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Fabricating an Obturator Prosthesis after Maxillectomy in a Rare Case of Adenoid Cystic Carcinoma - Case Report and Review of the Literature

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CASE REPORT

Abstract

Maxillary defects resulted after surgery, such as after an adenoid cystic carcinoma, are a real challenge for the restorative dentists. Mastication, deglutition, speech and facial contour are dramatically affected by the reduction of the supporting tissues.

Material and method. The case presented here is of a female patient in her fifth attempt of prosthetic rehabilitation, accusing sores on the mucosa in the segmental resection area, difficulties in feeding and hydration, nasal leakage of the food and liquids in the nasal cavity, hypernasality, impaired deglutition and unsatisfactory esthetics.

Conclusions. A careful step-by-step therapeutical approach using basic prosthodontic principles, with a special attention for the maxillary defect areas and also the simultaneous making of a maxillary obturator and a mandibular acrylic partial denture resulted in successfully restoring the separation between nasal and oral cavities and in providing the patient with functioning abilities and good esthetic results, improving her psychological state and self-confidence.

Keywords: maxillectomy, obturator prosthesis, acquired defect, adenoid cystic carcinoma

I. INTRODUCTION

Obturator prostheses restore the maxillary defects, successfully replacing lost tissues, including teeth and bone. During function, they restore the partition between the oral and nasal cavity in patients with major tissue deficiencies [1]. Also, they have a major impact in restoring the esthetics and the social life of these patients and improve their psychological status [2]. These prostheses can be partial or complete, depending on the oral status at the moment of the surgery; their retention and stability are proportional with the remaining anchorage and support, so their design must be carefully customized by the maxillofacial prosthodontist [3]. The defect areas must be relieved from excessive pressure exerted by the prosthesis, especially in its margins. Faults in designing and manufacturing the obturator can lead to further pathological changes in the tissues [4].

Designing a suitable obturator for maxillectomy patients is aiming to restore the separation between oral, antral and nasal cavity so that mastication, deglutition, speech and facial contour is regained. In any case, the supporting tissues are dramatically reduced after surgery, which affects the functionality of the prosthesis. Retention is crucial in obtaining comfort and functionality; therefore, one of the

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important aspects is to fabricate a light weight prosthesis [5,6,7,8]. For already-rehabilitated patients wearing old dentures and having reduced neuromuscular skills, denture-copying techniques can be used in order to minimize their need to acquire new abilities [9].

II. CASE PRESENTATION

A 61-year-old female patient came to our Clinic asking for functional oral rehabilitation consecutive of a surgery suffered for an adenoid cystic carcinoma in the maxillary lateral right incisor area. The resection was made six years ago and included a significant portion of the hard and soft palate, the alveolar ridge and the floor of the nasal cavity. Prophylactic bilateral cervical ganglionectomy was performed 4 weeks after the surgery, followed by contact x-ray brachytherapy, two sessions per week, for five weeks. The oro-naso-antral communication is bilateral. From the moment of the surgery until she came into our Clinic, the patient used a total of three obturator prostheses, including the immediate and the interim ones. At the presentation, the maxillary arch was completely edentulous, also presenting an acquired defect following the surgical resection (Figure 1,2). The mandibular arch was partially edentulous, a class II Kennedy with two modification spaces, presenting a combination of fixed partial dentures (crowns, bridges) and an acrylic removable partial denture with two wire clasps (Figure 3).

