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Denture adhesives

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Denture adhesives, also referred to as *adherents* or *fixatives*, have long been recognized by denture wearers as a useful adjunct to denture retention, stability, and function. Although denture adhesives were first used in the late eighteenth century, they were not mentioned in the dental literature until 1935, when the American Dental Association, Council on Dental Materials, Instruments and Equipment, described them as nonmedical. The earliest patent issued for a denture adhesive dates back to 1913, with others following in the 1920s and 1930s [1]. By 1939 there were some 15 million denture wearers and 30 manufacturers of dental adhesives with annual sales of $2.5 million. Adhesive sales grew from $2.5 million in 1939 to $148 million in 1989 and to over $200 million in 1994. This is not a true comparison of growth in dollars given that the change in dollar value over the period was not a constant; nevertheless, it does reflect a significant increase in sales of denture adhesives. Early fixatives were formulated from vegetable gums such as acacia, tragaeanth, or karya that adsorb water to form a mucilaginous layer between the denture-bearing tissue and the denture base. The early denture adhesives were not very satisfactory because they were highly soluble in water solutions (particularly hot liquids) and washed out readily from beneath the denture, rendering the fixative useful for only a relatively short period [2].

The composition of denture adhesives continues to change as manufacturers try to improve the efficacy of their products. Currently, denture adhesives can be divided into soluble and insoluble groups. The insoluble group includes pads and synthetic wafers; the soluble group includes creams, pastes, and powders [3]. However, the one ingredient constant in the composition of cream and powder denture adhesives is the inclusion of one or more components that swell and becomes viscous and sticky as they adsorb water, or more appropriately, become hydrated. The two ingredients

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constant in the insoluble group are a fabric carrier and a component that becomes sticky when hydrated.

Soluble group

Pre-1960 gum-based adhesives were followed by synthetic agents, which depend primarily on the chemical properties of one or more active ingredients that swell and become viscous and sticky in the presence of water or saliva. The increased volume resulting from this chemical action fills the voids between the denture base and the supporting tissues. It has been reported that denture adhesives in the presence of water swell by 50% to 150% [2].

The active ingredients in today's adhesives are a blend of polymer salts with differing degrees of water solubility. The blend of polymer salts is designed to produce a product with short- and long-term actions. Carboxymethylcellulose (CMC) and polyvinylether methyl cellulose (PVM-MA) are examples of short- and long-acting salts, respectively, incorporated in some of today's adhesives. These two compounds have different levels of solubility that affect their initial activation process. The CMC compound provides a strong initial hold, but because of its high solubility level it dissolves quickly and loses its effectiveness within a relatively short period. PVM-MA salts having a lower solubility level take longer to become activated, but they last longer [4].

In the 1970s the effectiveness of denture adhesives was improved by adding calcium salts to the blend, and in the 1980s the effectiveness of denture adhesives again was improved by adding zinc to the 1970 formulation.

In addition to the active ingredients of CMC and PVM-MA, soluble denture adhesives contain a number of nonactive components that add particular attributes to the formulations. Examples of nonactive ingredients included in the creams and pastes are: petrolatum, mineral oil, and polyethylene oxide as binding materials to facilitate placement; peppermint oils and menthol for flavoring; dye for color; and sodium borate and methyl or poly-paraban as preservatives. The active and nonactive ingredients essentially are the same for creams and powders, but the volume of each ingredient may differ between creams and powders; however, the main difference between creams and powders rests with the carrying agent and anticlumping ingredients. Petrolatum and mineral oil are used in creams but are not present in powders; calcium acetate and silicone dioxide may be used to minimize clumping in powder [5].

Insoluble group

Pads and synthetic wafers make up the insoluble group (Fig. 1). Although the composition of pads and wafers differs from manufacturer to manufac-

Fig. 1. Examples of a synthetic wafer.

turer, they all essentially include a laminated fabric with a water-activated component impregnated within the fabric's mesh, which becomes sticky upon adsorbing saliva. Webs of laminate may range from woven napped material to unwoven fiber or web such as light polypropylene scrim or cellulose paper. Examples of adhesive ingredients processed or included in selected fabrics include, but are not limited to, sodium alginate or ethylene oxide polymer, which become sticky when activated by saliva [6]. Perhaps the main difference between synthetic wafers and pads is the thickness of the fabric carrier—synthetic wafers are much thinner. Some professionals view pads as providing a dual action of reline and adhesive or reline alone, because some pads do not contain an adhesive.

