

Advantages Of Flexible Dentures Over Acrylic Dentures

by

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ABSTRACT

In an era of implants and fixed prostheses, removable partial dentures are still a treatment of choice for a wide range of patients and clinicians. Like every other treatment option, the removable prosthesis also has some disadvantages. However, through the introduction of flexible partial dentures, many of the disadvantages of conventional acrylic and cast partial dentures are taken care of. The purpose of this article is to discuss the basic material used in the fabrication, indications, and contraindications of the flexible denture and also its comparison with the removable partial denture. Both dentures were prepared for the same patient in the laboratory. The results and researches show that the flexible partial denture is better than the rigid removable denture. The flexible partial denture is unbreakable, pink-colored like the gums, it can be built quite thin and it can form the design of both the denture base and the clasps as well. Also, the flexible partial denture type is extremely stable and retentive, and the elasticity of the flexible plastic clasps keeps them that way indefinitely.

KEYWORDS: Partial removable denture; Flexible partial denture; Rigid denture.

INTRODUCTION

Modern dentistry offers many options for the restoration of partially edentulous mouth, like removable partial dentures. It is a common treatment alternative for missing teeth. Its ability to replace any number of missing teeth. The denture material should be biologically compatible, reasonably inexpensive, and simple to manipulate with a readily controlled technical procedure, to develop a prosthesis that is functionally effective and pleasing in appearance [12]. Poly methyl methacrylate (PMMA) is the main material used for the removal denture fabrication. However, there are some problems with PMMA that are hard to address, such as insertion in deep undercut regions, weakness of PMMA which leads to broken, and allergy of soft tissue to PMMA monomer. In addition, the main problem with rigid removable partial dentures is the metal clasps; form the esthetic part seems to be undesirable for the patients which leads to an increase in the number of them avoiding and neglecting their use. Furthermore, not like in the past, the current patients are more interested in the esthetic outcomes of conventional removable dentures.

In recent years, flexible removable partial dentures have become quite popular [21]. The strong and flexible nature of the material is perfectly suited to the variety of natural conditions in the mouth, simplifying design and enabling the flexible nylon resin to act as a built-in stress-breaker in order to provide superior function and stress distribution in a removable partial denture [23]. Hard and soft tissues undercut are frequently encountered in the fabrication of prostheses in partially as well as completely edentulous arches. It is aesthetically superior to a flipper and cast partial denture may be considered. An alternative denture prosthesis design in which optimal flange height and thickness can be achieved is by using flexible denture base material.

The soft denture is an excellent alternative to traditional hard-fitted dentures. The flexible material is now an option that does not trade off the ability to eat [9].

Therefore, flexible dentures are an excellent alternative to conventionally used methyl methacrylate dentures, which not only provide excellent aesthetics and comfort but also adapt to the constant movement and flexibility in the partially edentulous patient [22]. Flexible dentures are generally used when traditional dentures cause discomfort to the patient that cannot be solved through relining. An alternative denture prosthesis design in which optimal flange height and thickness can be achieved by using flexible denture base material [24].

FLEXIBLE PARTIAL DENTURES

Flexible partial dentures are dental prostheses made of thermoplastic nylon resin called polyamides used by professionals. Dentists use flexible dentures to replace one or more of missing teeth either in the upper or lower jaw. The advantages of nylon dentures are unique: ultra-thin, light, very flexible, and virtually unbreakable (this means more comfort for chewing and speaking than other dentures types). The name flexible dentures may indicate something quite funky, but it is just a term for dentures made from a superior quality denture material.

Flexible dentures help prevent many of the problems that regular dentures cause. Normally, regular dentures have a rigid resin or metal base that required some time to get used to it. As well as growing accustomed to the feel of the dentures, the patient has to learn how to hold them in place with the cheeks and tongue. New dentures often cause soreness and irritation in the early days, and patients must learn how to clean them carefully to avoid breakages [31]. On the other hand, it has many different advantages [10]. It is simple in design and free of clasps. Also, is light in weight [21]. Plus, it is potentially unbreakable and highly biocompatible with most other materials used in dentistry. The flexible denture is comfortable for patients and has excellent aesthetics. Besides good fitting, it doesn't deform [25].

