) tended to have worse speech scores (2.64±1.03) than those in Group (A) (1.63±0.88). The speech understandability scale revealed 58.3% of Group A and 14.3% of
Group B being understandable, 25% in Group (A) and 33.3% in Group (B) being understandable most of the time with occasional repetition necessary. More difficult to understand was reported in Group B (26.2%) when compared with Group A (4.2%).

**Ability to eat solid foods**

Tables (1,2) show that the mean diet score for subgroup analysis in patients in Group (A) (25±1.11) demonstrated a trend toward significantly worse diet scores ($p<0.001$) than those of patients in Group (B) (group 4.02±1.35). Ability to eat solid foods scored in Table 5). More patients in Group A were able to eat solid foods either with no restrictions (20.8%) or with few specific exclusions (50%) or facilitated by increased moisture or liquid (20.8%) compared with 7.1%, 7.1% and 11.9% in Group (B) respectively. On the other hand, more of Group B patients were eating either minced, moist, or soft diet (35.7%), pureed solids (26.2%), while 4.2% were not able to eat solids at all.

**Table (1):** Frequencies and basic of data on sex, age, hospital stay, contour deformity, follow-up, survival, speech, diet, and oronasal separation.

<table>
<thead>
<tr>
<th>Group</th>
<th>Valid No.</th>
<th>Median</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
<td>A</td>
<td>B</td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>Age</td>
<td>N=24 N=42</td>
<td>56.50</td>
<td>51.00</td>
<td>33.00</td>
<td>34.00</td>
<td>72.00</td>
</tr>
<tr>
<td>Hospital Stay</td>
<td>N=24 N=42</td>
<td>8.00</td>
<td>10.00</td>
<td>4.00</td>
<td>5.00</td>
<td>11.00</td>
</tr>
<tr>
<td>Facial Contour</td>
<td>N=24 N=42</td>
<td>2.00</td>
<td>3.00</td>
<td>1.00</td>
<td>1.00</td>
<td>4.00</td>
</tr>
<tr>
<td>Speech understandability</td>
<td>N=24 N=42</td>
<td>1.00</td>
<td>3.00</td>
<td>1.00</td>
<td>1.00</td>
<td>4.00</td>
</tr>
<tr>
<td>Ability to eat solid</td>
<td>N=24 N=42</td>
<td>2.00</td>
<td>4.00</td>
<td>1.00</td>
<td>1.00</td>
<td>6.00</td>
</tr>
<tr>
<td>Oronasal Separation</td>
<td>N=24 N=42</td>
<td>2.00</td>
<td>3.00</td>
<td>1.00</td>
<td>1.00</td>
<td>5.00</td>
</tr>
<tr>
<td>Socialization</td>
<td>N=24 N=42</td>
<td>1.00</td>
<td>1.00</td>
<td>3.00</td>
<td>4.00</td>
<td>1.29</td>
</tr>
</tbody>
</table>

**Table (2):** Comparison between 2 groups (test Mann-Whitney U).

<table>
<thead>
<tr>
<th></th>
<th>Mann-Whitney U</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital Stay</td>
<td>252.500</td>
<td>0.001</td>
</tr>
<tr>
<td>Facial Contour</td>
<td>369.000</td>
<td>0.056</td>
</tr>
<tr>
<td>Speech understandability</td>
<td>233.000</td>
<td>0.000</td>
</tr>
<tr>
<td>Ability to eat solid</td>
<td>162.000</td>
<td>0.000</td>
</tr>
<tr>
<td>Oronasal Separation</td>
<td>231.000</td>
<td>0.000</td>
</tr>
<tr>
<td>Socialization</td>
<td>385.500</td>
<td>0.064</td>
</tr>
</tbody>
</table>

**Oronasal separation**

There were significant differences in oronasal separation among the 2 groups, because the mean score in Group (A) was lower than Group (B) (Table 1). Oronasal separation was scored are shown in Table (6). No evidence of velopharyngeal incompetence, nasopharyngeal reflux, nasal regurgitation of liquids was reported by 45% of Group (A) patients and only 9.5% in Group (B). Mild inconsistent nasal emission, nares constriction, hyper nasality, nasal regurgitation, or reflux was reported by 33.3% of Group (A) patients compared with 16.7% in Group (B). 64.3% of patients in Group B experienced moderate or severe forms of consistent nasal emission, nares constriction, inappropriate nasality, reflux or regurgitation.

**Levels of Socialization and return-to-work status:**

Levels of Socialization and return-to-work status were tabulated in Table (7) in this population. All patients in this study socialized outside the home either frequently or in Emergency. Levels of Socialization and return-to-work status were also studied in this population. All patients who were not disabled or retired at the time of reconstruction (100%) returned to work.