Patient/dentist education

A comment often made by patients who have problems with their natural dentition is, "Take them all out and give me dentures so that I will not have any more dental problems." Nothing could be further from the truth. Edentulism is the beginning of lifelong prosthodontic treatment with concomitant changes in the oral cavity, which will require continuous monitoring to detect inevitable changes to the remaining supporting, peripheral, and oral tissues. Edentulism accompanied by denture treatment that has not received periodic professional scrutiny will eventually result in compromised fit and function of removable prostheses. Often denture patients, rather than seeking professional help to evaluate oral changes affecting denture function, will turn to some type of denture adhesive to achieve the desired function and comfort. It is therefore fitting and necessary that a recall system become an integral part of prosthodontic treatment and both dentist and patient be educated about the use, abuse, indications, contraindications, options, and selection of an adhesive. Unfortunately, dental professionals and teachers of dentistry have been slow to accept the use of dental adhesives, despite the fact that the use of denture adhesives is a fact of life for millions of denture wearers [7,8]. A survey by Slaughter and colleagues [9] using the Delphi Technique Survey Method was conducted

using a panel of 18 randomly selected prosthodontic program directors in the United States. The panel concluded that denture adhesives can be a useful adjunct in denture prosthodontic service. The panel also indicated that only through education of dentists and patients could the maximum benefit of denture adhesives be achieved while at the same time minimizing misuse. This study also noted that the current American Association of Dental Schools (AADS) curriculum guidelines do not include the use of denture adhesive in the undergraduate curriculum. The survey concluded that regardless of whether or not the topic of denture adhesive is included in the AADS undergraduate guidelines, it should be addressed and taught in the undergraduate curriculum.

Education of dental professionals extends beyond the clinical questions of indications, contraindications, risks, and benefits to long-held misconceptions and myths associated with these over-the-counter products [8,10]. Chief among the myths and misconceptions are:

- **Recommending the use of a denture adhesive will reflect poorly on the dentist's technical skills.** Not so, if in fact, appropriate technical skills were employed and treatment limitations did not exceed patient's expectations or provider's abilities.
- **Denture adhesives will increase the vertical dimension of occlusion.** Not so, if the patient has been professionally informed of the proper use and misuse of an adhesive.
- **Denture adhesive cannot play a role in well-fitting dentures.** It has been shown scientifically that the use of a denture adhesive can improve function, retention, stability, and bite force in well-fitting dentures. There are indications for use in well-fitting prostheses, though they are limited.
- **Bone resorption will result from microbial irritation of soft tissue.** There is no scientific evidence to support this claim.
- **The use of a denture adhesive will contribute to oral pathoses.** There is no scientific evidence to support this claim.

Risks

The risks of masking an underlying condition unrelated to denture adhesive use, per se, are real. Examples of the masking effect of a denture adhesive are those related to neoplasms and normal recontouring of the supporting tissues. Although the occurrence of tumors under a denture is relatively uncommon, patients and health care providers must be vigilant of this potential, because the adverse consequences can be serious. Inasmuch as tissue changes under the denture take place slowly and are often asymptomatic, the patient's initial reaction is to begin using an adhesive and later, usually unknowingly, modify the amount of adhesive used to compensate for what has become an ill-fitting denture. Because the growth of these tumors is relatively slow, the use of a denture adhesive may mask their initial

presence, and a tumor may not be noticed by a patient until it has reached a significant size. A more common masking of tissue changes occur in patients who at one time had a well-fitting denture that later became loose, unstable, and ill-fitting as a result of lifelong changes in the bony architecture (a normal sequalae of edentulism). At this point, dentures should be either refitted or remade. If not, bony resorption will continue and as time passes the denture will become more ill-fitting, thus masking deteriorating or deleterious tissue changes; this is a major contraindication for the use of a denture adhesive. Unfortunately, some patients, rather than solving this conundrum by seeking professional service, resort to the use of a denture adhesive.

General information

A basic knowledge of denture adhesives will help provide a patient with the expectations and limitations of a selected product.

The desired attributes of a denture fixative are:

1. Sensitive to hydration
2. Rapid onset
3. Sufficient duration of action
4. Washout resistance
5. Ease of cleansibility

Frequently asked questions

Health care providers frequently are asked advice in selecting the best adherent. This is a difficult question to answer, because the selection process is subjective and depends on many variables such as anatomy, condition of the supporting tissues, the expectations of the patient, the intended use, the product limitations, attributes, the mental and overall physical characteristics of the patient, and—perhaps most importantly—the indication for the use of an adhesive.

