3M ESPE

Impregum™ Soft

Polyether Impression Material

Technical Product Profile

Contents

Introduction

For over 35 years, polyether impression materials have been indispensable for taking precision impressions. 3M ESPE is the world's sole supplier of this class of material, which ensures high levels of precision and reliability. In addition, the universal applicability of polyethers is unmatched by any other modern impression material. Efforts in product development have now allowed 3M ESPE to further enhancing a class of material which is popular worldwide. This was a highly demanding development objective, since polyether production is a very complex process overall: from the fundamental chemistry through chemical synthesis of the primary ingredients down to the manufacturing of the actual product.

Impregum polyether impression materials: offering outstanding accuracy as early as the 1960s

Impregum provided excellent results for precision impressions as early as the 1960s. However, users had to contend with a number of features characteristic of polyether materials: removal from the patient's mouth and extraction of the plaster cast have never been exactly easy. The cause of this problem was the excellent hydrophilicity of the material, which is also responsible for the high precision of the impressions. For this reason, users were willing to accept occasional difficulties of this type in the dental surgery and laboratory – as the price to be paid for such precision, so to speak. An unpleasant aspect for the patient was the intraoral setting period, as polyethers previously featured a typical, bitter taste.

Impregum Soft new generation polyether impression materials: a new phase for precision plus easy handling

3M ESPE has solved these problems by developing the innovative Impregum Soft product range. The new formula allows simple removal from the patient's mouth, even in situations complicated by periodontal damage. In the dental laboratory, removal is both easy and reliable even for plaster casts with long abutment teeth. The previously bitter taste has now been replaced by a pleasant minty flavour.
The lower ultimate hardness provides for an impression which necessitates less blocking-out of undercuts. This significantly shortens working times without compromising precision. Due to its natural initial hydrophilicity, the material already displays excellent flow at the time of syringing. The level of initial hydrophilicity has now been boostered by raising the proportion of the polyether in the new formulation. The new polyether generation is now complete, combining maximum precision with convenience in line with practical needs.

	Monophase	**One-step two viscosities technique**
Handmix	Impregum Soft medium-bodied consistency	Impregum Soft heavy-bodied consistency Impregum Soft light-bodied consistency
Penta	Impregum Penta Soft	Impregum Penta DuoSoft = Impregum Penta H DuoSoft + Impregum Garant L DuoSoft or Impregum Penta L DuoSoft

Tab. 1:
3M ESPE Polyether Soft product range

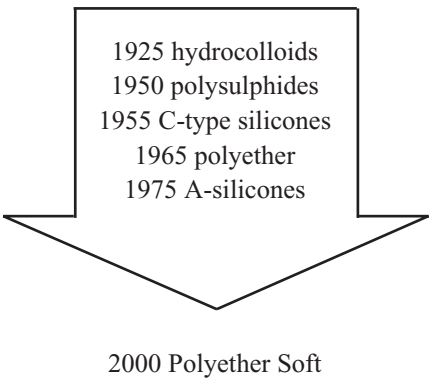
History of Precision Impressions

After the first impression methods using wax, plaster and zinc oxide eugenol pastes, true precision impressions were initially taken some 75 years ago (1925) using hydrocolloids. To this day, hydrocolloids are still used for a fixed, albeit minor, proportion of precision impressions. By contrast, the polysulphides introduced somewhat later are hardly used at all any more.

In the 1950s a new material class entered the dental market which had not originally been intended for intraoral use: C-type silicones (condensation cured). The major drawbacks of these products were and are intrinsic shrinkage (condensation curing entails the separation of a by-product) and hydrophobicity.

A decade later (see Fig. 1), 3M ESPE introduced polyether. This is an addition cured hydrophilic impression material which is a vast improvement on hydrocolloids and C-type silicones in its mechanical properties (e.g. tensile strength) and displays almost no shrinkage (addition curing does not lead to by-product release).

Fig. 1:
Chronology of impression materials



It was to take another ten years before the next generation of silicones found general use as impression materials. These addition cured A-silicones were, however, still hydrophobic. It was only a few years ago that efforts to reduce this hydrophobicity intrinsic to the material's molecular structure were successful. The addition of soap-like molecules (surfactants) increases the hydrophilicity of the polymerized material.

With the launch of the new Impregum Soft product range, new polyether-based impression materials are available which combine all the positive characteristics of polyether with simpler handling, both chairside and in the laboratory.

Motivation

Polyether impression materials feature a high level of accuracy in detail reproduction and dimensional stability. But the most important advantage of polyethers over other classes of impression materials is the reliability of the impressions – even in difficult clinical situations – and the high-precision fitting of the completed work.

The very detailed reproduction of polyether is mainly a result of its initial hydrophilicity due to its chemistry. This also means that the material is able to flow over surfaces wet with blood or saliva. Besides the hydrophilicity, the particularly marked intrinsic viscosity of polyether is also a reason for its high degree of reliability.

The properties discussed above do, however, also mean that in order to remove the impression, one must first overcome the suction effect caused by the precise flow, which does inhibit easy removal. The same has also been observed on removing models in the laboratory.

The goal in developing the Impregum Soft product range was to retain all the positive characteristics of polyether and at the same time to achieve ideal handling and convenience for the dentist, the patient and the dental technician.

The following chapters will show that Impregum Soft/DuoSoft are polyether impression materials which fulfil all the demands made on a modern impression material and at the same time provide for successful patient care.

Indications

The 3M ESPE Polyether Soft product range (Tab. 1) is excellently suited for the following fields of application:

- impressions of inlay, onlay, crown and bridge preparations
- impressions of edentulous jaws
- functional impressions
- implant impressions
- fixation impressions

Chemical Background

General Overview

The Impregum Soft base paste contains the already longer-chain polyether macromonomer. The termini of this macromolecule carry highly reactive ring groups which mediate crosslinking after polymerisation is initiated by the catalyst paste. (Fig. 2 and 3)

Fig. 2:
Polyether macromonomer, the highly reactive ring groups (marked with an R) are at its termini

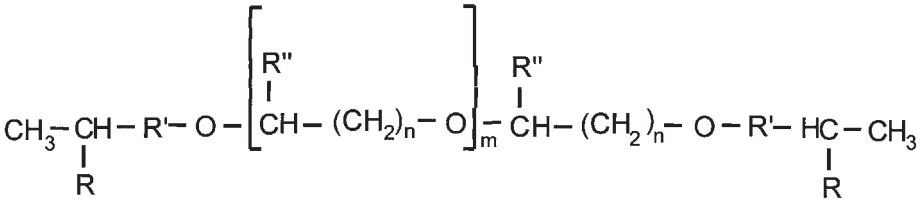
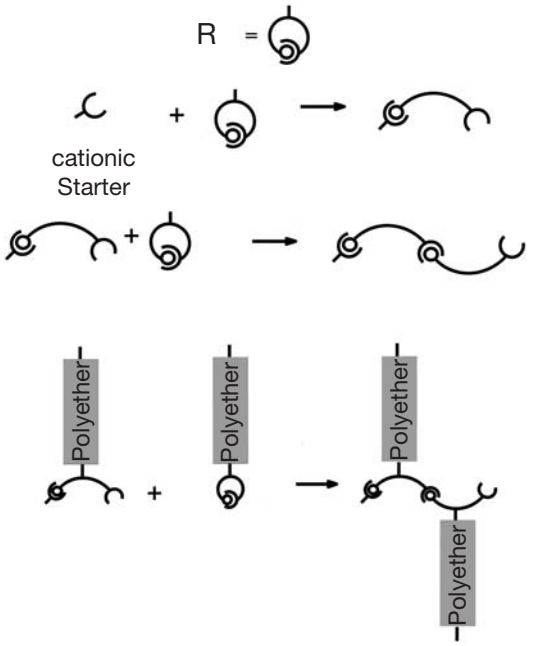


Fig. 3:
Polymerisation process in the cross-linking of polyether



The polyether macromonomer consists of a long chain of alternating oxygen molecules and alkyl groups (O-[CH_2]n). The setting reaction of the polyether is initiated by the cationic polymerisation initiator's opening of a highly reactive ring group (Fig. 3). The opened ring group now itself becomes a cation and can attack and open other rings (domino effect). As each ring opens, the cation which opened it remains on the end of the polyether macromonomer, thus lengthening the chain. [1]

Inorganic fillers effect the high rigidity of the impression and help maintain dimensional stability after removal of the set polyether material. The plasticisers are mainly responsible for adjusting the viscosity of the non-set material.

The addition of triglycerides serves to increase the intrinsic viscosity of the material (intrinsic viscosity: resilience coupled with very good flowability under pressure) (see chapter intrinsic viscosity). Because of their identical chemical base, all polyether consistencies can be combined with one another at will; after setting, the material will be cross-linked by covalent bonds.