The most excellent feature of the flexible denture, it is almost impossible to detect in the mouth [26]. However, flexible dentures are generally used only for provisional or temporary applications [15]. The problem of flexible denture is a drawback in the debonding of the acrylic teeth from the nylon denture base. In addition, the process to fabricate flexible denture is sensitive [18]. It does not conduct heat and cold like metal. Therefore, the patient may not enjoy certain food like hot soup or ice cream [32].

Soft dentures are generally used when traditional dentures cause discomfort to the patient that cannot be solved through relining. Soft dentures are not the same as soft relines for traditional dentures. Soft relines use a soft putty-like substance to separate gums from the hard acrylic in dentures. It also provides a soft base that prevents the gums from being rubbed raw. Some of the commercially available products are Valplast, Duraflex, Flexite, Proflex, Lucitone, and Impak. Both Valplast and Lucitone are monomer free [14,16,30,20,4,9].

There are many indications to using flexible dentures such as bilateral undercut is present, the patient having an allergy to acrylic resin, the patient doesn't have enough bone for a fitting dental implant, bruxism, single denture, and obturators [17]. It's so important that the flexible partials are ideal for people in high-risk situations like police and firefighters, military personnel, prisoners and prison officers, and any person who might be exposed to physical harm or injury [23]. On the other hand, it has some contraindications including patients who simply should not or would not wear any type of removable appliance, unilateral distal extension, low vertical dimension and closed bite, and bilateral free-end distal extension on maxilla with extremely atrophied alveolar ridges [16].

ACRYLIC RIGID DENTURE

Removable partial dentures (RPD) became commonly used many years ago with the introduction of acrylic polymers materials and chrome-cobalt alloys in the dental field. Most patients choose RPD due to the cheap materials [7]. Poly methyl methacrylate (PMMA) is the main polymer material as denture base material [2]. There are some of the problems with PMMA that are hard to address, such as insertion in deep undercut regions, weakness of PMMA and allergy of soft tissue to PMMA monomer. In addition, there is another main problem with regards to rigid removable partial denture metal clasps; form the esthetic part seems to be undesirable for the patients which leads to the increased number of them avoiding and neglecting their use. In the past, most patients had a low interest in the esthetic outcomes compared to the conventional removable denture [3]. However, today these interests have altered leading to more patients challenging the esthetic aspect of their own prostheses [1].

The acrylic denture has many advantages. It is easy to clean and maintain, easy to repair and adjust, not expensive and simple to design and fabricate. Nevertheless, acrylic denture has many disadvantages. Such as brittleness of PMMA which leads to cause a fracture, some patient has an allergy to PMMA monomer, over the years, the acrylic denture will give high porosity. Also, in most cases, the acrylic denture is difficult to insert in undercut areas. Moreover, its tendency for warpage if overheated during polishing or during recurring (for repairs or relining) [28].

METHODOLOGY

The study was divided into two stages; the First Stage is about the preparation of acrylic rigid partial denture and the Second Stage is regarding the preparation of flexible partial denture. Both denture preparation based on a case report of a seventy-five years old male patient reported to the Department of Prosthodontics at Nwajed Clinic, Libya with the major complaint of difficulty in mastication and no aesthetic. General physical examination was normal. The intraoral examination showed the presence of teeth on anterior teeth and posterior teeth (class 1 modification 1) just canine and first premolars are present in the mandibular arch. The treatment plan is a mandibular flexible partial denture. Both acrylic rigid partial denture and the flexible partial denture were fixed in the patient's mouth and continuously tested and evaluated for 3 months, respectively.