**Complications:**

The main complications which were observed after maxillectomy surgery were ranged from case to case as follows:

1- Enophthalmos and hypophthalmos, which create a cosmetic deformity.
2- Infraorbital nerve injury, which results in anesthesia or paraesthesia of the ipsilateral cheek and upper lip. On occasion, the infraorbital nerve had to be sacrificed as part of the planned resection.

3- Epiphoria, caused by scarring of the nasolacrimal duct.

Difficult retention of the dental prosthesis, which could be prevented by careful preoperative evaluation and appropriate choice of the reconstructive method. In select cases, free tissue reconstruction without a dental prosthesis was optimal.

Table (3): Facial contour and aesthetic results scale

<table>
<thead>
<tr>
<th></th>
<th>Group (A)</th>
<th>Group (B)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency (%)</td>
<td>Frequency (%)</td>
</tr>
<tr>
<td>No def.</td>
<td>3 (12.5)</td>
<td>3 (7.1)</td>
</tr>
<tr>
<td>Minimal</td>
<td>6 (25.0)</td>
<td>11 (26.2)</td>
</tr>
<tr>
<td>Moderate</td>
<td>3 (12.5)</td>
<td>7 (16.7)</td>
</tr>
</tbody>
</table>

Table (4): The speech understandability scale

<table>
<thead>
<tr>
<th></th>
<th>Frequency (%)</th>
<th>Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understandable</td>
<td>14 (58.3)</td>
<td>6 (14.3)</td>
</tr>
<tr>
<td>Occasional repeat</td>
<td>6 (25.0)</td>
<td>14 (33.3)</td>
</tr>
<tr>
<td>Face to face Contact</td>
<td>3 (12.5)</td>
<td>11 (26.2)</td>
</tr>
<tr>
<td>Difficult</td>
<td>1 (4.2)</td>
<td>11 (26.2)</td>
</tr>
<tr>
<td>never understandable</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
</tbody>
</table>

Table (5): Ability to eat solid foods scale.

<table>
<thead>
<tr>
<th></th>
<th>Group (A)</th>
<th>Group (B)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency (%)</td>
<td>Frequency (%)</td>
</tr>
<tr>
<td>Full Range</td>
<td>5 (20.8)</td>
<td>3 (7.1)</td>
</tr>
<tr>
<td>Minimal Restricted</td>
<td>12 (50.0)</td>
<td>3 (7.1)</td>
</tr>
<tr>
<td>Increased Liquid</td>
<td>5 (20.8)</td>
<td>5 (11.9)</td>
</tr>
<tr>
<td>Minced Soft</td>
<td>1 (4.2)</td>
<td>15 (35.7)</td>
</tr>
<tr>
<td>Pureed Solids</td>
<td>0 (0)</td>
<td>11 (26.2)</td>
</tr>
<tr>
<td>No Solids</td>
<td>1 (4.2)</td>
<td>5 (11.9)</td>
</tr>
</tbody>
</table>

Table (6): Oronasal separation scale.

<table>
<thead>
<tr>
<th></th>
<th>Group (A)</th>
<th>Group (B)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency (%)</td>
<td>Frequency (%)</td>
</tr>
<tr>
<td>No</td>
<td>11</td>
<td>4</td>
</tr>
<tr>
<td>Mild</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>Moderate</td>
<td>2</td>
<td>15</td>
</tr>
<tr>
<td>Sever</td>
<td>1</td>
<td>12</td>
</tr>
<tr>
<td>continuous</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

Table (7): Socialization scale.

<table>
<thead>
<tr>
<th>Socialization scale</th>
<th>Group (A)</th>
<th>Group (B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1- Frequently</td>
<td>19 (79.2%)</td>
<td>23 (54.8%)</td>
</tr>
<tr>
<td>2- Occasionally</td>
<td>3 (12.5%)</td>
<td>14 (33.3%)</td>
</tr>
<tr>
<td>3- Social occ.</td>
<td>2 (8.3%)</td>
<td>3 (7.1%)</td>
</tr>
<tr>
<td>4- Emergency</td>
<td>--</td>
<td>2 (4.8%)</td>
</tr>
<tr>
<td>5- Disabled</td>
<td>(0%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>

DISCUSSION

The complete maxillectomy defect creates a significant rehabilitative challenge as it creates problems with speech, deglutition, and aesthetics. The basic objectives of prosthetic reconstruction should include preservation of tissue, positive support, retention, and prosthesis stability for patients requiring obturator therapy for such maxillectomy defects [6,18,21,31]. Rehabilitation is an essential phase of cancer care and should be considered from the time of diagnosis in a complete and comprehensive treatment plan. If cosmetic and functional impairments are not corrected or minimized, the patient may be unable to resume a normal working and social life [14].