Polyether materials and the addition cured silicones are the most important materials in the field of high-precision impression taking. Their intrinsic initial hydrophilicity particularly accommodates impressions in sulcal areas, in subgingival preparations [2]. As a result of this hydrophilicity, polyether exhibits an even flow pattern. This also explains the strong initial adhesion of the polyether impression on removal.

Base	Catalyst
Polyether macromonomer	Initiator (cationic polymerisation initiator)
Fillers	Fillers
Plasticiser (high and low viscosity)	Plasticiser
Pigments	Pigments
Flavourings	
Triglycerides	

Tab. 2:
Typical composition of polyether impression materials

Hydrophilicity

The term hydrophilic is generally used to describe materials with a strong affinity for water. From a chemical viewpoint, hydrophilicity derives from the polarity of water. Within a water molecule, there is a strong difference in polarity between the hydrogen and oxygen parts (see Fig. 4). If a water molecule encounters another polar group, it associates itself appropriately: all polar molecules are thus by principle hydrophilic.

A well-known example of a hydrophilic impression material is the hydrocolloid, whose main component, namely water, sets together with agar-agar, a long-chain galactose polysaccharide. Hydrocolloids are therefore hydrophilic by nature.

Fig. 4:
Water molecule (H_2O)

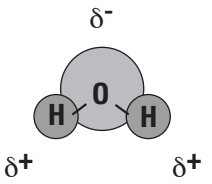
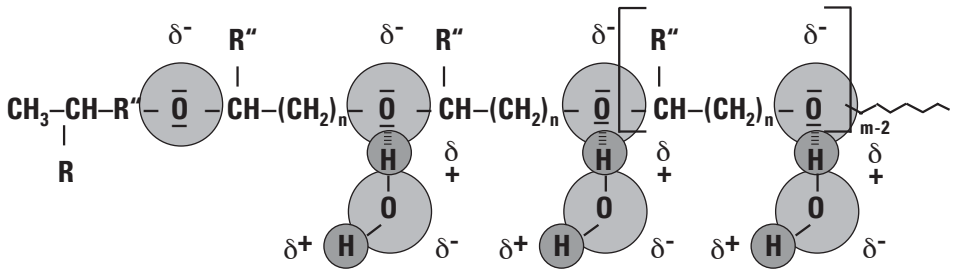


Fig. 5:
Polar water molecules can attach themselves to the polar groups of the polyether



A-silicones, on the other hand – which consist basically of apolar carbon-oxygen chains – are naturally hydrophobic due to their chemistry [3].

Apart from hydrocolloids, polyether is the only precision impression material which is naturally hydrophilic. This is due to the molecular structure of polyether. Polyether itself consists of a long chain of alternating oxygen atoms and alkyl groups (O-[CH_2]n) – as shown in the example of a polyether molecule in Fig. 2 and 5. Due to the difference in polarities between oxygen and carbon, the water – which is also polar – can attach itself to the polar polyether chains (Fig. 5). In the clinical practice this means that, due to its hydrophilic nature, polyether can flow optimally in a constantly wet environment such as the mouth, even in the area of the sulcus.

This initial hydrophilicity of polyether – hydrophilicity in its non-set state – can be demonstrated using the lying droplet method. If a drop of water is placed on the surface of non-set Impregum Penta Soft, it is strongly attracted and spreads immediately on the surface (Fig. 6). By contrast, contact between A-silicones and the water droplet typically results in the formation of a very high contact angle. A-silicones are outright hydrophobic in this phase (water repellent).

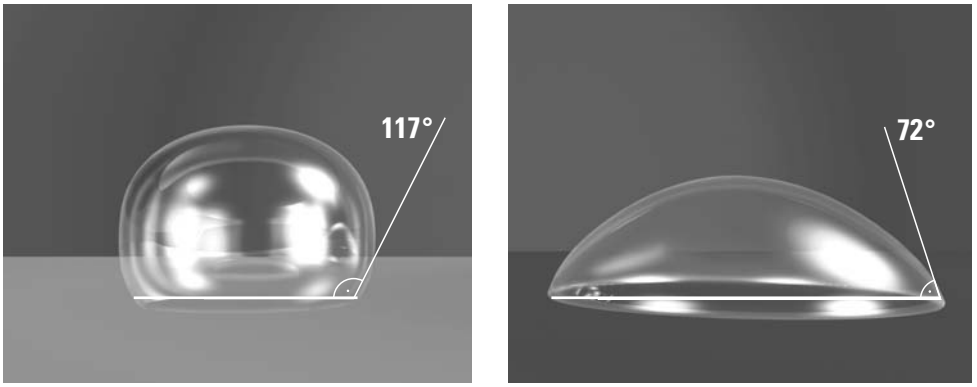


Fig. 6: Water droplet on A-silicone (left) and Impregum Penta Soft (right). In contrast to A-silicones, a smaller contact angle will form immediately after the first contact of a water droplet with Impregum Penta Soft due to the initial hydrophilicity of Impregum Penta Soft

Although polyether is hydrophilic, it has been possible to demonstrate in various studies by comparing A-silicones and polyether that the initial hydrophilicity of polyether has no effect on the dimensional stability through the uptake of water (during the recommended use of disinfectant) [4], [5], [6], [7], [8], [9], [10].

Snap Set

The term “snap set” of impression materials means the rapid transition from the non-set to the set state, as shown in Fig. 7. From a rheological viewpoint, snap set can be described as the transition from a plastic to an elastic material.

Plasticity describes the property of a material to remain deformed after the action of an outside force. Elasticity means that the material returns to its original state after deformation.

During the working phase, an impression material should be completely plastic in order to ensure optimal flow. As soon as it begins to set, the material acquires more and more elastic properties until after setting it can be described as virtually completely elastic. In its set state, the material should also be truly elastic, so that after the deformation of removal it will fully return to its original shape. The industrial standard ISO 4823 mandates a recovery of over 96.5%.

If the impression material already demonstrates elastic properties during the working period, tension in the material and, subsequently, an inaccurate impression may result.

The transition from plastic to elastic properties should thus take place in the shortest possible time in order to avoid inaccuracies of the impression. Polyether and in particular Impregum Soft/DuoSoft display this behaviour. In the case of some silicones (like Aquasil, President [11]) presetting often occurs, so that elastic sections are to be found even during the working period. Snap setting like with polyethers is not observed here [11]; the transition is less abrupt.

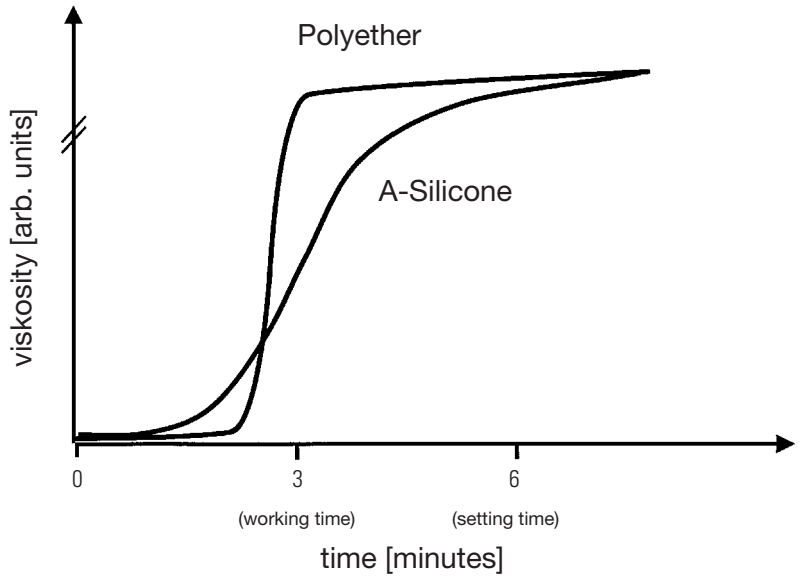


Fig. 7:
The short transition from the working period to the set state, as is typical for polyether, is called snap set

Thixotropy – Intrisinc Viscosity

The rheological properties of impression materials have a major influence on their behaviour in clinical use. A term often used to describe these impression material properties is one taken from rheology: thixotropy. However, closer examination shows that the definition of thixotropy does not correctly describe the actual (or desirable) properties of impression materials; indeed, true thixotropic behaviour is, if anything, undesirable in impression materials. The behaviour required of impression materials is that of intrinsic viscosity. The following section gives an explanation of the terms thixotropy and intrinsic viscosity.

The thixotropy of a material is evidenced by a reduction in viscosity under constant pressure and with increasing testing time. After the outside force is removed, the original viscosity is restored after a given time. There can under certain circumstances be a considerable delay (hysteresis) in the reduction and restoration of viscosity.

A very well-known example of a thixotropic fluid is ketchup. Prolonged shaking or stirring causes a reduction in the viscosity of ketchup. Only after a given period does the viscosity increase again. One characteristic of thixotropy is therefore that it is a reversible process which, however, can take a considerable amount of time (hysteresis).