Figure 1: Intraoral clinical appearance after surgical resection

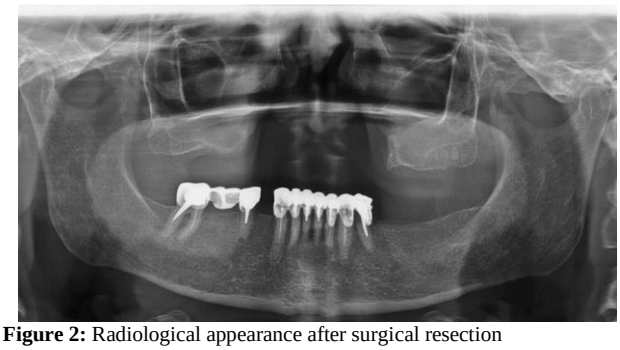

Figure 2: Radiological appearance after surgical resection

Figure 3: Intraoral clinical appearance of the mandibular arch

Her present obturator prosthesis was unstable and moving during function. The first one, also unstable, was obtained from one of her previous existing partial dentures, which was modified to temporary serve as an immediate and interim obturator for 2 months after the surgery. The patient waited 4 months to make another denture, in accordance with the recommendations received from the surgeon. Another denture was fabricated after one year, followed by an additional one after six months. During the whole period, the dimensional changes caused by scar contracture were compensated through rebasing and occlusion corrections. Still, at the presentation in our clinic, her current prosthesis was causing sores on the mucosa in the segmental resection area, difficulties in feeding and hydration, because of the nasal leakage of the food and liquids in the nasal cavity. Also, the patient accused phonetic disturbances (hypernasality) affecting speech, impaired deglutition and an unsatisfactory esthetics (appearance), caused by inadequate lip support. Psychological consequences were represented by declared moderate social withdrawal; she was compliant and willing to participate in the treatment phases, hoping that the new prosthesis will ensure a facial appearance that she will consider psychologically comfortable.

The significant heredo-collateral antecedents included colon cancer (the mother) and a history of multiple caries and early age complete edentulous arches for both parents. Her past medical history included breast cancer diagnosed two years before and she also had a history of multiple caries and became partially edentulous years before the surgery, first extractions taking place early in her twenties. Intraoral oncology preventive examination was performed, showing no signs of abnormalities. Saliva was viscous and reduced in quantity (hyposialia). Facial aspect was moderately modified, through reduced vertical dimension of occlusion, absence of maxillary bone contours in the medial and paramedial area and muscular hypotonia of the orbicularis oris muscle. The patient declared reduced sensibility on the right side. Trismus was present along with a limited mouth opening.

The informed consent was obtained for manufacturing an obturator made from acrylic resin (polymethyl methacrylate) and a mandibular acrylic partial denture; they were made using basic prosthodontic principles, paying a special attention to the maxillary defect areas. It was decided that both dentures will be simultaneously realized. A primary impression was made using low viscosity condensation silicone impression

material and the old patient's denture (Figure 4); the primary cast and an individualized tray with proper border molding were obtained. The final impression was made using also a low viscosity condensation silicone, which presented a better elasticity after setting, in order to minimize the disinsertion trauma. In the laboratory the technician made a master cast and duplicated it. The mandibular primary impression was made using irreversible hydrocolloid impression material; the primary cast and an individualized tray were obtained. After the final impression, a master cast was poured in the laboratory. The master cast's borders were outlined for the record bases. The undercuts on the sides of the defect were blocked with wax. Occlusal rim with bases were sent to the clinic and a jaw relation record was made; in this phase, difficulties were related to the resilient and unsupported tissues.

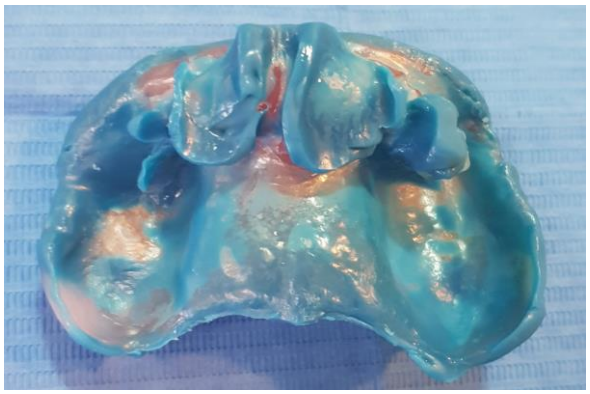

Figure 4: Preliminary impression

Waxed up dentures were tried in the mouth and checked for retention, stability and comfort and, also during this phase, phonetics was checked during phonation. Vaseline tents were placed on the entire internal part of the defect cavity before making the acrylic record bases. We used acrylic non-anatomic posterior teeth (Figure 5) and care was taken to obtain a correct selection of an occlusal scheme, elimination of premature occlusal contacts, and wide distribution of stabilizing components (Figure 6); The dentures were cured, finished and polished and the patient was instructed regarding oral hygiene and the maintenance of the prosthesis (brushing, use of dental collutoria and Zinc-free dental adhesives), diet, speech exercises and follow-up sessions.

Figure 5: Waxed up dentures with acrylic non-anatomic posterior teeth

Figure 6: Intraoral appearance of occlusion, lateral view

We used the residual postero-lateral region of the palate for proper sealing and all the peripheral area of the maxilla, including the residual alveolar ridge. The patient had a flat palate, favorable for the stability of the prosthesis. Because of the lack of teeth, the obturator had to be extended into the defect area for retention and stability, but not excessively in order to avoid adding too much weight on the prosthesis (Figure 7,8). We also used the available undercuts, especially the maxillary tuberosities, for retention.

