

Fixed Dentures Combined with Removable Dentures Retained with Extracoronal Attachments

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Abstract

The restoration of the lost structures can be achieved using conventional removal dentures, fixed dentures, skeletal prosthesis, skeletal prosthesis with attachments, telescopic system or dental implants. The creation of the dentures more difficult if the number of the lost teeth, result of decays or periodontal disease, is bigger. There are specific factors that interfere with an implant therapy. The treatment of partial edentulous space needs to always follow certain biologic principles. The removable partial denture with attachments is not considered a history treatment solution. It is more contemporain then ever in our society, more actual then the moment of its creation. There is an important number of patients who could benefit of this treatment option, on short term as well as on long term. Although, the lack of adequate knowledge, the overwhelming number of accessories available on the market, the multiple adjustments and the restorations, make the dentist hesitant in offering this solution of treatment to his patients. The aim of this paper is to offer a complex image of the existing attachments and also, a simplified approach on this clinical solution, things sustain also by a clinical case.

Keywords: *extracoronal attachments, partial edentulous space, skeletal removable partial dentures, fixed metal-ceramic dentures.*

Introduction

The attachment is a support, retention and stabilization device, which is form of two or more small parts. One part is connected with the tooth root, dentures or an implant, while the other is connected at the partial dentures. (1,2). The attachments are used in the treatment solution of the partial edentulous space in order to improve the esthetics and the life of the prosthetics. In the end of 19th century Parr, Peeso and Chayes built together a king of gadgets so called attachments which combine the advantages of fixed dentures with the ones of removable dentures. (3) This attachments were initiated by Henry R. Boos (1900) and modified by F Ewing Roach (1908). Most of them will replace the nocive bars of the classic clasps and can be use to retain partial or total dentures.

The attachments allow joint, vertical and rotational movements during activity, offering a free move of dentures in order to provide equable harmful force distribution as far as possible from the remaining teeth to the edentulous space and surrounding tissue (4). There are different treatment solutions for the uni- or bi-terminal edentulous patients (the absence of superior or/and inferior molars – Kennedy 1st and 2nd class). Although the prosthodontics restoration on implants are successful these days, the conventional methods used for removable dentures still have extraordinary practical applications, in many of the clinical cases, especially when implanter therapy cannot be used to substitute missing teeth (5). There are many scientific data which indicate the use of implants in partial edentulous treatment, serving as retainers for crowns and bridges but, regarding the combination of partial removable dentures and dental implants are few. Even more, the combination of dental implants and fixed dentures is sometime difficult.

Contraindications are related to medical and anatomic factors, as the position of mandibular nerve or the extension of maxillary sinus or the costs of implant therapy. These limitations are commune for the posterior maxillary or mandibular zone.

Removable partial denture from distal areas suffer vertical, horizontal and torsional forces which can have a negative impact during functional and parafunctional activity. These forces affect the retention, stability and support of the dentures, but they can be neutralized using design principles. Removable partial denture can be designed with or without metal skeleton. On both ways, the physiognomic appearance is modified, the retaining elements are visible and many of the patients are not pleased with the results and can refuse wearing the dentures (6). The failure rate is around 26%. The motivation of patient can be achieving trough removable partial dentures if physiognomic and masticatory functions are improved (7). Hybrid or composite solutions used in partial edentulous space treatment aim to increase retention and stability of the dentures in order to offer superior esthetics by replacing clasps with special attachments according with the clinical situation. These oral rehabilitations assume the preparation of one or more of the remaining teeth, there are more difficult to accomplish and it necessitate an exclusive clinical and laboratory technology. Also, in these kind of hybrid solutions, the use of iso-parallelometer is needed (especially for precision milling). The special systems for retention, support and stabilization are very accurate mechanical devices, with small dimensions, which connect remaining teeth with the dentures (8).

The **advantages** are:

- Eliminate the friction between natural teeth and clap;
- The attachments will be obligatory placed parallel one with the other and it will not provide stress forces on the remaining teeth during insertion and removal of the removable dentures;
- Attachments help at distributioning masticatory stress forces all over the prosthodontics field;
- Dentures are more comfortable for patients comparing with the ones with clasps;
- Dentures have an extraordinary esthetics, being used especially in young patients.