A thixotrophic impression material would thus become increasingly lighter-bodied the longer it was, for instance, mixed. But in fact it is intrinsic viscosity which is required in an impression material. Intrinsic viscosity means that the viscosity diminishes under the influence of an increasing outside force or shearing speed. When the influence is discontinued, however, viscosity immediately increases again.

An impression material should display exactly this kind of behaviour. At increased shearing speed, such as injecting around the site of the teeth or applying to the tray, the viscosity should sink. But when there is no outside influence on the material, it must quickly reattain a high level of stability in order to prevent the material from flowing away from the tooth prep or out of the tray.

The excellent intrinsic viscosity of Impregum Soft/DuoSoft is partly due to the addition of triglycerides – as is typical for polyethers. Through crystalisation, triglycerides form a three-dimensional lattice which harbours the lighter-bodied parts of the impression material.

Without the influence of an outside force, this three-dimensional network lends the polyether a high level of viscosity (Fig. 8). If an outside force is exercised on the material, the crystals align themselves evenly and flowability increases or, in other words, viscosity decreases (Fig. 9).

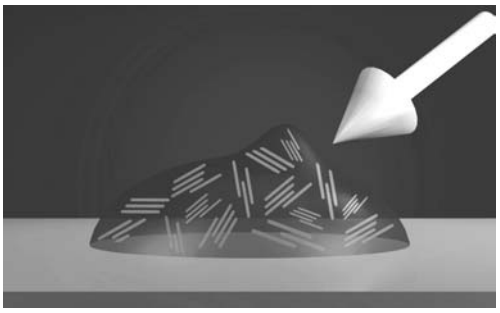


Fig. 8:
Due to the crystalisation effect, triglycerides in the polyether form a three-dimensional lattice which lends the polyether a high level of viscosity

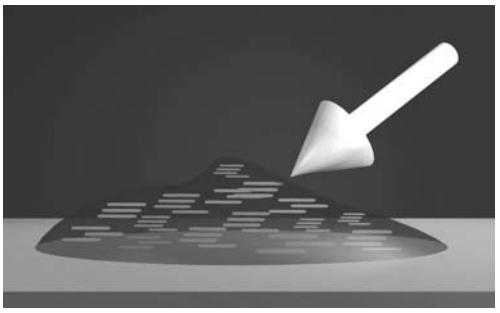


Fig. 9:
The application of an outside force causes the crystals to align themselves and the flowability of polyether increases

If the force is no longer applied, the three-dimensional network can reform, and the material resumes its original viscosity (Fig. 10). Thus, polyether is an impression material with particularly good intrinsic viscosity properties.

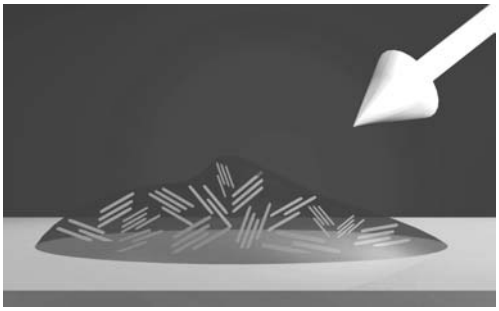


Fig. 10:
Without the application of an outside force the three-dimensional network forms again and the polyether has regained its high level of viscosity

In conjunction with the snap setting described in the previous chapter, Impregum Penta Soft thus displays ideal handling properties. As Fig. 11 shows, during the working period the network of weak interactions, mediated by the crystalisation effect described above, determines the viscosity and flowability of the material. The result is ideal plastic behaviour. After the rapid setting phase, the strong covalent network formed during polymerisation determines the rigidity of the material. It now demonstrates optimal elastic behaviour.

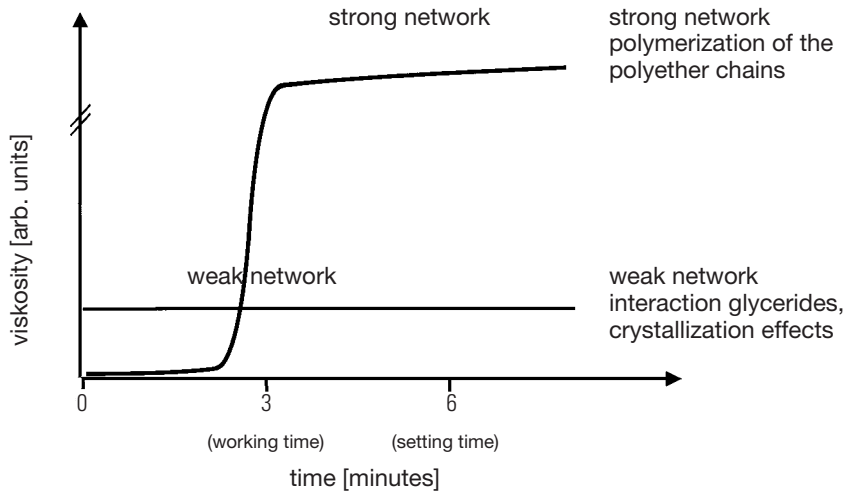


Fig. 11:
The relation between strong and weak networks determines the viscosity of polyether

Technical Properties

Material Properties at a Glance

As is standard for the polyether class of materials, Impregum Soft fulfils the following requirements:

- hydrophilic behaviour before (initial hydrophilicity) and after setting, even after disinfection
- precise setting behaviour (snap set)
- dimensional accuracy
- precise reproduction of detail
- intrinsic viscosity
- precise flowability
- high rigidity
- good elastic recovery
- dimensional stability
- consistency of shape
- good flowability to the crevices
- broad spectrum of indications
- can be electroplated with silver

Product Composition

The following table 3 gives an overview of the qualitative composition of Impregum Soft.

Tab. 3: Components of Impregum Soft

Base	Catalyst
Polyether macromonomer	Initiator (cationic polymerisation initiator)
Fillers	Fillers
Plasticiser (high and low viscosity)	Plasticiser
Pigments	Pigments
Flavourings	
Triglycerides	

Handmix Products: Final colour after mixing of
Impregum Soft medium-bodied consistency: violet,
Impregum Soft heavy-bodied consistency: violet,
Impregum Soft light-bodied consistency: pink.

Automix Products: Final colour after mixing of
Impregum Penta Soft: violet,
Impregum Penta H DuoSoft: violet,
Impregum Penta L DuoSoft: pink,
Impregum Garant L DuoSoft: pink.

The composition is comparable to that of Impregum Penta and Impregum F, but modified to achieve the following improvements:

- easier removal
- improved taste
- optimal convenience and handling

These goals have been fulfilled by making the following changes: the proportion of filler has been reduced, resulting in a decreased final hardness of the set material. This makes it easier to remove the impression from the mouth and the model from the impression. However, in order to guarantee a viscosity of the unset material identical to that of Impregum Penta and Impregum F, the proportions of high and low viscosity plasticisers differ in comparison to Impregum Penta formulations. The improved taste has been achieved by optimising the manufacturing process and adding a mint flavour.

Clinical and Material Science Results

Removability

An in vitro trial at the University of Iowa [12] showed that the force necessary to remove an impression can be considerably reduced by decreasing the final rigidity of the set material (Shore A hardness). These tests served as the basis for the development of Impregum Soft. As can be seen from the figures (see Technical Data Sheet), advantages were seen both for the dentist (equivalent to measurement of Shore A hardness after 15 min) and the dental technician (measurement of Shore A hardness after 1 h and 24 h) when removing Impregum Penta Soft as compared to Impregum Penta, due to the reduced hardness of Impregum Penta Soft.

Contact Angle Measurements

Hydrophilicity can be shown in the “water droplet test” by the contact angle: The contact angle which one water droplet assumes in a test specimen of the material under examination is a direct measure of the hydrophilicity, i.e. a material’s affinity to water. The more hydrophilic the material, the smaller the angle of contact is, i.e. the better the droplet flows on the material (see Fig. 12).

Fig. 12:
A water droplet on a hydrophobic surface shows a contact angle of more than 90°; on a hydrophilic surface, however, the contact angle is less than 90°

So far, contact angle measurements by this method have mainly been taken on set material. The aim of this study was to determine the hydrophilicity or wettability of impression materials in a non-set state (initial hydrophilicity), i.e. as close as possible to the clinically relevant situation.

Monophase

In order to achieve this, a droplet on a thin layer of non-set impression material was used as a model for the flowing situation in the mouth of the patient. This study was performed by Dr. H. Mondon and Prof. Dr. Ch. Ziegler, University of Kaiserslautern. An A-silicone (Aquasil, Dentsply DeTrey GmbH) and a polyether (Impregum Penta Soft) were tested.