First Stage: Preparation of Acrylic Rigid Partial Denture

The raw material used was acrylic (Vertex, Holland) by using mixing ratio of 1 ml/0.95 g liquid (monomer)/1.7 g powder (polymer). Firstly, diagnostic casts were prepared using alginate impressions. Then, the casts were mounted on the surveyor. After that, the diagnostic casts were articulated (semi-adjustable articulator) using centric relation record and face bow transfer to evaluate inter arch space. Next, final impressions were made using polyvinyl siloxane light body material. In the case of distal extension cases, primary impressions were made with alginate and primary casts were made using a special tray prepared with self-cure acrylic resin. Definitive impressions were made using custom trays border molding was done with low fusing compound and final impressions were made using polyvinyl siloxane light body material. Final casts were made.

Maxillomandibular relationships were recorded with the check bite method. Definitive casts were mounted on a semi-adjustable articulator. Subsequently, shade selection was done and artificial acrylic resin teeth were arranged. Later, dentures were tried in the patient's mouth and after approval by the patient, dentures were processed in the injection system. Finally, dentures were flasking, finished, polished, and inserted. Occlusion was evaluated and adjusted. Post-operative instructions on how to insert the prostheses and instruction on adequate oral hygiene maintenance. Figure 1 shows the example of an acrylic rigid partial denture with clasp metal.



Figure 1: Acrylic rigid partial denture (with clasp metal)

Second stage: Preparation of flexible partial denture.

The raw material used was Valplast (monomer free, Lingchen Dental, China) with the usage ratio of one denture from 5 tubes. Essentially, mouth preparation is usually not required for the fabrication of flexible partial dentures as required for removable cast partial dentures. Firstly, just make an impression with hydrocolloids or elastomeric impression material and obtain a master cast. Then, duplicate the master cast in any suitable duplicating material. At that time make wax occlusal rim to record jaw relations and mount the casts on the articulator. Then, make 'T' shape holes (diatorics) in the teeth of the selected shade. The orientation of the holes is made for mechanical retention of acrylic teeth to a flexible denture base. The holes may be made before arranging teeth or removing the teeth from the mold after dewaxing. After that, the wax should be completely removed from the holes in the teeth. If the wax is not completely removed from the holes, the flexible material may not flow properly into holes from the cartridge thereby affecting the retention of teeth with a denture base. This technique of retention of acrylic teeth with a flexible denture base is known as the Retento-Grip tissue bearing technique. This prosthesis is contraindicated in patients where interarch space is less than 4 mm (insufficient space for placing diatorics). Next, arrange the teeth, do they try in and wax-up and attach the sprue formers to make the channels for flowing of fluid resin into the mold. Prefabricated sprue formers are available but these can also be made from modeling wax. After investing in a special flask designed for the injection molding technique, dewaxing is done by placing flasks in boiling water for 3 to 5 minutes to soften the wax. The flask and flush were opened with clean boiling water to remove all the residue of wax. The flask margin must be checked to ensure that both flask halves fit together with an intimate metal contact. Apply a thin coat of separating agent to the model and allow the model to dry completely. Select a cartridge of suitable size and spray silicone spray on it. Then, place it in a cartridge carrier which is then placed in an electric cartridge furnace used for softening flexible denture base material.

The application of spray prevents the adhesion of the cartridge with the cartridge carrier and allows smooth separation. The material should be plasticized for 15 to 20 minutes at 550 to 560 °F (Valplast). The softening temperature may be different for different types of flexible denture base material (follow manufacturer instructions). Maintain this temperature for 15 to 20 minutes. Remove the cartridge from the electric furnace and place it on the inlet of the flask and compress it with the mechanical compressor. The time between removing the cartridge

assembly from the furnace and injection should be less than 1 minute. If longer, the cartridge will begin to cool and may result in partial or no injection. The levers of the press should be turned rapidly to apply firm pressure until the springs of the press were fully compressed. The pressure should be maintained for 3 to 5 minutes. The pressure was then relieved and the flask was allowed to bench cool for at least 15 to 20 minutes before opening. The material flows through the sprues into the mold. Open the flask and retrieve the prosthesis.