Figure 7: Obturator prosthesis, mucosal view

Figure 8: Obturator prosthesis, lateral view

In order to adapt to the prosthesis, the patient was instructed to speak and swallow. Any excessive pressure on tissues was eliminated. Finally, the obturator was finished and polished. Deglutition improved almost immediately; speech

was better after a week, in the follow-up presentation. Patient was given hygiene and home care instructions.

III. DISCUSSION

The recommended treatment for most of the carcinomas is alveolectomy, palatectomy, partial/total maxillectomy, resulting in surgical defects with multiple consequences such as hypernasal speech, regurgitation of food and fluids into nasal cavity, impaired mastication and deglutition; a definitive obturator is indicated only after the complete healing of the tissues [10,11]. Assessing eating, swallowing, speech, esthetics and psychological consequences needs to be made for each case [12]; although, the manufacturing of the prosthesis follows the steps of conventional denture fabrication, it must take into account the particularities of planning, impression taking, laboratory phases, delivery and adjustments [13,14]. After surgery, a patient is not expected to give a centric relation record [3].

Depending on location of the defect, different types of obturators can be used accordingly. Alpine et al. describe a combined obturator and palatal-lift composite prosthesis, serving both functions, in a young patient with two distinct defects [1]. Other authors reported a combination obturator-eye prosthesis retained with magnets for a patient with an intraoral-extraoral defect [15]. Some authors describe the single step manufacturing of a lightweight definitive closed hollow bulb obturator, using a simple lost wax technique which utilizes easily available modeling wax in order to obtain a denture with a uniform thickness of heat cured resin encapsulating the hollow prosthesis [16].

If the obturator is not properly designed and constructed, the stress on the remaining hard and soft tissues may be pathological and may lead to premature loss of abutment teeth (if they exist) and chronic irritation of soft tissues; difficulties in obtaining a good function and esthetics often require a multidisciplinary approach for oral rehabilitation of these patients [17]. Srinivasan et al. presented a case of acquired maxillary defect with limited mouth opening and unfavorable undercuts in the defect who was successfully treated by making a two-piece hollow bulb obturator, connected by magnets, and with a transitional implant placed in order to aid as an auxiliary retentive measure [18]. Generally speaking, the presence of teeth is a favorable factor, since they can be included in the design of the prosthesis and used for its retention, either by simple wire clasps anchorages [19,20] or using attachments [21,22], or using a combination of implants and attachments [23,24,25]. Some authors evaluated the stress on the abutment teeth and framework in an obturator retained by resin-bonded extracoronal attachment using a three-dimensional finite element analysis method; the obtained stress values were lower on the anterior teeth compared with the posteriors, benefit being gained by splinting the abutment teeth [26]. In an in vitro study aiming to photoelastically compare the forces exerted on the abutment teeth in 3 differently sized surgical resections, the results suggested that splinting the 2 teeth adjacent to a resection defect improves stress distribution around the roots during loading, reducing tipping of the teeth even in the model with the largest resection [27]. Finite element analysis studies were made to evaluate the stress distribution and the displacement of the obturator, showing that both parameters have higher values in those prostheses, compared to the complete dentures [28].

Other authors tried to establish an alternative method to fabricate individualized obturator prosthesis through a modern approach, using a computer-aided design (CAD) and rapid prototyping (RP) technique, obtaining obturators that exactly matched the static shape and fit of the defect completed with clinical modifications to improve border contours [29]. Michelinakis et al. also reported the rehabilitation of a maxillectomy patient using a digital oral impression and a computer-aided design/computer-aided manufacturing obturator removable partial denture; the metal framework was made utilizing a selective laser melting [30]. Modern approaches have been also tested by other authors, who reported that using 3D digital casts instead of conventional stone casts is also suitable for the fabrication of obturators with good clinical effectiveness [31]. A study aiming to investigate the influence of maxillary obturator prostheses on facial morphology of individuals with unilateral maxillary defects by using 3-dimensional digital stereophotogrammetry proved that this method can be useful in evaluating facial reconstruction with maxillary obturator prostheses of individuals with unilateral maxillary defects [32].

