# *Use of the rubber base impression materials in Mouth rehabilitation*

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The use of the rubber base impression materials in restorative and prosthetic dentistry is increasing daily. Equally as accurage as reversible hydrocolloid, their simplicity of use and lack of expensive armamentarium make them ideally suited for a multitude of dental operations.

As with all new dental materials, they have been subject to much abuse, due in part to a lack of adequate research defining the variables which influence their handling characteristics and accuracy. However, scientifically sound and standardized procedures have now evolved. It is the purpose of this paper to summarize the pertinent physical properties and manipulative variables which will influence these properties, and thus the clinical success of the material.

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**Composition.**

There are two classifications of the rubber base materials, both types polymerizing into a long chain, coiled molecule which is extremely elastic. One of the types commonly called just Thikol,

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but more correctly classified as a polysulfide polymer, has a mercaptan base. This compound contains extremely reactive SH terminals which are polymerized usually by use of both lead peroxide and sulphur.

Other vehicles and fillers are added. An analysis (2) reported by Pearson for a typical Americal product may be seen in table 1. The compositions of these products are now well establised and the shelf life is excellent. Most manufacurers are supplying such materials in varying viscosities -athin material for injection into the cavity preparation in the indirect technic and heavier-bodied pastes for filling the tray. The use of two consistencies does generally assist in minimizing the trapping of bubbles and producing maximum accuracy. 3

The Second type of rubber base material, a silicone, has as its chief ingredient some from of poly (dimethy) siloxane. 4

The exact compositions and modes of polymerizing the material are not commonly known. Organic tin compounds or benzoyl peroxide may be employed.

The formulation of may of the silicones are presently undergoing marked changes. Most of the newer batches, at least with certain products, have definitely improved the former shortcomings of prolonged tackiness, insufficient working time and flabbiness of the cured impression. Possibly of even greater concern to date has been the limited shelf life of the material, resulting in erratic setting times and handling characteristics. Whether the manufacturers have completely solved this problem remains to be seen. Unquestionably the shelf life has been extended as compared to the earlier formulation. However, it is recommended that relatively small amounts of the pastes be purchased at one time.

Storage in a refrigerator aids in prolonging the stabilitiy.

The obvious merits of the silicone type material are improved aesthetics from the standpoint of color and odor and greater cleanliness in handling. On the other hand, the polysulfide polymers are somewhat better standardized from batch to batch, as stated, and have a superior shelf life. Equally satisfactory clinical results may be attained with either type.

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**Setting time.**

Setting time of an impression material both to the dentist and patient is obviously important. There must be sufficient working time to permit mixing, injection if for indirect work, and seating of the tray. Polymerization should then take place rapidly enough to prevent any distortion while the tray is in position and to minimize the time required to hold the tray in the mouth. Generally the silicone materials set more rapidly than the Thiokols.

Temperature and humidity will influence the setting time, particularly for the polysulfide polymers. 1,5.

The higher the temperature and the greater the humidity the more rapid is the set. For example one way of accelerating the set of the materials is by the addition of a drop of water to the impression paste. Naturally the base-accelerator ratio will also influence the setting time but marked deviations from the recommended ratio should not be used since the other physical properties, in particular the elastic recovery, may be deleteriously affected. The set may be retarded by using a cooling mixing slab and spatula. Likewise, the addition of a drop or two of oleic aid to the mix of a polysulfide polymer will increase the working time.

The stiffness of the material, particularly with the silicones, at the time when the tray is seated will have an effect on the occuracy. 6

Use of either an extremely low viscosity material or a mass which is undully stiff will influence the ability of the material to reproduce minute detail. The exact stiffness desired will vary with each material and probably can only be determined with experience. As with the hydrocolloid type impression materials, it is essential that the materials be adequately cured before its removal from the mouth.

The elastic properties are markedly influenced by the degree of polymerization of the material. The minimum time for the positioned tray to be held in the mouth is 8 minutes, representing an elapsed time of approximately (10) minutes from the start of the mix. This time cannot be reduced appreciably without serious risk of distortion, With experience the proper time for removing the impression can also be judged by lightly impressing the surface of the material with the blunt point of an instrument. When the

point no longer leaves an indentation on the surface, the elasticity is fufficient so that the impression may be removed safely. When his technique is employed, it is important to impress both the syring and the tray material since they are polymerizing at different rates.

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**Bulk of Material.**

Contrary to the hydrocolloids, bulk is never desirable with the rubber base type materials. Use of the minimum amount of material necessary to take the impression will reduce the number of bubbles and polymerization shrinkage. This is particularly true whenever a single mixtechnic is employed. Whereever possible the bulk should not exceed 2.0 mm. This need for a minimal bulk emphasized the importance of a carefully selected band or tray. It must be rigid and adjusted or fabricated to provide an even distribution of bulk around the cavity preparation. Non-uniform masses of material produce distortion.