The health care provider can give limited, hopefully convincing advice, but the final decision rests with the patient. Often patients will try different products before settling on one. Nevertheless, advice to the patient should at a minimum include:

- Pointing out differences among powders, creams and pads
- Have a clear focus on the reasons for using an adhesive
- Use the minimum amount necessary to achieve the desired result
- Distribute the adhesive evenly over the tissue bearing surfaces
- Apply or reapply when necessary
- Always apply denture adhesive to a clean tissue-bearing surface
- The risk factors and the necessity for periodic professional evaluation

- The use of a denture adhesive is NOT a treatment modality, per se, but rather an adjunct to denture treatment

Pads and synthetic wafers

Pads are very different from creams and powders. The unique attributes of pads and synthetic wafers include a fabric carrier impregnated with an adhesive. Pads and synthetic wafers are applied by adapting them to the contour of the prosthesis and seating with firm pressure. It may also be advisable to wet the pad before inserting, because it is most effective when wet. Pads or synthetic wafers placed in the mandibular denture may require trimming with scissors (Fig. 2). As with creams and powders, the preference for selecting a pad or synthetic wafer is personal and subjective; however, an advantage of insoluble products over soluble products relates to the cleansibility factor. Because a limited amount of adhesive is incorporated in the fabric carrier, the small amount left in the mouth is easily removed and the pad or synthetic wafer can be readily peeled from the denture base; creams and powders are more difficult to remove because of the relatively large amount of sticky material that remains. (Anecdotally, there are some who claim that pads are less retentive than creams and powder.)

Creams and powders

Creams and powders essentially include the same active ingredients, which differ slightly among manufacturers. However, the method of applying each to the denture base differs and the use of one over the other is a matter of personal preference. According to personal communication with a manufacturer, the market is just about evenly balanced between the two. Patients should be advised on the application process of each of these products as well as the removal of the residual material from the mouth and denture base between applications. Because of its bulk and stickiness, removal from the mouth and denture base often require mechanical removal with toothbrush and or gauze pads. At times it can be frustrating and time consuming. This is especially important to point out to individuals who are

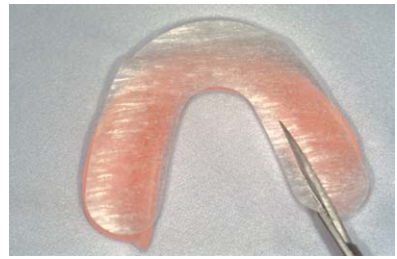

Fig. 2. Trimming a synthetic wafer to fit the mandibular denture.

mentally, physically, or neuromuscularly compromised. It should also be noted, irrespective of the adherent used, that the initial and full effect will not take place immediately and will start to diminish within 6 to 8 hours [11–13].

Powders

When applying a denture powder, the denture base should be dry before sprinkling a thin, even coating of the adhesive onto the tissue-bearing surface of the prosthesis (Fig. 3). The excess is shaken off and the prosthesis is inserted and firmly seated. Some denture adhesive users claim that they can achieve a more even distribution of the powder than they can with creams and also use less adhesive. This view is not shared by many who use creams.

Creams

Two application approaches are possible with creams, each with advantages and disadvantages. The "strip" method is commonly recommended by most manufacturers. In the mandibular prosthesis, a thin strip is placed onto the denture base in the molar/premolar ridge areas and in the incisor area (Fig. 4). In the maxillary denture, three thin strips are placed on denture base, one anterioposteriorily along the midline of the hard palate and one each along the ridges in the molar/premolar areas (Fig. 5). The two units are inserted and seated with firm pressure for a few seconds. Placing a little water on the denture base after applying the strips will facilitate initial hydration. Controlling the amount of adhesive applied with the strip method may be cumbersome and often results in applying more than is needed. Ooze of excess adhesive over the denture flange is to be avoided, because this is an indication of uneven distribution or too much adhesive having been applied.

A second approach also recommended by some manufacturers—and myself—is the placement of several small spots about the size of the tube diameter, some distance apart throughout the tissue-bearing surface (Fig. 6). Of course, the number and distance apart will depend on the desired amount, though the minimal amount necessary should be used to achieve

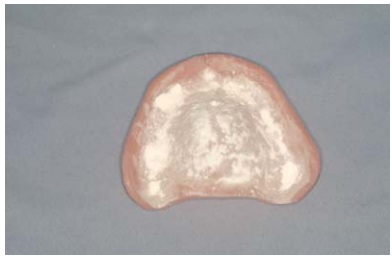

Fig. 3. A uniform thin layer of powder applied to a maxillary denture.

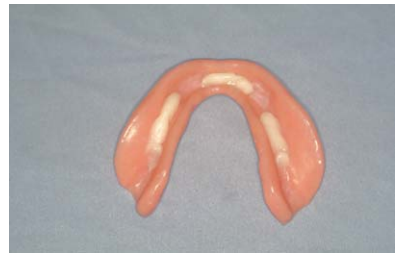

Fig. 4. Strips of a cream adhesive applied to mandibular denture.

the desired result. This can only be determined by trial and error and the amount applied will vary from person to person (Fig. 7).