The quality of life is significantly improving through manufacturing and wearing an obturator prosthesis, if it is correctly designed and functional. A study that included 43 patients revealed that orofacial rehabilitation of patients with maxillofacial defects using obturator protheses is an appropriate treatment modality, but information about the treatment, adequate psychological care and speech therapy should be provided [33]. Another study made on 57 patients who underwent maxillectomy and prosthetic rehabilitation concluded that a well-functioning obturator prosthesis was the most significant determinant for improved quality of life in patients with maxillary resection; although, age at the time of surgery, adjuvant treatments, presence of mandibular teeth, and previous maxillary removable prosthetic experience were the most significant predictors for better obturator functioning, whereas the size of the maxillectomy defect had a significant effect on quality of life but did not influence the functional outcome [34]. Some authors compared in terms of quality of life the rehabilitation with a palatal obturator versus the one with fixed-implant prosthesis, and concluded that the latter one is the best solution for rehabilitation of the head and neck oncologic patients [35]. Using implants in association with remaining teeth was considered helpful by some authors using a computer-aided design/ computer-aided manufacture (CAD/CAM) technology [36]. In absence of teeth, retention was considered the major problem for patients with maxillectomy defects; if they can be used, zygomatic implants can be a good solution for reconstruction, with or without standard endoosseous implants [37, 38]. Other authors used for retention a multiunit retentive mechanism consisting of an

orthodontic forsus fatigue resistant device and Herbst appliances with a lock mechanism to prevent excessive lateral movement [39].

Speech improves almost immediately after delivery of obturator prostheses; some authors have used clinical tools designed to measure the acoustic, physiologic, and perceptual bases of speech and revealed that speech without an obturator is significantly different from the preoperative state, while speech with an obturator does not differ significantly from preoperative function; still, they found that rehabilitation of individuals with involvement of the soft palate may be more challenging [40]. Chewing function of obturator wearers was self-evaluated in a study reported by Matsuyama et al., using 3 assessment tools: a self-assessment mastication scale, a chewing function score, and a mastication score [41]. In a cross-sectional cohort study on 49 patients with unilateral maxillectomy, Chen et al. evaluated the functioning of obturator prosthesis finding that stud attachments and magnets significantly improved the chewing, speech and swallow abilities [42]. Difficulties in swallowing range from food dropping from the mouth to nasal leakage. They are depending on the size and location of the defect and the number and location of the remaining teeth. Studies show that the swallowing ability of patients after maxillectomy improved, both quantitatively and qualitative, through wearing an obturator prosthesis; some authors used the "water-drinking test", conceived for dysphagia paralytica in cerebro-vascular disease, to evaluate the time required for drinking the water and the incidence of cough reflex [43]. The nasopharyngeal extension of the obturator minimizes the passage of food and liquids and also provide retention, besides the specific areas of the residual maxilla minimizing the extent of the potential movements during function; for stability, one of the most important aspect is obtaining a proper occlusion [44].

Some authors recommend the temporarily use of the permanent soft liners for fabricating provisional obturators [3]; still, another study mentioned that, despite good oral hygiene of the patient, after a period of nine-months, black stains appeared in the area where the soft resin was placed [45]. Other authors recommend them only for recently created defects, since they need repetitive replacement [46]. Several species of viable bacteria were detected in acrylic resin denture bases and obturators, in a study made by Takeuchi et al. [47]. Researches have been made in designing antifungal coatings for denture soft linings and obturator materials [48]. A crossover clinical trial on twelve patients comparing masticatory scores for two types of obturators made for the same patient, all-PMMA with a hollow obturator bulb and a hollow-core PMMA with an outer layer of silicone-resilient liner, found that resilient lining of PMMA resin obturator bulbs significantly improved masticatory ability in rehabilitated areas of the mouth [49]. Resilient liners have been used by other authors in fabricating the obturator part from a two-piece denture-obturator prosthesis for a patient with severe trismus and healing contracture appeared as a consequence of maxillectomy [50]. Two-piece obturator was reported difficult to insert by Sukumaran et al., who described a lock-and-key mechanism facilitating insertion and making the prosthesis easy to assemble intraorally; the obturator was also made from flexible, resilient heat-cured acrylic material [51]. Batra reported a case restored with an obturator made from a flexible resin material in order to improve patient's comfort [52]. A gas injection technique was used by other authors for fabricating the obturator in one step [53].

IV. CONCLUSIONS

Maxillectomy defects are a challenging situation for patients and practitioners. The prosthesis should be made to have support, retention and stability in order to successfully restore the separation between nasal and oral cavities and to provide the patient with functioning abilities. In this case, the obturator ensured the support of the soft tissues and restored the facial contour, correcting the lip and cheek shape, with a good esthetic results, improving the psychological state of the patient and self-confidence.

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