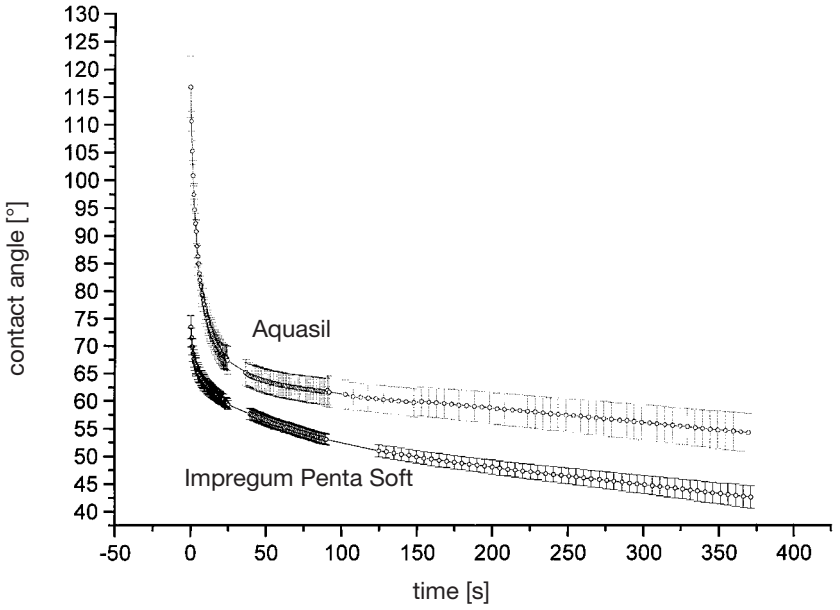


Fig. 13: Contact angle curve of non-set impression materials (measurement points with standard deviations)

Significant differences were observed for the various impression materials tested. The A-silicone Aquasil showed a higher contact angle in comparison to Impregum Penta Soft over the entire range of the curve. Particularly the initial contact angles (see. Fig. 13), which were 116.8° ± 5.5° in the case of Aquasil and 73.4° ± 2.1° for Impregum Penta Soft, indicate the considerably higher initial hydrophilicity of Impregum Penta Soft.

This is also confirmed when observing the application of the material to the test surface. When the water droplet comes into contact with the surface of Impregum Penta Soft, it immediately detaches from the syringe with which it is applied. In the case of Aquasil, the droplet does not detach itself on its own. This only occurs after the substrate is withdrawn. This observation also suggests that polyether is more hydrophilic (Impregum Penta Soft) and ties in very well with the statements in chapter of hydrophilicity.

Low Consistency

In addition to the monophase materials, light-bodied impression materials were compared in a second test which was performed by Dr. F. Rupp and Prof. Dr. J. Geis-Gerstorfer, University of Tübingen. In this case, the A-silicones Aquasil ULV and Provil Novo Light C.D. were compared with the two polyethers Impregum Garant L DuoSoft and Permadyne Garant 2:1. Here too, the results are similar to those obtained with the monophase materials. Aquasil ULV has an initial contact angle of 86° and Provil Novo Light C.D. 91°, whilst Impregum Garant L DuoSoft (59°) and Permadyne Garant 2:1 (62°) are considerably more hydrophilic. Both the initial contact angle and its progression over time are shown for all the materials in Fig. 14.

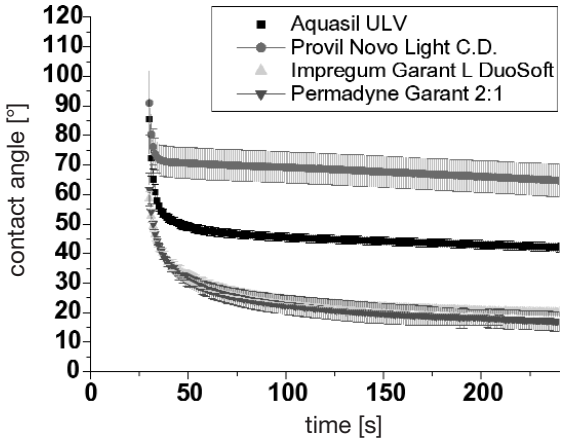


Fig. 14:
Contact angle curve of non-set light-bodied impression materials (measurement points with standard deviations)

Handmix Materials

In addition to the Pentamix materials the Handmix Impregum Soft (heavy-, medium- and light bodied consistency) and Impregum F were tested.
The measurement of the contact angles was performed by Dr. F. Rupp and Prof. Dr. J. Geis-Gerstorfer, University of Tübingen.

Compared with C-Silicones (Fig. 15) Impregum F shows a initial contact angle of at least 30° below the contact angle of Silasoft direct and express and Xantopren blue.

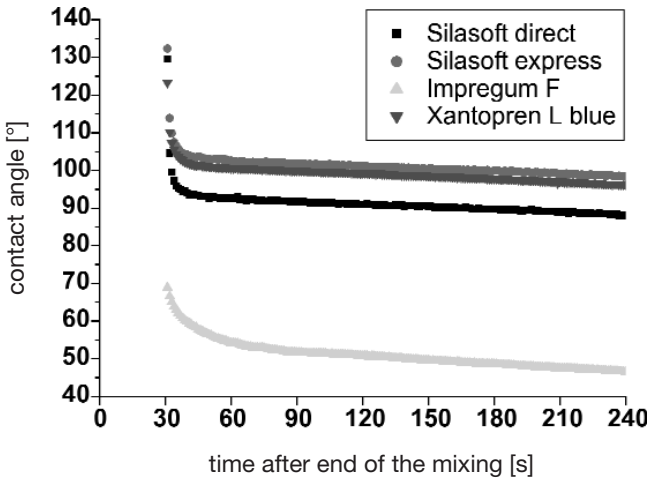


Fig. 15
Contact angle curve of not-set material: Comparison of Impregum F versus C-silicones

The comparison of Impregum F versus Impregum Soft (Fig. 16) shows a further improvement of the hydrophilic properties of Impregum Soft. The initial contact angle especially of Impregum Soft light-bodied consistency is more than 10° below that of Impregum F.

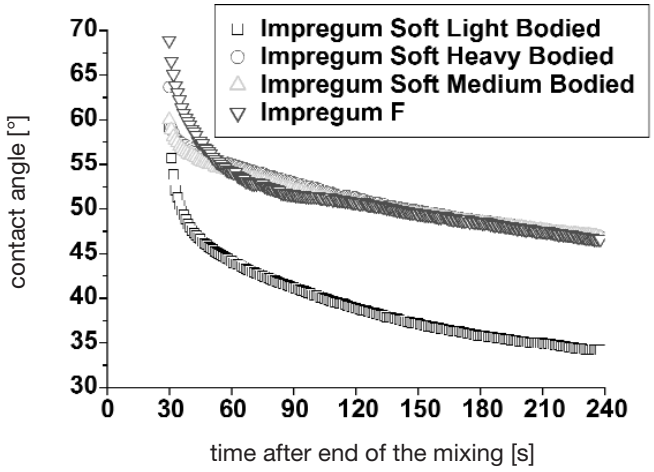


Fig. 16
Contact angle curve of non-set material: Impregum Soft handmix materials and Impregum F

Disinfection – 3D Dimensional Accuracy

The aim of the study headed by Dr. R. Stoll, from the Department of Restorative Dentistry at the University of Marburg a. d. Lahn, was to investigate whether polyether-based impression materials are deformed under the influence of a disinfectant.

For this purpose, impressions were taken using 10 cylindrical test specimens of each material in a simulated upper jaw model (see Fig. 17 and Fig. 18) with Impregum Penta, Impregum Penta Soft, Impregum Penta L DuoSoft and Impregum Penta H DuoSoft. After a recovery period of 60 mins, the impressions were immersed in both water and Impresept for periods of 10 min. and 60 min.. Subsequently, the impressions were cast with super-hard plaster. The test specimens were measured with a 3D coordinate measuring device. For comparison, measurements were carried out on test specimens where the impressions were not disinfected, but were cast after a 60 mins recovery period. A control measurement was also taken, which is designated as control group in the illustrations. The results were then compared for normal distribution and compared with non-parametric test procedures.

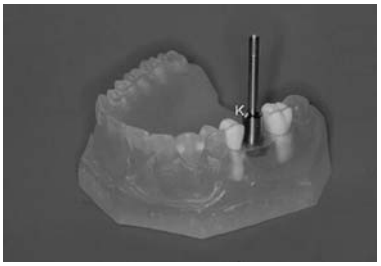


Fig. 17:
Upper Jaw Model: original test specimens fitted in the upper jaw model. The mounting post is pointing towards occlusal; a notch (K) marks the mesial position.

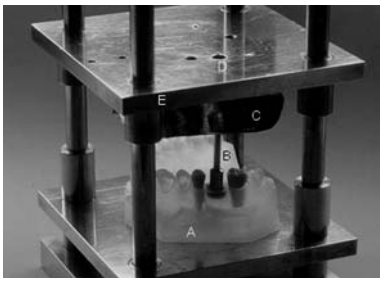


Fig. 18:
Device: Model (A) in the device for impression taking. The matching rimlock tray (C) is mounted on the support plate (E) and can be lowered into the correct posi-tion. The mounting post (B) then protrudes into a drilled hole (D).

