

Tissue Tolerability of the Thermo and Photopolymerizable Resins Used in Prosthetic Restoration after Removal of the Lower Facial Floor

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The introduction of the thermo and fotopolymerizable acrylic resins for the manufacture of total prostheses base has revolutionized dentistry in the 20th century. Thermopolymerizable acrylic resins (methacrylic acid derivatives) are found to have a low degree of toxicity on oral tissues after resection of the lower facial floor. It raises the question of thermo and fotopolimerizable acrylic resins toxicity compared with transplanted tissues from outside the oral cavity, in these cases compared with free osseomiocutaneous fibular flap. With the help of these resins, the restoration of the mastication, swallowing, phonation and physiognomy functions was achieved. The impact of free flaps in reconstruction of the mandible and oral floor and osseointegration of dental implants ensuring the stability of dentures are remarkable, allowing the reconstruction of the lower facial floor in a very high degree and the restoration of all functions.

Keywords: acrilic resins, reconstruction lower floor

Several vital functions are dependent on the existence of the mandible and its dynamics, on the existence of tongue and adjacent structures. The resection lower facial floor imposed by the presence of malignant tumors leads to permanent alteration of masticatory, swallowing, phonation and esthetic functions. Block resection operations in the lower floor of the face involve, during the second operation step, the reconstruction of the facial floor for keeping functions. In the postoperative stage, after tissue healing occurred, the rehabilitation of the masticatory function rehabilitation through prosthetic dentistry is questioned. This, however, does not represent a common dental workmanship because the prosthetic field resulted after surgical reconstruction of the lower facial floor is totally different from a usual prosthetic field as form and from the standpoint of the tissues involved. Normal oral tissues are resected since they are included in malignant tumor and replaced, by surgical reconstruction, with tissues transplanted from another region of the body. The introduction of the thermo and fotopolymerizable acrylic resins for the manufacture of total prostheses base has revolutionized dentistry in the 20th century[1]. Their use has been successful on oral healthy tissues, with several decades of experience clinically proving the tolerability of acrylic resins and their reduced toxicity on healthy tissues.

The article aims at looking for technical solutions to recover lost functions in these patients.

It raises the question of thermo and fotopolimerizable acrylic resins toxicity compared with transplanted tissues from outside the oral cavity, in these cases compared with free osseomiocutaneous fibular flap.

It was also monitored if there are notable tolerability differences between thermo and fotopolymerizable acrylic resins widely used to manufacture the base of total movable dentures.

Experimental part

The study was performed retrospectively on a group of seven patients, aged between 46 and 68 years, diagnosed

with mandible or pelvimandibular carcinoma in advanced stages with invasion of surrounding soft tissue: oral floor, tongue or chin. All subjects were treated at the Oral and Maxillo-Facial Surgery Clinic in Timisoara, during 2008-2013.

In the first phase of treatment, all the patients went through a surgery which consisted in the resection of the lower facial floor and the reconstruction of facial defect in one surgical step with free osseomiocutaneous fibular flap [2]. The tumor resection included a mandibular bone segment, causing interruption of the bone continuity, together with the soft tissues block of the oral floor, partial resection of the tongue together with its insertion on the mandible and of other soft tissues, aiming to be within safe oncological clinical limits.



Fig 1 Mandibular reconstruction using fibular flap (radiography)

In order to achieve a prosthetic field more favourable to total prosthesis with movable prosthesys of acrylic resins, plasty of the defect was achieved by using a osseomiocutaneous free fibular flap (fig. 1), which was reanastomized by standard microsurgical technique.

The bone component of the flap, fastened between mandibular blunts by osteosynthesis, restored the mandibular continuity and the miocutaneous component of the fibular flap inserted into the defect endooral rebuilt the lack of soft tissue on the oral floor and the insertion of the tongue and exooral chin, providing protection for the bone graft and oral cavity continence[3].

Postoperative evolution of these patients went without complications, the surgery being followed by radiation

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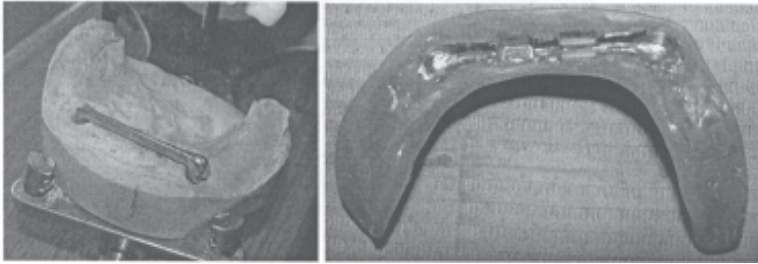


Fig. 2 Dolder bar on 2 dental implants for prosthetic field retentivity increase

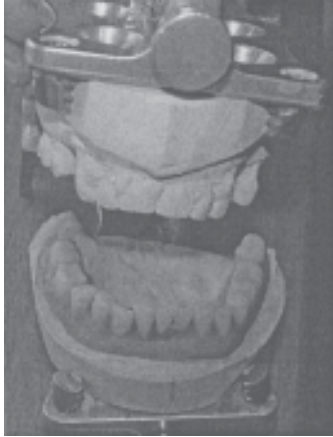


Fig. 3 Total movable acrylic denture

therapy in all cases. Given the totally atypical form of the prosthetic field, the prosthetics stage began after five months on average, by inserting two dental implants in the lower canines area. Subsequently, they were loaded by manufacturing a „Dolder” type bar (fig. 2) in the laboratory which aimed to increase prosthetic field retentivity. Finally, a full total movable acrylic denture (fig. 3) was made by using one of these two materials: thermopolymerizable acrylic resins and diacrylate composite fotopolymerizable resins.