In studies of denture movement by Grasso and colleagues [10,11,13] with a cream adhesive, it was noted in establishing a usage baseline when using the strip method that test subjects tended to use more adhesive than necessary. Many subjects initially experienced ooze over the borders of the denture flange, an observation that also was noted in clinical patients. The strip method is more prone to result in more adhesive use than necessary, especially in mandibular dentures.

After changing to the "spot" method, patients and researchers on the denture movement study noted the following advantages of this approach:

- A more controlled application
- Less likelihood of applying an excessive amount
- Elimination of ooze
- Easier to achieve a more even distribution
- Helps impress upon the patient that he/she has control of the amount used

Indications and contraindications

Indications and contraindications in the use of adjuncts in a prescribed treatment process are standard considerations, especially when employed in a product like a denture adhesive where the acceptance by both profes-

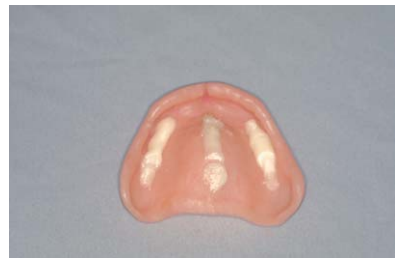

Fig. 5. Strips of a cream adhesive applied to a maxillary denture.

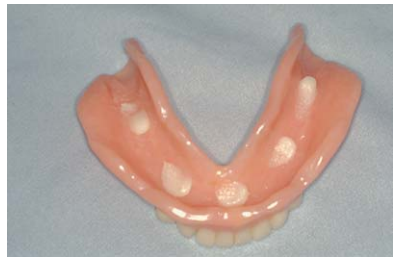

Fig. 6. Spots of a cream adhesive placed in mandibular dentures.

sionals and patients is universally mixed. Knowing when and when not to use a health-related over-the-counter product is fundamental to maximizing benefits and minimizing potential adverse effects.

Indications

Trial bases

Stable trial bases are necessary to obtain accurate jaw relation records in the course of fabricating new dentures. A denture adhesive, powder, or cream may be used in situations in which the retention and stability are less than desirable. As previously stated, only the minimal amount should be used. If too much is used, jaw relation records on trial bases may not be properly seated.

Immediate dentures

Recontouring of the soft and hard tissues related to the extraction sites is an integral part of immediate denture treatment and the healing process. Complete reontouring of the alveolar ridge may take 6 or more months [14]. During this recontouring phase, the immediate denture may become loose and ill fitting and require one or more temporary soft relines. Recontouring of the extraction sites is a continuous process, and the use of a denture

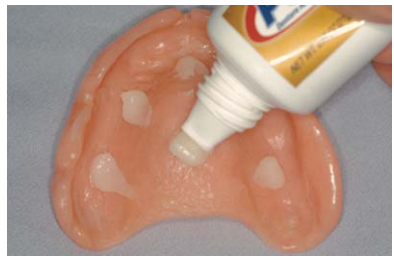

Fig. 7. Spots of a cream adhesive placed in a maxillary denture.

adhesive may be desirable to augment retention and stability during this process. However, the use of a denture adhesive is contraindicated immediately following the extraction of teeth and insertion of the prosthesis, because adhesive may be expressed into the extraction sites and interfere with clot formation.

Reconstruction or preprosthetic surgery

Patients undergoing intraoral surgical procedures may require the use of a denture adhesive for a short period to secure an existing or interim prosthesis. The indefinite use of a denture adhesive may be required in some patients who have undergone extensive oralmaxillofacial surgery when no other alternative is available.

Psychologic support

Patients such as athletes, actors, musicians, attorneys, and others in the public arena, on occasion, may need the psychological support of a denture adhesive to avoid a perceived or potentially embarrassing situation even though the denture is well fitting. Avoidance of this interim use of an adhesive should be encouraged for fear of it becoming a daily routine.

Compromised anatomic structures

Compromised denture supporting hard and soft tissues may be caused by a number of factors and may present in many forms. Some of the more common compromised anatomic structures may include, but are not limited to, excessive ridge resorption, developmental abnormalities, surgical intervention, trauma, and cerebrovascular (stroke) disorders. When evaluating the conditions and the many treatment challenges that must be addressed by both the patient and provider, the use of a denture adherent must be a consideration. In some instances the recommended use may be for a short duration; while in other instances it may be for an indefinite period. Nevertheless, the use of an adhesive can be a valuable adjunct.