The **disadvantages** of the special systems are:

- Cannot be used on teeth with small crowns;
- They needs performance laboratory endowment and clinical experience;
- They needs special retain techniques for the fixed dentures (the one that anchor the teeth) because, the move of a quarter of millimeter won't allow optimal denture insertion;
- Optimization and reoptimization of the hybrid dentures are extremely difficult;
- Handiness is requested.

Indications of extracoronal attachments:

- Removable dental bridges;
- Partial skeletal dentures;
- Overdentures;
- Implant dentures.

The **placement** of attachment on dental structure:

- Intracoronal;
- Extracoronal (staple, slide);
- Around/inside tooth root;
- Intermediary (in breaches);
- Bar tipe (fixe or mobile joint);
- Auxiliary: screw type systems, closing systems, latch, tipping stoppers (hinges), patrice-matrix drive systems, pins screws, articular support, magnetic systems.

The **attachments** are **classified** in two categories:

- Precision;
- Semi-precision.

Precision attachment (9,10) parts are made of special alloys with precision tolerance around 0.01 mm. Since the specific hardness of alloys can be determined, the attachments precision offer the advantage of light load on the remaining teeth. The standard component parts can be changed, offering a simple to use solution in case of damage.

Semi-precision attachments are made through direct casting, industrial type, from plastic or wax. The majority of these type of attachments are included in the costs of model in order to reduce expenses. They are considered semi-precision because, during the fabrication process, there is an inconstant rate of liquid/powder at specific temperature and there are presents also other variables. Also, component parts obtained through this process present small dimensional variations as the alloy contract at casting. The most important advantages of it are: economy, easy to fabricate and the possibility to be casted in different variants of the alloy without having connection problems between industrial and hand casting.

Attachments can be grouped in: rigid and resilient, depending on dental prosthodontics type. If the support is entirely dento-periodontal, rigid attachments can be applied, if the support is mixt, the resilient ones are preferred.

Attachments are classified as:

- Class 1a: solid, rigid non-resilient;
- Class 1b: solid, rigid, removable through a pin or a screw;
- Class 2: with vertical resilience;
- Class 3: with resilience present under a specific ax;
- Class 4: with vertical and under a specific ax resilience;
- Class 5: with vertical and rotational resilience;
- Class 6: with universal resilience.

The retention system with attachment could be achieved through different possibilities:

- Friction;
- Mechanical retention;
- Frictional and mechanical retention;
- Magnetic systems;
- Suction and vacuum.

After the space occupied by the system, there are vertical, buccal-oral or labial-oral, and lingual and mesio-distal or disto-mesial attachments.

After the relation with remain teeth:

- a) Adhesive attachments which are soldered at prepared teeth
- b) Attachments applied on tooth with dental crowns

The attachments could be: activatable, partial activatable, non-activatable. Some of them could have interchangeable parts.

Intracoronal attachments are included in the shape of tooth crown. Their major advantage is the distribution of occlusal forces in the ax of tooth and the hygienic process is much easier. The disadvantage consists in the important loss of tooth tissue and the special design.

The technology of using attachments include tooth crown model, on which the milling process is done using the paralelometer, obtaining the specific space needed for pre-fabricated parts to be adapt, parts which form the skeletal dentures. Matrix band, component part of the skeletal dentures, is casted in the same time with metallic skeleton.

Some of the most known intracoronal systems are: Biloc, Beyeler, Combi-Snap, Crismani, Cros Arch Roach, Interlock, Omega-M, Mc Collum, Swiss Taper etc.