If success injection system is used, the injection pressure should be 100 psi (minimum 75 psi) and the injection time should be 1 minute.

After retrieving the prosthesis, finish the prosthesis. The finishing procedure used for flexible partial denture is different from the finishing of acrylic resin prosthesis. The acrylic instruments should not be used because they generate heat and cause fiber formation and roughness of the prosthesis. Being thermoplastic material, the high heat generated while finishing with acrylic trimmers may soften and distort the prosthesis. The sprue formers are cut with a special type of knife or disk and finishing is done with vulcanite burs and green and pink mounted stones, usually used for porcelain finishing, using a rapid and light shaving motion. The staining resistance of the prosthesis depends on its shiny/lustrous appearance. The polishing of flexible partial dentures is done in different steps after cutting. The complete preparation steps of flexible partial denture are shown in Figures 2 - 4.

Special precaution for this flexible prosthesis which must be placed in hot boiling water at least for about 1 minute prior to insertion in the patient's mouth. Remove the denture and allow it to cool just to the point where it can be tolerated by the patient. This process makes the partial denture as flexible as it would be at body temperature. Gently insert the prosthesis into the patient's mouth. The hot water treatment permits a very smooth initial insertion and a good adaptation to the natural tissues in the mouth. If the patient senses any discomfort because of the tightness of a clasp, the clasp may be loosened slightly by immersing that area of the clasp in hot water and bending the clasp outward. If a clasp required tightening, the clasp area is immersed in hot water and bent inward to tighten. After insertion of the prosthesis instruct the patient to remove the prosthesis during the night and keep it in water. Remove the prosthesis during brushing of remaining natural teeth because toothbrushes may produce scratches on the prosthesis. Clean the prosthesis after every meal.

The disadvantage of the injection-molding technique is due to expensive equipment. The specially designed equipment required for this technique includes a mechanical compress, investing flask, cartridges and electric furnace. Also, is that it requires firm and quick application of the pressure for proper flow of the resin through sprues into the mold.



Figure 2. Taken the impression and pouring the cast.



Figure 3. A- Shows the wire orientation of the holes. B- Manual compression unit used to ensure complete material flows through the sprues into the mold



Figure 4. The final flexible removable partial denture (flexible denture)

RESULTS AND DISCUSSION

As mentioned earlier, flexible partial dentures have many advantages over conventional acrylic and cast partial dentures. Hard and soft tissue undercuts are often encountered within the fabrication of dentures in partially as well as fully edentulous arches. Although alteration of dentures by different relining materials can serve the aim, however, the different denture base materials stand in a superior position compared to alternative choices. Partially edentulous patients with challenging conditions like abused ridges, allergy to denture resins, undercut due to angulated remaining teeth, cancerous lesions and cleft palate pose a great challenge for the fabrication of a successful removable partial denture. Flexible denture offers a simpler and cost-effective treatment for the oral rehabilitation of such cases.

Thermoplastic removable dentures are known as flexible dentures, clasp-free metal-free, and non-metal clasp dentures. In recent years, flexible dentures have become commonly used. Dentures made from these materials should be showing some advantages over the conventional acrylic rigid denture ones. Since these materials are flexible, the undercuts area of the alveolar ridges can be easier engaged for better retention, path insertion in the mouth is much easier, well resistant to plastic deformation and breakage, the denture base can be thinner than in acrylic rigid dentures, no allergic response, with good esthetic due to the semitransparency of the material that gives and reflects the color of the mucosa and the lack of metal clasps which makes the dentures practically invisible in the mouth [1]. Dentures with thermoplastic nylon do not fracture even if are thrown intentionally from some height whereas the patient with full acrylic partial or complete dentures often visits the dentist with a broken or fractured prosthesis as these are brittle.