The figures 19, 20, 21 and 22 show the results for the individual materials with various pretreatments. For Impregum Penta, no difference was detectable between water and Impresept after immersion for 10 mins. However, when the time was extended (60 mins) a slight swelling effect occurred in the Impresept group compared to water. The material Impregum Penta Soft displayed no effects caused by immersion in either water or Impresept for the parameter MR.
The material Impregum Penta H und L DuoSoft produced good results without treatment. However, the use of Impresept with a normal immersion time produced a slight shrinkage for Impregum Penta L DuoSoft, which was compensated by a swelling effect with longer immersion time. With Impregum Penta H DuoSoft, an opposite effect was determined. However, neither tendency is significant.

To sum up, it can be said that the dimensional changes measured in this study and reported in the literature are insignificant for clinical application [Langenwalter, E.M., Aquilino, S.A., Turner, K.A., The dimensional stability of elastomeric impression materials following disinfection, J Prosth Dent 63,270-276 (1990)] [14]. It can therefore be assumed that if the prescribed immersion time is observed, no disadvantages for the dimensional stability of the impression result from disinfection. Even if the disinfection time is several times longer than it should be, as is certainly possible in the dental practice, there is no cause for concern. If, however, the immersion time is exceeded by several hours, problems could occur with polyether materials. But this can also be observed with silicone impression materials. However, even in normal dental practice it is unusual for immersion times to be exceeded by more than 8-16 hours, and such occurrences can be avoided by simple organisational measures.

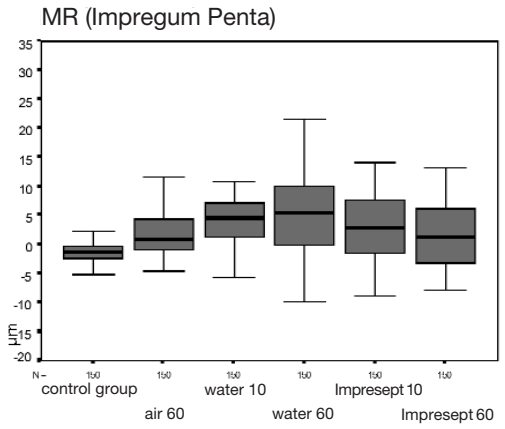


Fig. 19:
Boxplots (median and internal 50% quartile) of MR (mean radius change in µm) from Group 1 (Impregum Penta)

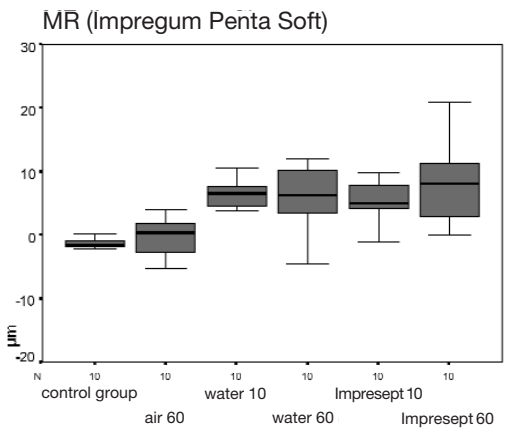


Fig. 20:
Boxplots (median and internal 50% quartile) of MR (mean radius change in µm) from Group 2 (Impregum Penta Soft)

Fig. 21:
Boxplots (median and internal 50% quartile) of MR (mean radius change in µm) from Group 3 (Impregum Penta DuoSoft L)

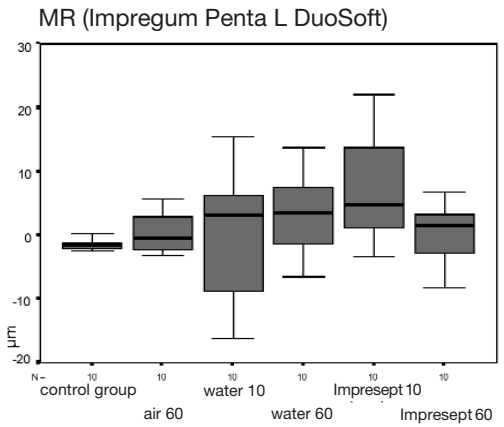
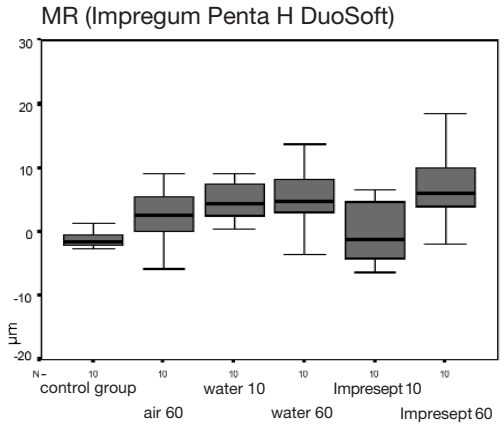


Fig. 22:
Boxplots (Median and internal 50% quartile) of MR (mean radius change in µm) from Group 4 (Impregum Penta H Duosoft)



Disinfection – Dimensional Accuracy

Due to the hydrophilic nature of polyether impression materials, discussion repeatedly focuses on the question of accuracy after they have undergone disinfection. A study performed by the University of Washington (Seattle, WA) investigated this situation [K. Phillips, T. C. Aw, G. H. Johnson, Accuracy of Three Monophase Impression Materials with Immersion Disinfection, AADR, #1678, 2001]. [15]
Three different impression materials (Impregum Penta, Impregum Penta Soft and Aquasil Deca Monophase) were used to take impressions on a modified Typodont master cast. After impression-taking, each impression material was disinfected for 45 minutes (group 1) or for 18 hours (group 2) using a 2% glutaraldehyde solution (Banicide). One group for each impression material did not undergo disinfection and acted as the control group. For each impression material 5 impressions were taken per group. After disinfection, plaster casts were produced and the following measurements carried out: anteroposterior (AP), diametrical (CA), occlusogingival (OG), mesiodistal (MD) and buccolingual (BL).
Figure 23 shows the mean deviation (for 5 plaster casts) from the master cast in mm.

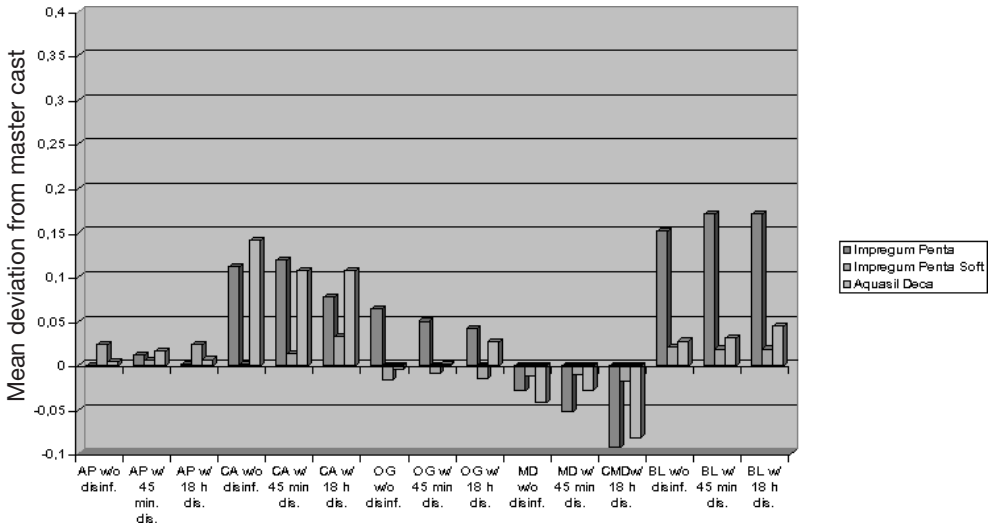


Fig. 23:
Dimensional change in impression materials investigated without disinfection, after disinfection for 45 min. and after disinfection for 18 hrs.

With the materials tested no statistically significant difference (ANOVA) was found between non-disinfected impressions, impressions with a disinfection time of 45 minutes and impressions with a disinfection time of 18 hours. The accuracy of impressions is thus not affected even after a disinfection time of up to 18 hours.

Diametral Accuracy and Sulkus Fluid Flow Model

For the successful fitting of a prosthesis, two criteria are of decisive importance from the dentist's and dental technician's point of view, namely the dimensional accuracy and marginal integrity of a restoration. For this reason the clinical situation has to be recorded with utmost precision by the impression material, and subsequently transferred to the model. The effect of moisture, which can never be entirely excluded in the clinical situation, should have the least possible influence on the impression.

Two models were used to investigate the precision. An original model for recording the diametral accuracy (Fig. 24) and a sulcus fluid flow model (Fig. 23) for determining the accuracy of marginal adaptation.