For making dentures, patients have opted for one of the two types of materials commonly used dental laboratories. They opted by their own reasons, as no specific studies about the superiority of one or the other material in relation to transplanted tissues[4].

Patients were clinically monitored for 2 years. The medical checks were performed in the first year on a 6 months basis, the data being recorded in individual files. We have also performed laboratory tests to determine the presence of *Candida albicans* and other yeasts, samples were collected from the surface of whole dentures[5].

Results and discussions

Using acrylic resins for manufacturing dentures has allowed successful restoration of masticatory, swallowing and the physiognomic function as follows.

Dental implant supported deployable denture restores chewing function. It is permanently altered after the reconstruction of mandible, patients have the whole mandibular body replaced with a graft, fractured in 4 pieces, from a straight bone (fibula) that does not have the strength and form needed to perform the mastication. Soft tissues covering the graft do not belong naturally either to the oral cavity, being leg soft tissue at the origin (muscle and cutaneous tissue).

Kinematics of swallowing is based on stabilizing the mandible, in occlusal arch top and pushing the tongue to the hard palate from anterior to posterior, resulting in food bowel pushing toward the oropharynx isthmus. In the absence of the lower dental arch, in the absence of the mandible, which was reconstructed using a bone graft only

trying to imitate its original, swallowing is done slowly and incorrectly, the patient showing a degree of salivary incontinence. The manufacturing of a denture allows restoring the vertical dimension of occlusion and thus making the act of swallowing possible.

Physiognomic function was restored by restoring the vertical dimension of the lower floor of the face using total denture in dental [6]. Thus we witnessed the restoration of proportionality between the facial floors. In addition, the presence of dental arches visible during phonation and smile visibly improved postoperative patient's physiognomy, relieving the negative effect of postoperative facial scars at facial level.

For the rehabilitation of phonation function a psycho speech therapist was used, in most cases speech therapy sessions indicating a favorable outcome.

The most common location of the squamous cell carcinoma is the lateral edge of the tongue and the oral floor. Both locations predispose the jaw to tumor invasion, often requiring bone resection with excision of a large portion of the tongue and oral floor[7]. Disabilities resulting from these resections include difficulty speaking, impaired mandibular dynamic and reduced control of salivary secretions.

Reconstruction of the dental arches is the first requirement to be able to correct the altered oral functions. Thus, during the reconstruction surgery it was intended to create a more favorable prosthetic field for prosthetic restoration.

These altered functions are incompatible with life. So facial reconstruction efforts of the lower floor and prosthetic rehabilitation are needed to improve such functions. Choosing the proper material to get a good prosthesis is very important, because it has a direct effect on the quality of life[8].

Thermopolymerizable acrylic resins (methacrylic acid derivatives) are found to have a low degree of toxicity on oral tissues after resection of the lower facial floor. This was demonstrated by periodic clinical controls which did not reveal the occurrence of ulcerative, irritative areas such as stomatitis or open lesions in reconstruction tissues after wearing total prosthesis. It has been observed that through mobile prosthesis, patients have been able to maintain proper hygiene.

Each clinical control of patients was accompanied by pathological product sampling from the prostheses surface for identifying the presence of yeasts, especially *Candida albicans* type. These analyzes were negative demonstrating good immunity of the oral cavity reconstructed with grafted tissues.

Among the mechanical properties of thermopolymerizable acrylic resins, it is worth noting that Knoop hardness is 20, much lower than dentin that is approximately 65 and enamel with 300. Compressive strength is approximately 75 Mpa, tensile strength being approximately 52.5 Mpa.

Regarding corrosion, it has a high chemical inertness, making it very stable in the oral cavity. However, after a

while an unfavorable evolution is possible. Initially translucent acrylic resin becomes opaque and yellow. Microfissures that may occur over time can cause the decrease of the mechanical strength. But all these issues are the effect of physical causes and rarely chemicals.

The processing of acrylic resins was performed by using the usual technique. The stage 3 acrylate paste was poured into mold, then placed in a steam bath. The temperature was increased to the point where there were sufficient benzoylperoxide radicals to cancel the inhibitory effect of oxygen, thus triggering formation of the polymer chains through addition. The result was a polymer with a low hardness.

The presence of large amounts of residual monomer and not polymerized cross-linking agent can result in unfavorable mechanical. Thus optimal polymerization was done by observing a suitable heat treatment.

It is known that acrylate heating at temperatures above 100 C can lead to the formation of internal porosities of the polymerization product. For this reason, the water was heated very slowly.

We followed a regime of polymerization with favorable results regarding the final structure of PMMA's: water temperature rose to 65 C, the mould was inserted, maintaining the constant temperature of the bath for 60 min. Then the temperature was gradually raised to 100 C during one hour.

In terms of chemical properties of fotopolymerizable diacrylic composite resins, the organic matrix is a loaded dimetacrylate urethane with pyrolytic silica, pearls of acrylate and acrylic resins monomers with high molecular weight. Camphorquinone (photoinitiator) is activated by the same type of light sources, in terms of intensity and wavelength, to those used in dental office. But the final polymerization uses a special, very powerful light source.

Conclusions

Thermo and fotopolymerizable acrylic resins can be successfully used in prosthetic surgery for patients who have lower facial floor cancer.

With the help of these resins, the restoration of the mastication, swallowing, phonation and physiognomy functions was achieved.

The low level of toxicity of acrylic resins does not affect soft tissues grafted from the distance, normally not belonging in the oral cavity or tissues operated.

By resection of the lower facial floor and in the absence of reconstruction, the mastication, swallowing, phonation and physiognomy functions are permanently altered.

The impact of free flaps in reconstruction of the mandible and oral floor and osseointegration of dental implants ensuring the stability of dentures is remarkable, allowing the reconstruction of the lower facial floor in a very high degree and the restoration of all functions.

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