Flexible removable partial denture shows excellent biocompatibility but acrylic dentures cause allergic reactions due to free monomer content, high porosity, high water sorption, foul smell,

and are difficult to insert when undercuts are present. Moreover, laboratory techniques used in the fabrication of flexible removable partial dentures are more stable and accurate than those used in full acrylic dentures [8].

The design and appearances: The most special things about flexible dentures are somewhat less noticeable. The flexibility of the material of flexible dentures helps to shift the burden of force control from the design features of the appliance to the properties of the base material. A lever is more efficient if it is made from a rigid material. Leverage is the critical component of the conventional removable partial denture design that can be controlled using flexible materials. A flexible lever does not work well as a lever. Therefore, a flexible partial denture reduces the leverage effects of its extensions without compromising good retention and support. Also, there is no need for an occlusal rest or vertical stop in the flexible partial denture [11].

Ultra-light and thin: The material thickness may vary from 0.6 mm to 1.8 mm so each nylon denture is five times lighter than a standard dental prosthesis and even more if compared to other dentures especially, metal cast partials. Flexible dentures make the patients forget about the bulky feeling that made wearing partial appliances so uncomfortable in the past.

Light in weight: The first thing that patients notice when they go from normal dentures to flexible ones is the decrease in weight. The stronger material allows for a much thinner prosthesis that is much more comfortable to wear. The patients would think that a lighter prosthesis would be very beneficial for the upper arch, however, there the palate provides rigid support and no tongue is present to keep dislodging the denture [6].

An allergic and biocompatibility: A flexible partial denture made from a thin, heat-sensitive type of plastic, a flexible partial is both comfortable and highly realistic in appearance. Flexible partials are attached with thin, gum-colored clasps that fit into the natural spaces around your teeth. Because polyamides (also known as thermoplastic nylon resin) don't contain **bisphenol** therefore it is **the most biocompatible material** for building dental resins.

Polyamides dentures are a valid alternative for patients that suffer from **allergies to acrylic or certain metals such as chromium and cobalt** used in the framework of traditional dentures. Therefore, partial nylon dentures are considered **metal-free dental appliances** [19].

Effect on oral mucosa: Flexible dentures exhibit viscous elastic behavior that leads to improvement in masticatory function and patients comfort compared with hard dentures. It shows little effects on the mucosa of denture bearing area and little changes in the mucosa. Denture bearing areas of the flexible denture are healthier with fewer tissue changes. It can adapt to the shape and movement of the mouth and for this reason, these are far more comfortable to wear. In a study, conducted about the preference among the two types of denture base material; flexible dentures versus conventional acrylic, 100% of patients preferred the flexible dentures over customary methyl methacrylate dentures [27].

Comfortable and excellent aesthetics: Generally, clasp design is reasonably esthetic, and often it is possible for them not to be seen. However, depending upon partial denture design, which is based on mouth conditions, there may be some show of clasps. Often this is not an appearance problem. However, if avoiding an unacceptable show of clasps would compromise optimal partial denture design, various special attachments may sometimes be employed to do away with conventional clasps. These attachments are more technically complex and often are referred to as precision or semi-precision attachments. The soft material does not cause gingival irritation because there are no metal clasps around the natural teeth and are virtually invisible. The color of the base material blends with the natural color of the gums in your mouth. No one will discover the patients are wearing a flexible partial denture. The metallic clasps that are a dead giveaway with conventional dentures are replaced by clasps made of the same flexible acrylic material. The design also ensures that the entire denture is just one piece. There are no joints or attachments as in the case of metallic clasps. It looks better and it fits better [5].