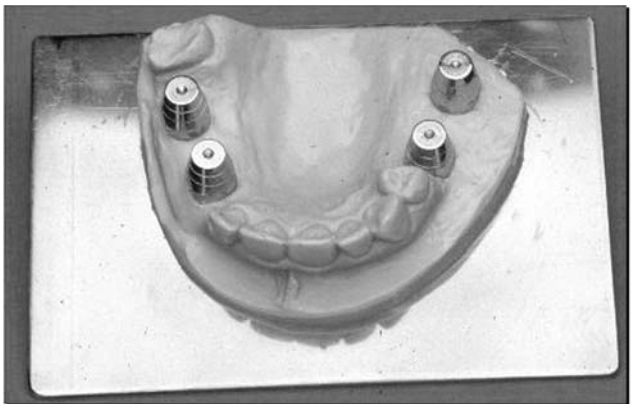
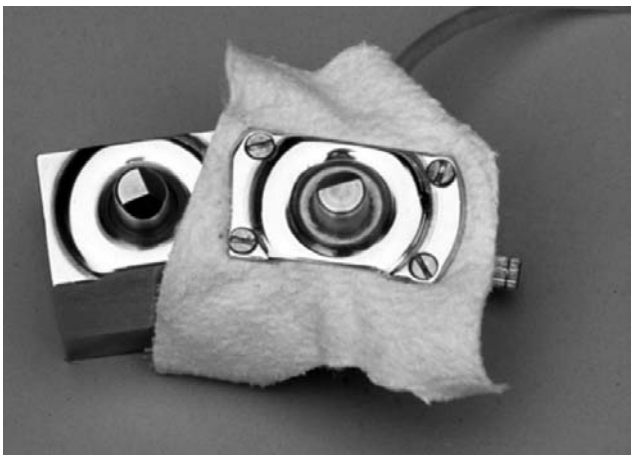


Fig. 24:
The original model for recording the accuracy. The diametral distances are measured on the model and afterwards compared with the original distances.

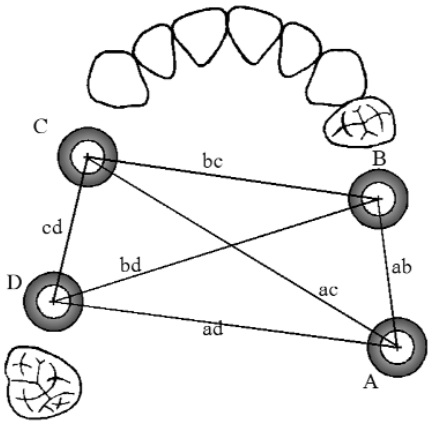
Fig. 25:
Sulcus fluid flow model for determining the accuracy of marginal adaption. The right idealised preparation serves to simulate a most sulcus.



The tests were carried out under the guidance of Prof. Wöstmann, Clinic for Dental Prosthetics at the Justus Liebig University, Giessen [U. Lammert, S. Nave, B. Wöstmann, A comparative study of two new polyether impression materials, AADR, #972, 2001]. [16]

The so-called original model (Fig. 24) consists of four surface-ground metal abutments. Each of these has a centric drill hole which serves to determine the diametral abutment distances. The original model was approximated to the clinical situation by also integrating a palate, and posterior and anterior teeth based on epoxy resin. An impression is taken of the original model with the materials and process being examined, and the impression is cast after one hour using Type IV plaster. The dimensional changes of the six diametral distances are determined with a measuring microscope and the measurements obtained can be compared with those of the original model. In Fig. 24, the diametral distances measured after casting the impression on the model are drawn in.
A comparison between the distances measured on the models and the original distances of the original model shows that the diametral distances are reproduced with extreme precision in impressions taken with Impregum Penta, Impregum Penta Soft and also with Impregum Penta H and L DuoSoft (see Table 4 Diametral distances).

Fig. 26:
Original model showing the distances which are measured.



	Distance ab [mm]	Distance ac [mm]	Distance bc [mm]	Distance bd [mm]	Distance cd [mm]	Distance da [mm]
Original model	**37,986**	**45,844**	**14,551**	**43,674**	**47,579**	**13,519**
Impregum Penta	38,028	45,866	14,549	43,702	47,583	13,529
Impregum Penta Soft	38,016	45,861	14,564	43,654	47,550	13,476
Impregum Penta H and L DuoSoft	38,018	45,863	14,563	43,681	47,577	13,485

Tab. 4:
Results and comparison of the measured distances

The sulcus fluid flow model (Fig. 25) consists of two idealised preparations which are precisely fitted into a brass block representing the model base. One of the idealised preparations serves to simulate a moist sulcus, whilst the second preparation represents a tooth in a dry sulcus. A feed system transports a defined quantity of liquid to the moist preparation. The gingiva is simulated by a semipermeable membrane made of a leather fabric. An impression is taken of the sulcus fluid flow model using the material being examined, and a model is cast from the impression using super-hard plaster Type IV. Copings of phantom metal are made on the model. These copings are used as measuring copings on the original preparation. The accuracy of marginal adaptation of the copings is measured with a measuring microscope at six reference points.

Figure 27 shows the average values of the crown margin gap measured between the coping and the original preparation. For each of the impression materials examined, the crown margin gap at the coping was measured on the preparation in both the dry state and surrounded by moisture.

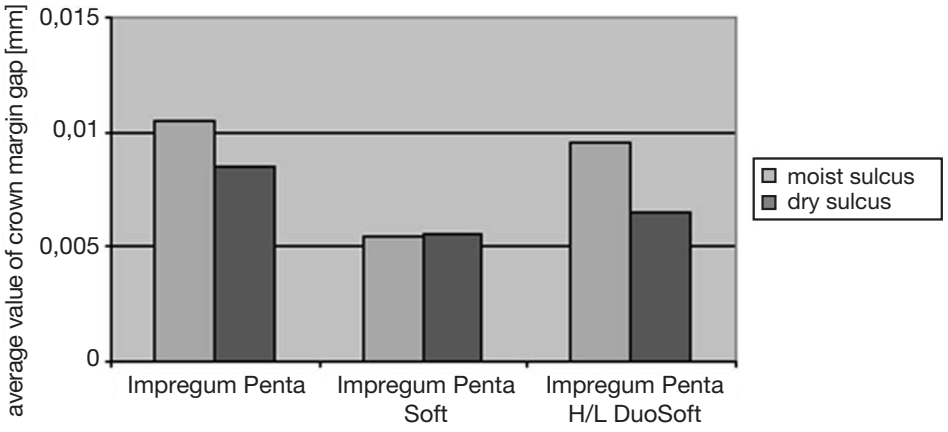


Fig. 27:
Crown margin gaps for the dry idealized preparation and surrounded by moisture

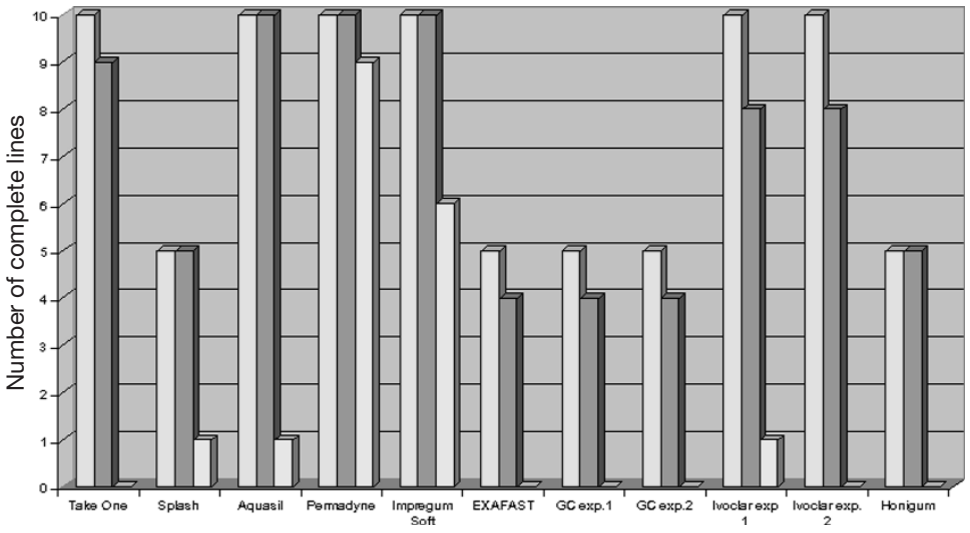
With Impregum Penta Soft, the respective average values (dry and moist preparation) are at the same level, i.e. the moist preparation had no influence on precision in this test. For Impregum Penta and Impregum Penta H und L DuoSoft, the average value of the crown margin gap on the moist preparation increased somewhat, but this increase was not statistically significant considering the standard deviation of the average values. Thus, both Impregum Penta Soft and Impregum Penta DuoSoft meet the high polyether precision standard that is familiar from clinical experience.