Extracoronal attachments are placed entirely outside tooth crown perimeter (10). These type of attachments are commonly used in dental practice, they have the classical name of slides and staple. The advantage of using these types of attachments consists in maintaining the external shape of the tooth, with a minimal tissue sacrifice preparation. Most of the actual extracoronal attachments are resilient. However, it is recommended to distributed them bilateral on the arch. These attachments have a patrice connected to the tooth crown and a matrix related to the metallic component of skeletal dentures, they are connecting perfectly and contribute to optimal retention

and stabilization of skeletal dentures. The matrix and matrix holder have different design, depending on the manufacturer. The disadvantage is related to difficulty in sanitation.

The known extracoronary attachments systems are: ASC 52, Bredent SG Vario Snap, Dalbo, Rhein OT Strategy, Screw-Bloc, Swiss Anchor-DE, Swiss Bloc, T-Bloc.

STUD TYPE attachments connect to a periradicular or intraradicular preparation. The matrix is corrected on/or in the root of the tooth or implant pillar. These attachments give good retention.

The most common used systems are: Bredent Vario Snap UNI, Compact, Dalla Bora, Magnets, Rothermann Schubinger, Micro-Fix, Moser Post.

Bar form attachments are connecting or anchored teeth, roots or implants. They are used mainly when few teeth remain on the arch. These systems obtain good maintenance and a limitation of the removable partial denture rotation. Typical examples of the bars attachments are: ABS Bar & Rider System, Clip, Ackermann, CM Bar & Rider System, CBS Complet Bar System, Dolder Bar System, EDS Bar System, PPM Bar System.

Criteria to choose one system or the other is based on the principle of forces distribution in order to maintain the health of the remaining teeth and alveolar ridges and improving patient comfort and function (11).

Clinical case

Male patient, 46 years old, addresses to Prosthetics Clinic of the Faculty of Dentistry, Ovidius University of Constanta and motivate severe masticatory, phonetics and esthetics dysfunction.

After clinical and radiographic examination, severe coronary destructions due to untreated complicated decays are found. The treatment plan is established and it is presented to the patient to obtain written consent. After compromised teeth extraction and periodontal clinical status and diagnosis, the diagnosis of Kennedy 1st class edentation with one modification in the maxillary arch is made and Kennedy 1st Class edentation in the mandible (*Figures 1, 2*). Remaining teeth are 11,13,21,22,23,31,32,33,34,41,42,43,44 (*Figure 1*).

Figure 1. Preoperative Intra oral picture



Figure 2. X-Ray Exam



Prosthetic treatment aims to achieve prosthetic restorations with metal-ceramic abutments and removable partial dentures anchored with extracoronary attachments. Preparation of remaining teeth is done in order to be restored with fixed metal-ceramic bridge (*Figure 3*). Gingival retraction was achieved by double wire method (Ultradent Products Inc). Final impression was made with polyvinyl siloxane putty-wash method (*Figure 4*).

Figure 3. Teeth prepared receive porcelain fused to metal crowns



Figure 4. Definitive impressions



Dental preparation were covered temporarily after definitive impression with Protemp (3M ESPE Dental Products, St. Paul, USA), finished and provisionally cemented. The final model was performed in gypsum type IV (Kalrock, Kalabhai Karson Pvt. Ltd., Mumbai), mounted in articulator based on interocclusal records.

In laboratory the metal-ceramic restorations models are made and distal attachments were attached. The stages of casting, finishing, cape probe, and color selection for ceramics follow (Figure 5). Frosting of metal-ceramic crowns, intraoral prosthodontics probation (Figures 6, 7). Impressions of prosthodontics areas (Figure 8), model probation and laboratory polymerization follow.

Figure 5. Metal framework on the master cast



Figure 6. Try-in of the joint PFM crown with attachments on the master cast



Figure 7. Try-in of the joint PFM crown with attachments



Figure 8. Definitive impressions for cast mobile denture



Colorful rubber bands were placed inside the matrix in order to improve retention as strong force breaker (*Figures 9, 10*). The metal-ceramic crowns were cemented using glass ionomer cement. During cementation, a special care was given to the attachments. Petroleum jelly was applied inside of the attachments in order to facilitate removal of cement. After final adjustment, occlusion is checked and the patient is recalled by protocol to regulate evaluation (*Figures 11, 12*).