Stain and odor resistance: Even if flexible partial dentures are more resistant to capture odor and to stain than traditional acrylic dentures they still need to be properly cleaned and maintained as described below. Describing standard partial denture, it is better to put it in a glass of water or in a damp little towel when not in use. The reason is simple, if a denture gets dry it tends to change its shape. With flexible dentures, this risk doesn't exist because they always tend to go back to their original shape. Anyway, dentists always advise their patients to keep their flexible partials hydrated using proper liquid.

The cost: Flexible partial dentures are more expensive than rigid dentures. Also considered a temporary option, but they are durable enough that some patients wear them for many years.

Breaking: If any sudden accidents happen, and the mouth is constantly changing, then partial rigid dentures may no longer fit properly, can break or bend or simply wear out. In fact, there is nothing made for the mouth that is permanent. Fractured clasps and so forth may often be repaired. However, the nylon base makes the prosthesis flexible so, it may absorb well an accidental fall to the ground. Since it is an unbreakable feature, some brands such as Valplast offer a lifetime warranty that applies to the flexible material only [13].

The technique: Polymerization shrinkage encountered in conventionally cured PMMA led to the development of a special injection-molding technique. Initially developed as a fluoropolymer then acetal began to be used. The material used nowadays is nylon-based plastic (polyamide). Elastomeric resins can be added to resin polymer formulas to create greater flexibility. Unique features of the semi-crystalline nylon composition provide strength, flexibility, transparency, high impact resistance, color stability, high creep resistance, high fatigue endurance, excellent wear characteristics, good solvent resistance, no porosity, no biological material build-up or odors or stains, low water sorption and good dimensional stability, monomer and metal-free and the microcrystalline structure are easy to finish and polish like acrylic. An alternative denture prosthesis design in which optimal flange height and thickness can be achieved by using flexible denture base material.

Relining: Soft dentures are an excellent alternative to traditional hard-fitted dentures. Traditionally relining dentures with a soft base increases comfort at the cost of chewing efficiency. To make up for the loss of chewing efficiency, denture wearers would use denture adhesive, which has its own problems. The flexible material is now an option that does not trade off the ability to eat. Flexible dentures (soft dentures) are generally used when traditional dentures cause discomfort to the patient that cannot be solved through relining. Soft dentures are not the same as soft reline for traditional dentures. Flexible dentures use a special flexible resin that prevents them from chafing the gums and allows the wearer to chew properly. It also provides a soft base that prevents the gums from being rubbed raw.

Feeling the pain: Flexible dentures help the patients to avoid some kind of pain associated with the old-style denture models. A flexible resin coating allows for a custom fit, with hard synthetic teeth still imbedded in the design to help with chewing food. Flexible dentures help achieve greater stability and comfort. Those who have found, for example, that even the simple back and forth action of chewing causes gum pain with traditional dentures may be able to find relief in new and more precise fitting flexible varieties of denture products. In addition to these benefits, flexible dentures are also designed to be porous and to "breathe" better than some other kinds of dentures. This helps prevent the buildup of bacteria on the dentures and is another reason that these innovative denture products are so popular [29].

CONCLUSION

No product can solve all the problems associated with partial prosthesis, nor can it meet all the requirements of a challenged mouth. The key is to solve and address as many problems and

needs as possible in a simple way that is affordable for the patient. An effort has been made to focus on improvements over conventional partial dentures in aesthetics, function, durability, and long life of a partial denture made from a flexible denture material. Flexible partial dentures may become a simpler answer to complex partially edentulous oral conditions. This treatment modality is not expensive and helpful for patients with a poor economic background in the rural region. Flexible dentures will not cause painful spots as seen with rigid acrylic resins. With proper care and prosthodontic treatment, the patient can enjoy a relatively normal life.

RECOMMENDATIONS

In the present study, the materials used to fabricate the flexible denture were reviewed. Other possible studies, comparing the flexible denture with rigid dentures with the different materials for both. Also, it can be compared between the flexible denture and rigid dentures in different patients' ages with different cases.

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