Accuracy of Detail Under Moist Conditions

The accuracy of detail is an important characteristic of impression materials. According to the most widely used specification (ADA specification No. 19), it is measured using a standard made of stainless steel, which has three lines with a specific width (75, 50 and 20 micrometers).
To obtain data that is relevant to dental practice, the Department of Prosthetics at Oregon Health Sciences University (Portland, OR) carried out a study [W. Jia, J. A. Sorensen, Wet Detail Reproduction And Dynamic Contact Angle Of Impression Materials, AADR, #1679, 2001] [17], in which a moist plaster block with line structures (three lines, 75, 50 and 25 micrometers wide respectively) was used instead of the stainless-steel standard described above.

Five test specimens were prepared for each of the impression materials tested. Then the number of test specimens which reproduced all the lines (75, 50, 25 micrometers) fully was recorded. The results of this study are shown in Fig. 28.

Fig. 28:
Accuracy of detail under moist conditions



According to this study, the low-viscosity polyether impression material Permadyne Garant L from 3M ESPE reproduces detail most accurately, followed closely by Impregum Penta Soft. Most PVS impression materials were not able to reproduce the 25-micrometer-wide line.

Rheology

Thixotropic or intrinsically viscous characteristics (chapter material characteristics background – structural viscosity) and the snap set behaviour (chapter material characteristics background – snap set) can both be measured with the aid of rheological tests. Studies in this area were conducted back in 1998 by Prof. John F. McCabe (Department of Restorative Dentistry, Newcastle upon Tyne) (1. McCabe J. F., Carrick T. E., Rheological Properties of Elastomers during Setting, J Dent Res 68(8), 1218-1222, 1998; 2. McCabe J. F., Arikawa H., Rheological Properties of Elastomeric Impression Materials Before and During Setting, J Dent Res 77(11), 1874-1880, 1998) [11a/11b]. These studies already demonstrated that polyether impression materials possess particularly good thixotropic properties compared to other elastomeric impression materials. To test

whether these properties are also apparent with the new polyether “Soft” chemistry, Prof. J. F. McCabe repeated the rheological tests with Impregum Penta, Impregum Penta Soft and the A-silicone, Aquasil Monophase.

As already discussed in the previous chapters, impression materials should display plastic behaviour during the working phase. Plastic behaviour means that a material remains deformed when exposed to an external force. The plasticity of the impression material allows it to flow optimally and free of material stresses. In the tests described here, this corresponds to a large Tan δ by first approximation.

In the set state, the material should be elastic, which corresponds to a small Tan δ. Elasticity in the set state is necessary so that the impression material can return to its original state after deformation. Plastic and elastic behaviour were examined in these tests using a cone-plate rheometer.

Figure 29 shows the Tan δ curve as a function of time. The high value of Tan δ is indicative of the plastic behaviour of Impregum Penta Soft during the working phase. This results in optimum flow during insertion of the tray. The plateau-like shape of the Tan δ curve shows that the plastic properties remain throughout the working phase. If Impregum Penta Soft already displayed elastic properties during the working phase, this could cause distortion and inaccuracies in the impression. When the working phase ends, Impregum Penta Soft displays a rapid transition from the plastic (large Tan δ) to the elastic (small Tan δ) state. This transition is referred to as snap set.

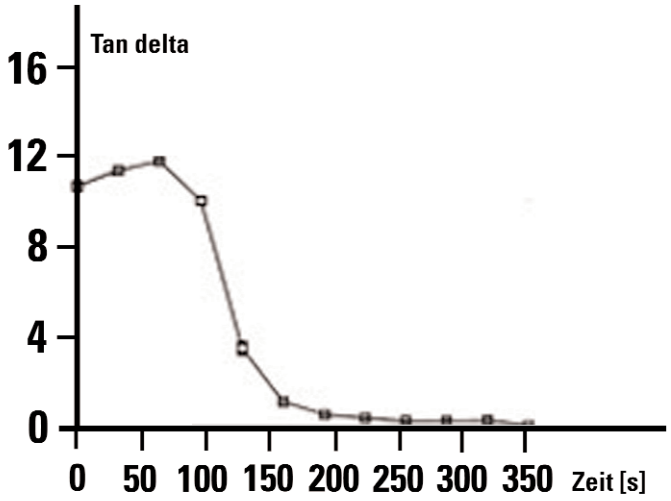
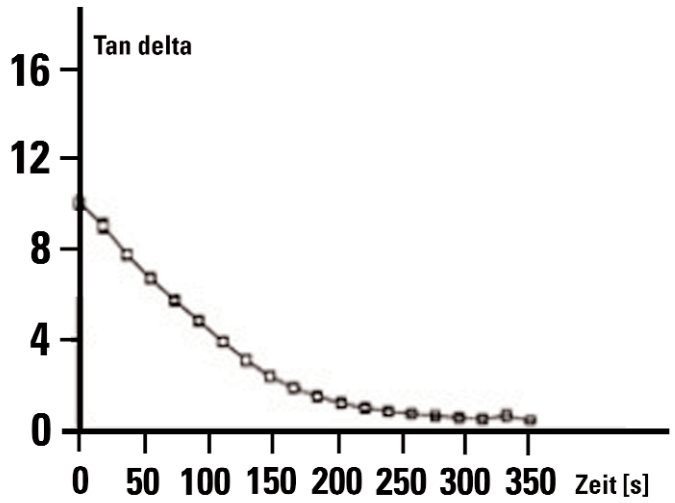


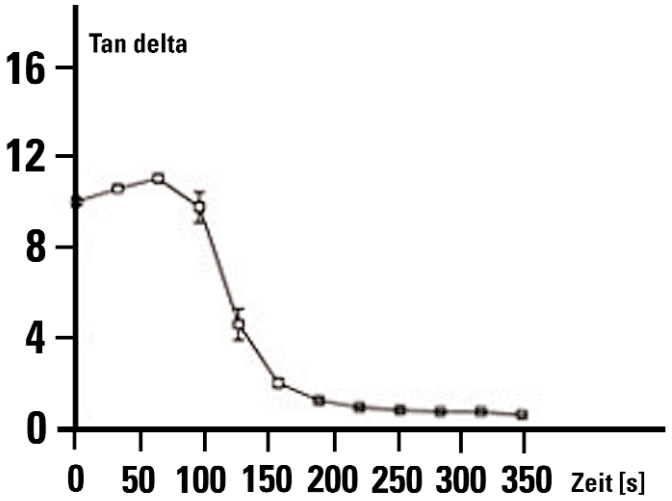
Fig. 29:
Tan δ curve of Impregum Penta Soft. The curve indicates an optimum flow during insertion ans Snap-Set setting

Fig. 30:
Tan δ curve of Aquasil. The curve indicates a possible premature crosslinking.



In contrast to Impregum Penta Soft, the Tan δ curve for Aquasil (Fig. 30) falls immediately after the start of measurement. A plateau with virtually uniform plastic properties is not recognisable in these tests. The fact that the elastic components gain in significance at an earlier stage indicates a material with premature crosslinking.

Fig. 31:
Tan δ curve as typical for polyether impression materials



With Impregum Penta (Fig. 31), an optimal plastic behaviour is seen during the working phase, as is typical of polyethers, followed by a transition to an elastic behaviour after the snap set. These special rheological properties, which characterise both the classic polyether composition of Impregum Penta and the new “Soft” composition, are undoubtedly one of the reasons for the exceptionally high level of reliability and reproducibility of polyether impressions.

Flowability Under Pressure

In this study, the flowability under pressure of different impression materials with medium consistency was examined.

To simulate the intraoral situation, a special test (shark fin test: for further details, see V. Vaugen et. al., IADR 1997) was used. The measuring device has a slot-shaped opening (length 18 mm, maximum width 2 mm). The impression material is put into a mould and the measuring device described above is placed on top with a specified force (a weight of 275 g is positioned on the tip of the measuring device). After the material has set, the measuring device is removed and the height of the test specimen obtained in this way is measured. The test specimen is shaped like a shark's fin, hence the name of the test. The maximum height of this “fin” is measured. The higher the measurement, the greater the flowability of the impression material under pressure.

This study was conducted at the School of Dentistry at Tufts University (Boston, MA). Figure 30 shows the average fin height of the impression materials. 10 test specimens were prepared for each material [M. S. Kim, E. H. Doherty, G. Kugel, Flow Under Pressure of Four Impression Materials Using Shark-Fin Device, AADR, #624, 2001]. [18]

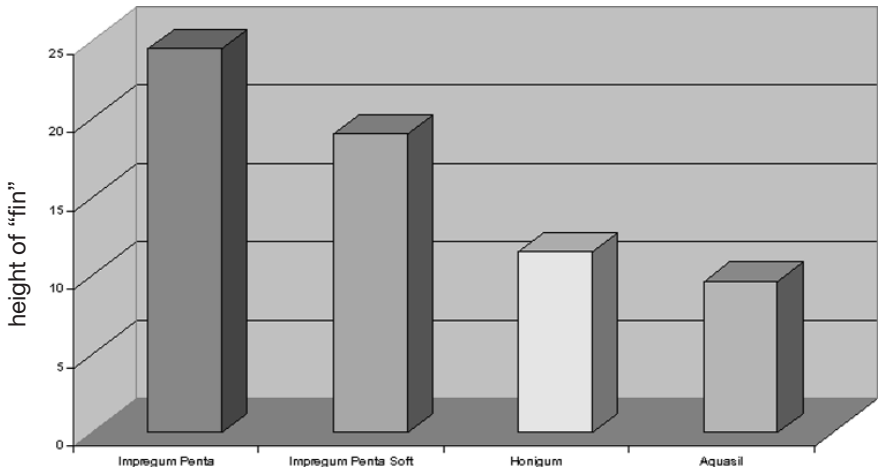


Fig. 32:
The height of the “fin” measured in mm is related to the flowability of the impression material under pressure.