Figure 9. Final Prosthesis



Figure 10. Male and female parts of extracoronal attachment



Figure 11. Postinsertion photo with combined prosthesis seated



Figure 12. Showing post-treatment intra-oral view of restoration



The patient was instructed regarding oral hygiene, use of interproximal brushes, how to remove and insert the denture and the time to recall for matrices check, in order to have a good functionality.

The end result has provided patient satisfaction regarding the combination of fixed dentures and removable skeletal dentures anchored by extracoronal attachments.

Occlusion stabilization was achieved, improved chewing and good aesthetics.

Discussion

To meet the patient's expectations regarding masticatory efficiency, the procedure described in the rehabilitation of this patient is one way to restore the edentulous areas. The classical conventional clasps act destructive on remaining bone and teeth.

It provides treatment solution a maximum retention and stability is offered, and in the same time protects the bone and prosthesis abutments. Impact resistance, compressive strength is superior compared to denture base materials, especially this allows the patient to fulfill his needs. Additional extracoronal attachments provide easy insertion and removal of dentures. The only service requirement is replacing the Teflon matrix. Long-term success depends on biological factors, especially the periodontal ones.

The available studies indicate a success rate of 83.3 % at 5 years, from 67.3 % to 15 years and 50 % in extrapolated cases reaching 20 years (11).

Conclusions

The main objective of prosthodontics should be preserving the health of the remaining structures, tissues, teeth, periodontal structures, temporomandibular joint and orofacial muscles and prosthodontics principle following.

Partial edentulous stage restoring uni- or bilateral involves making difficult decisions in planning treatment without compromising patient needs. The method used in treating this patient is simple and the results are effective. Removable partial dentures anchored by special retention systems are still a good treatment option for edentulous spaces especially 1st and 2nd Kennedy class. Proper selection of the clinical case and a good treatment plan can be conducted using extracoronal attachments solution to ensure retention, stabilization, aesthetics and function of the dentures.

Their retention can be monitored and improved over time. Removable partial dentures design has been improved in order to get maximum support, stability and comfort.

The adaptation process with the dentures is easy and has the argument that it is inseparable from the patient prosthodontics, being perceived as part of the patient, therefore, would be the best solution to the edentulous unilateral or bi-terminal.

References

1. Burns DR, Ward JE. A review of attachments for removable partial denture design: part 1. Classification and selection. *Int J Prosthodont*. 1990, 3: 98-102.
2. Burns DR, Ward JE. A review of attachments for removable partial denture design: part 2. Treatment planning and attachment selection. *Int J Prosthodont* 1990, 3: 169-174.
3. Preiskel HW. Precision Attachment in Dentures, vol. 1-2, Quintessence Publishing, London, UK, 1995, pp. 12-67.
4. Feinberg E. Diagnosing and prescribing therapeutic attachment-retained partial dentures. *The New York State Dental Journal*, vol. 48, no. 1, 1982, pp. 27-29.
5. Staubli PE. Attachments & implants: reference manual. 6th edn. San Mateo, CA: Attachments International, 1996, pp. 3-46.
6. Makkar A, Chhabra, and A. Khare. Attachment retained Removable partial denture: a case report. *International Journal of Computing and Digital Systems*, 2011, 2(2): 39-43.
7. Mc Craken's Removable partial denture dentures 12th edition. 2011, pp. 12.
8. Baker JL, Goodkind RJ. Precision attachment removable partial dentures. San Mateo, CA: Mosby, 1981, pp. 1-54.

9. Preiskel HW. Precision Attachments in Dentures: Overdentures and Telescopic Prostheses. Volume 2. Chicago, IL: Quintessence Publishing Co, Ltd; 1985, pp. 2
10. Attachment and Prefabricated Castables Component. Accessed on 2014 April 01. Available from: <http://www.rhein83.com>.
11. Kapur KK, Deupree R, Dent RJ, Hasse AL. A randomized clinical trial of two basic removable partial denture designs. Part-I: Comparison of five year success rates and periodontal health. *J Prosthet Dent* 1994, 72(3): 268-282.

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