There are various methods of fabricating an acceptable tray. One method is to prepare a stone cast from an impression taken before the cavity preparations are made. Several layers of asbestos or base plate wax are laid over the areas to be involved in the operative procedure. A self-cured resin tray is then formed over the asbestos, permitted to cure, removed and the asbestos or wax removed. The only thickness of impression material will be that previously occupied by the asbestos or wax and that to be injected into the cavity preparation.

It has been shown that the materials must be held firmly by the band or tray. If not, they will distort upon removal. Any of the commercially available cements work nicely. However, rubber cements prepared for the silicones will not necessarily work for the polysulfide polymers. If a plastic tray is employed, liberal coatings should be used as the resin absorbs the cement. The band or tray is painted 7 or 8 minutes before it is to be filed with the impression material.

Dimensional stability.

One of the arguments commnly made in favor of this type of material, as compared to the hydrocolloids, is that they have

excellent dimensional stability and may be stored indefinitely without distorting. This view is most optimistic and dimensional stability still remains a real problem with most if not all, elastic impression materials. 3,7. Several factors contribute to distortion of the rubber base materials upon storage. Contined polymerization, as it is not complete at the time of removal of the impression from the mouth, is accompanied by a contraction of the material. Release of the internal stress, as with the hydrocolloids, is always present in the impression and probably influences stability. Collapse of internal bubbles and volatilization of some of the ingredients also produces distortion. Thus, although syneresis and inhibition are not problems, these other factors do definitely influence stability.

There is some debate on the magnitude of this dimensional change and its clinical signifiance. Much of the controversy can be attributed to use of different test methods. 8. The magnitude of the dimensional change is influenced by the method of measurement. For example, whether the specimen is unconfined or is restricted by the tray will markedly alter the data obtained. Likewise, there is a difference of opinion regarding the standars required in any impression material. The more critical the investigator or operator, the less tolerant he is of even minute dimensional change.

However, the evidence seems clear that storage of these materials, especially the silicones, is contra-indcted. The more critical the cavity preparation, the more important becomes this step. A cavity preparation involving long. parallel walls will demand greater accuracy than one where the walls are short and tapering. Generally speaking though, storage beyond one or two hours invites failure and immediate pouring of the dic is most certainly perferable.

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**Electro-plating**

One of the merits of these materials is the ease with which they can be electroplated, a difinite shortcoming with the hydrocolloids, Various metallizing and plating technics have been advocated. However, best results with the polysulfide polymers can be obtained by metalizing with silver powder and plating in a basic

silver syanide bath. 9 Although it is true that the plated die is not quite as accurate as a stone die poured in an unplated impression, the dies are clinically acceptable even for critical and complex preparations, For the silicones, copper plating produces more consistent results than silver plating, with metalizing being done either by bronzing or copper powder. However, due to distortion of the impression material during the plating procedure, and the tendency of the plate to pull away from the silicone, electroformed dies from silicone are not to be recommended, at least with the technics currently available.

**Conclusions.**

The accuracy of the polysulfide and silicone impression materials compares favorably with the reversible hydrocoloids. The advantages of the silicone type lie in better aesthetics and handling characteristics while the polyfulfide polymers at present have superior shelf life and are less erratic in their behavior.

The accuracy of these materials is dependent upon (1) use of a minimum amount of material. (2) having the impression material well bonded to the side of the rigid band or tray by use of a rubber cement (3) a minimum curing time of 8 minutes in the oral cavity (4) use of a double mix technic with syringe wherever possible; (5) pouring of the impression as soon as possible. Improvements with both types of materials, particularly the silicones may be anticipated. Their use in many phases of dentistry should continue to expand.


**Ö Z E T**

Ploysulfide ve Silicone tipi ölçü maddelerinin netliği reversible hydrocoloid'lere oranla üstünlük gösterir. Silicone tipi ölçü maddelerinin avantajları, daha estetik olmaları ve kullanımlarının kolay olmasıdır. Buna karşın polysulfide ölçü maddelerin uzun süre saklanabilirliği, ve dimansiyonel stabiite açısından üstünlüğü'de söz konusudur. Bu ölçü maddelerinin net ölçü verebilmeleri aşağıdaki faktörlere bağlıdır.

1. Az miktarda ölçü maddesi kullanılmalıdır.
2. Gerekirse kavçuk simani kullanarak ölçü maddesinin, ölçü kaşığına iyice yapışması sağlanmalıdır.

3. Ağız içinde sertleşmeleri için gerekli zaman 8 dakikadır.

4. Elden geldiğince özel enjektör kullanarak çift karıştırma tekniği uygulanmalıdır.

5. Ölçü erken dökülmelidir.

Her iki ölçü maddesinin özellikle Silicon'ların, daha da geliştirilmesi arzu edilir. Bunlar dişhekimliğinde devamlı kullanımları gelecekteki gelişimlerine yardımcı olacaktır.

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**Table 1**

| Base | Per Cent |
|---|---|
| Polysulfide polymer | 79.72 |
| Zinc oxide | 4.89 |
| Calcium sulphate | 15.39 |
| Accelerator | |
| Lead peroxide | 77.65 |
| Sulphur | 3.52 |
| Castro Oil | 16.84 |
| Other | 1.99 |