At the past, tissue-borne prosthetic obturation was the only option for orodental rehabilitation of post ablative palatomaxillary defects while at the present time, if the planned surgical procedure involves resection of part of the maxilla or the mandible, appropriate dental consultation should be obtained preoperatively and continued during every phase of treatment. A general principle with regards to the maxillary patient is to do all that can be done in the time allowed including implantation of an osseointegrated implant.

Although there are several factors influencing the prognosis of prosthetic reconstruction in patients whom underwent maxillectomy such as the size of the defect, availability of hard and soft tissues in the defect area to provide support for the prosthesis, proximity of vital structures, patient attitude, temperament, systemic conditions, and the patient’s ability to adapt to the prosthesis [8,24]. This study added the necessity to put in consideration the importance of pre-prosthetic Surgical procedure at the time of maxillectomy.
In the Extra oral approach (Weber-Ferguson approach), the lateral incision should be continued laterally in the subciliary crease along the inferior eyelid or maximum 2mm away from eyelid to the lateral canthus of the eye to avoid formation of preocular edema due to interference with lymph drainage in this area which may cause facial disfigurement [8,24,32].

Many articles [25,27,28] illustrated that the patient with a maxillary resection has poor or no dentition. This study emphasized that preservation of all possible teeth and vigorous dental hygiene are important in the preoperative period to reduce problems in the postoperative period. In addition to assessment and preservation of teeth, the premaxillary anatomy should be preserved (provided the preservation does not compromise the oncologic objective) to provide greater prosthetic support and stability. Preservation should also include height and width of the residual alveolar ridge because preservation of any portion of the alveolus or additional non-involved teeth will improve the post-surgical results dramatically. A study [25] proved that natural teeth greatly improve retention and stability of a maxillary prosthesis. When a prosthesis is properly extended, speech, swallowing, mastication, and facial contour restoration can be accomplished. In its final contour, the obturator should extend maximally along the lateral wall of the defect [25].

It is advised to attempt placing the line of resection through the socket of an extracted tooth rather than attempting to cut between roots of adjacent teeth should also be attempted. If necessary, teeth may be extracted to allow the surgeon to make bone cuts through tooth sockets while preserving adjacent teeth. Cuts between teeth sockets will result in loss of support for adjacent teeth and lead to loss of uninvolved teeth. The surgeon should be encouraged to resect only enough hard palate to allow adequate tumor margins to maintain as much hard palate as possible especially the anterior alveolus which give the patient the chance to have less contracture postoperatively. Peltier et al. [25] recorded the importance of maintaining as much as possible of the hard palate in primary retention, support, and stability. Especially ipsilateral palate preservation, which will allow a tripoding effect [25].

It is advisable to remove any exposed inferior turbinate, regardless of oncologic necessity to facilitate superior prosthetic extension and retention and to prohibits the potential for subsequent inferior turbinate edema and descent into the oral cavity. By removing the inferior turbinate, the prosthesis can be contoured to fit into the nasal cavity and this vertical height will resist the rotational forces applied during mastication. Jacques Peltier [25] illustrated that by removing the inferior turbinate, the prosthesis can be contoured to fit into the nasal cavity. This vertical height will resist the rotational forces applied during mastication. In addition, by adding the nasal cavity, a larger surface of bone will be utilized to distribute force during mastication [25,33].

The flap of hard palate mucosa should be brought up over the cut bony edge of the palate and held in place with several sutures aiming to preserve bone in this area, accelerate healing during early healing phase and eliminates pain caused by pressure from the obturator on bar bone. This opinion is hardly supported by Bradlord et al. [2] who recommended that the cut in the hard palate mucosa should be made lateral to the planned cuts in the hard palate bone to create a mucosal flap, which will be used to cover the cut bony edge of the hard palate and added. The bone is cut with a high-speed power saw, and an ostetome is used to divide any remaining bony attachments and deliver the specimen. Some other researchers believed that covering the cut edge of the hard palate bone with mucosa only eliminates pain caused by pressure from the obturator on thinly covered bone [9].