Elderly patients

Treating elderly patients who have had their present prosthesis for years, which most likely has become ill-fitting, poses a dilemma for providers. The first course of action would be to recommend new dentures or reline the present prosthesis. However, this should be done with trepedation, because adjusting to new or relined dentures, both mentally and physically, may be very difficult for elderly patients. In such situations it may be advisable or necessary to recommend the use of an adhesive to help the patient adjust to the new occlusion, contours, and general fit of the prosthesis. Although the recommended interim use of an adhesive may have been intended for a short duration until the patient adjusted to the new prosthesis, it very often

becomes a permanent part of the patient's daily routine, especially with patients who have memory problems (eg, they may not recall the original instructions of interim, short-term use of the adhesive). Treating elderly patients who have relatively old, ill-fitting dentures secured with an adhesive and who refuse to have the dentures refitted or have new ones made is an even greater dilemma, because the use of an adhesive may in all probability be masking problems associated with ill-fitting prosthesis. The solution to this dilemma is often as complex as the patient's many other ailments. Without patient compliance, there is not much that can be done.

Physically/mentally challenged patients

Complete denture patients who have disorders such as Down syndrome or neuromuscular disorders affecting muscular movement may benefit from the use of a denture adhesive. As we all know, successful denture treatment depends in part on the best efforts of the provider and in part on the patient's ability to learn to function with what may initially be viewed as a foreign object in the oral cavity. Therefore, because the learning process is compromised, the acceptance and function of a prosthesis may be enhanced with the use of an adhesive.

Xerostomia

The causes of xerostomia are many and are usually related to, but not limited to, the following: side effects of medication, radiation therapy, hormonal changes, and systemic disorders such as Sjogren's syndrome. As the flow of saliva becomes diminished, so does the amount of saliva necessary for adequate denture retention. Denture adhesives may be of limited value depending on the degree of xerostomia.

New dentures

It has been stated that the application of a minimal amount of adhesive may be used upon the insertion of new dentures to help overcome initial anxiety. For some, myself included, this approach is not advisable because experience has demonstrated that interim use of an adhesive becomes indefinite use. There are times, despite the provider's best efforts and clinical skills, when the expectations of both the provider and patient cannot be achieved. Usually this is due to some anatomic compromise, such as excessive bone resorption or unreasonable patient expectations.

Osseointergrated implants

Patients who have had maxillary and mandibular complete dentures and who have subsequently replaced the mandibular complete denture with an osseointergrate implant–supported prosthesis may now notice that the maxillary denture is not as stable or retentive as it was when the mandible

complete denture was in place. This may be real, because in the past, the mandibular prosthesis when compared with the maxillary prosthesis was the less stable of the two. As a result of the mandibular implant treatment, the mandibular prosthesis has become the more stable of the two, and the maxillary prosthesis—which is tissue-supported—may now be perceived to be or may in fact be negatively affected. This issue and the methods of solving a potential problem should be addressed with the patient before implant treatment is initiated. The treatment options may include: (1) learning to live with this treatment-induced dilemma; (2) resorting to the use of an adhesive, despite the fact that the maxillary denture is well fitting, as it has been scientifically shown that well-fitting dentures can benefit from the use of a denture adhesive [13]; or (3) replace the maxillary complete denture with an implant-supported prosthesis.

Removable partial dentures

Although denture adhesives are generally associated with complete denture treatment, there are times when they may be of value in removable partial denture treatment. Depending on the design of the prosthesis and position of the abutment teeth, a denture adhesive may be advisable (case in point: a removable partial denture with abutment teeth on one side of the maxillary arch and no teeth on the opposite side of the arch to support a prosthesis). In effect, some class I, II, or IV situations may require the use of a denture adhesive to provide the maxillary prosthesis with necessary bilateral retention and support.

Contradictions

As mentioned previously, denture adhesives are contraindicated in ill-fitting dentures. Other examples of misuse or contraindication for denture adhesive include, but are not limited to: midline fractures in maxillary dentures; missing parts of a denture base or flange in removable partial dentures where the abutment teeth have been extracted or decayed beyond restorability; and frank pathology or tissue hyperplasia. Long-term use of a denture adhesive without periodic professional advice is especially contraindicated for reasons already cited.

Summary

An attempt has been made to present an overview of this controversial topic of over-the-counter denture adherents. The proper use of a denture adhesive can truly provide both dentist and patient with a means of securing a prosthesis despite the practitioner's best efforts. It is through a thorough knowledge of the attributes and limitations of these products that the dental profession can better guide patients in the management of their prosthesis.

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