If the cheek flap left to heal by secondary intention, the healing time will be prolonged for extend many weeks, and the area will be covered with respiratory epithelium from the nasal cavity and nasopharynx. This epithelium is problematic in two ways: 1- The tissue is easily abraded by future prosthesis, 2- This type of epithelium is secretory adding secretions that the patient must clean or have cleaned [23,34,35]. The thick squamous epithelium of a split-thickness skin graft will resist the wear and tear applied by the obturator reduce healing period and skin graft and a scar band which form at skin graft mucosal junction can be used to help with retention of the prosthetic appliance. Several publications [2,3,34,35] have been reported that retention of the obturator is aided by the band of scar tissue that forms at the junction of the mucosa and the skin graft. Covering the cheeks row area by Split-thickness skin graft
was recommended by Schusterman et al. [4]. Who considered split-thickness skin graft a traditional reconstructive approaches to maxillectomy to line the internal cavity and palatal prosthesis to obturate the palate and serve as a denture.

Patients in Group (B) had significantly longer hospital stays compared with those patients in Group (A). This may be either due to acceleration of healing in Group (B) due to covering the check raw area and palatal bar bone or due to early jaw function which allow him to have his meal without the use of nasogastric tube this in addition to immediate prosthetic rehabilitation which correct facial disfigurement resulting resection of portion of maxilla this factors had positive psychological condition on the patient that allowed him to leave the hospital earlier.

The present study showed that the preprosthetic surgical technique applied in this study has no significant impact on facial contour and aesthetic results and significant improvements in speech understandability, ability to eat solid food and oronasal separation. This may be due to the concentration in the present study on the elements that improve retention and stability of the obturator rather than the elements that improve of facial aesthetic. In similar study carried by Ducic and Oxford [16] approved that correctly constructed obturator will usually result in the return of normal speech and swallowing. During breathing and the production of nasal speech sounds, the space around the obturator reflects the potential for muscular contraction. Some researchers have focused on Several surgical principles should be utilized when performing lip-splitting incision and include the following: 1- Sharp dissection rather than electrocautery should be utilized when incising the labial, buccal, and palatal mucosa to minimize postoperative dehiscence, 2- An adequate blood supply should be maintained to the mucosal flap that will be utilized to cover the oronasal or oroantral defect that results from the surgical procedure, 3- A two-layer closure should be utilized when possible, 4- Tissue tension should be avoided across the incision line, 5- A one centimeter margin of healthy tissue should be removed with the tumor [33,36,37].

The Speech understandability was improved in Group (A) compared with Group (B). May be due to restoration of the functional anatomy of the maxillary sinus by well fit obturator researchers reported that restoration of maxillary defect simulates the functional anatomy of the maxillary sinus and adds resonance to the speech [29,34,35].

Although all patients in the present study socialized outside the home and return-to-work status either frequently or occasionally, there was border line significance between the two groups (Table 7). The levels of socialization and return-to-work status was higher in Group (A) (79.2%) than that in Group (B) (54.8%). These may be due to the self confidence gained from the improvements in speech understandability, ability to eat solid food and complete oronasal separation due to retentive and stable prosthesis (Table 5) which allowed the patient to freely communicated with others people.

The primary objective of rehabilitation is the restoration of appearance and function. How successfully this is accomplished, depends upon both the judgment and skill of the therapist, and the post-treatment anatomic, physiologic, and psychological makeup of the patient. In addition to assessment and fabrication of obturators for the maxillectomy patient, dental oncologist can also make suggestions to the surgeon for resections that will make the stability and comfort of the prosthesis better. Of-course, total eradication of disease is the primary concern in any patient with cancer. There are several strategies to resection of oral cancers that would add no increase in the chance of recurrence of disease and decrease postoperative morbidity [34,37].

Conclusion:

Treatment of the patient with cancers of the maxillary sinus and hard palate is complex and requires a multidisciplinary team approach at the time of initial diagnosis and treatment planning. For maximal patient satisfaction and rehabilitation, the maxillofacial prosthodontist must have an active role in the pre and postoperative coordination of patient care and the head and neck surgeon must be aware of the assistance that the maxillofacial surgeon can offer in the treatment of this difficult and often devastating disease. The surgeon and the prosthodontist should be encouraged to work together to develop surgical and nonsurgical measures for achieving functional success of prostheses, success of surgical procedure, prevention of postoperative complications, and improved aesthetic and functional results which can add to patient satisfaction. Rehabilitative treatment plans
should be based on fundamental principles of prosthodontics, including a philosophy of preventive dentistry and conservative restorative dentistry. Surgery before prosthetic rehabilitation may be indicated to improve the existing anatomic configuration after ablative cancer surgery, reconstructive surgery, and/or radiation therapy. Multidisciplinary cancer care is required to achieve the best functional, physical, and psychologic outcomes.

REFERENCES