The results show that flowability under pressure is most pronounced with 3M™ ESPE™ Impregum™ Penta™ and 3M™ ESPE™ Impregum™ Penta™ Soft. This is a very important clinical characteristic of impression materials. Flowability under pressure has a direct effect on how the material flows into the sulcus, and is necessary for obtaining a precisely formed preparation margin with good detail reproduction. AADR, #624, 2001]. [18]

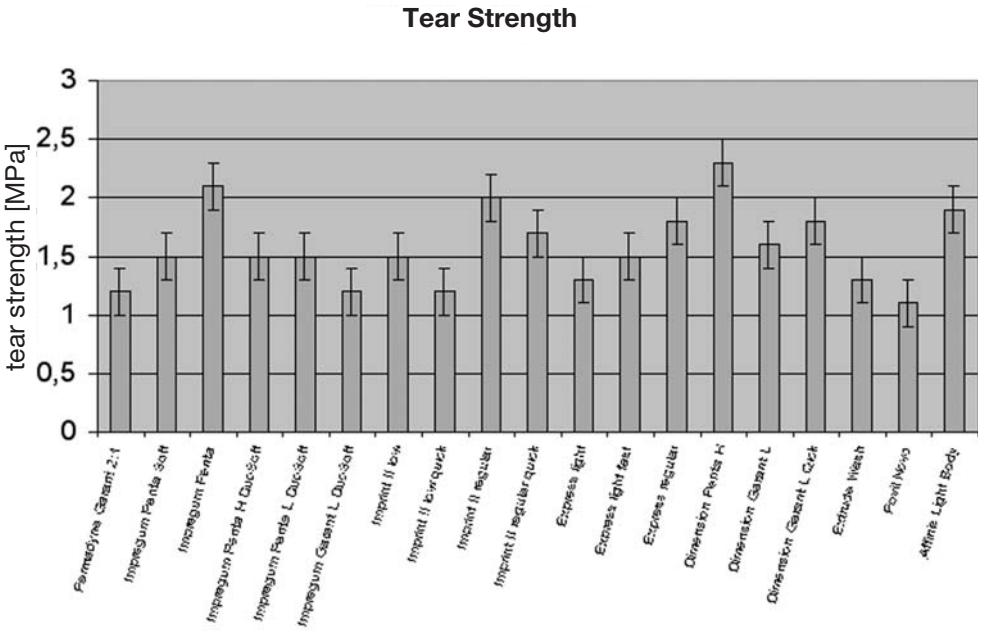
Tear Strength of Polyether and Vinyl Polysiloxanes

In addition to the properties tested in ISO 4823, such as recovery after deformation or dimensional change, the tear strength of impression materials is also an important factor. However, testing of tear strength is not mentioned in ISO 4823, and therefore is not standardised for elastomeric impression materials. This is certainly a reason why widely differing information about tear strength is encountered in the literature. Not only do the reported results vary considerably between the individual material classes, even comparisons of the same material produce very disparate results.

Individual methods of measuring tear strength display very large standard deviations even within the measurements. In these cases, differences in the average values of the individual materials can be recognised, but no statistically significant statements can be made due to the high standard deviations.

Nevertheless, in order to obtain reproducible and comparable results, 3M ESPE tests impression materials for tear strength on the basis of DIN 50125, Form 0. The results obtained are shown in figure 33.

Fig. 33:
Tear Strength of the measured impression materials based on DIN 50125



It is apparent that both polyether (Impregum, Impregum Soft/DuoSoft) and the A-silicones (e.g. Imprint, Dimension), but also rival products such as Extrude and Provil, are within a comparable range. The deviations indicated in the measurement bars show the spread due to the inaccuracy of the measuring method.

However, it is not possible to derive a clinical lower limit for tensile strength from the measurements based on DIN 50125. Nevertheless, long experience with Impregum and Express show that with tensile strength values around 1.5 MPa, no clinical problems are to be expected.

In addition to tear strength, the fracture elongation at tear also plays an important role. But here too, the values shown in Fig. 34 fracture elongation show that there are no significant differences between the polyether material class and the A-silicones.

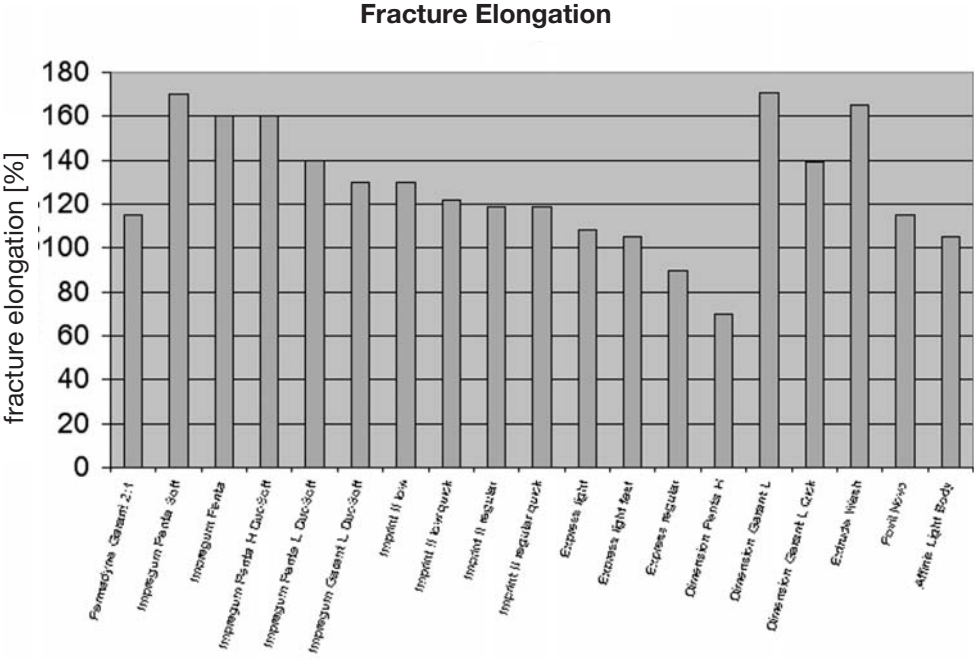


Fig. 34:
Fracture elongation based on DIN 50125

Here again, both new products such as 3M™ ESPE™ Impregum™ Penta™ Soft/DuoSoft™ and clinically tested materials such as 3M™ ESPE™ Imprint™ and 3M™ ESPE™ Express™ are in a comparable range.

Finally, it should again be mentioned that the absolute results obtained by this testing method are not comparable with those from other methods. Nevertheless, a comparable ranking of the materials is also to be expected with other methods.

Clinical Case Report – Porcelain Fused to Metal (PFM) Crown

(Case report by Andre v. Ritter, University of North Carolina, Chapel Hill, NC)

The patient initially presented with a broken off front cusp on tooth 5 (FDI 14). A large MOD amalgam restoration was already present (Fig. 35, 36). First of all, treatment options and possible end results were explained to the patient. He decided on a PFM crown with complete porcelain veneer in the front area.
The patient was anaesthetised, the old restoration isolated and removed (Fig. 37) and a core build-up made. Once the preparation was completed (Fig. 38), the impression was taken with Impregum Penta Soft in the syringe and tray (Fig. 39). The impression is very homogeneous with easily recognisable detail. The preparation margins are precisely reproduced.
After checking the final crown on the master cast, the restoration was permanently cemented. Fig. 41 and 42 show the postoperative view of the final crown.

Fig. 35:
Buccal view of the fractured tooth 14

Fig. 36:
Fractured tooth 14, occlusal

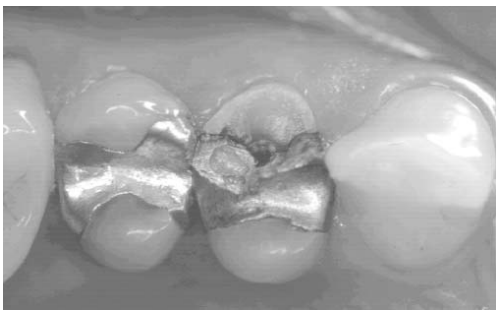


Fig. 37:
Situation after removal of the amalgam restoration

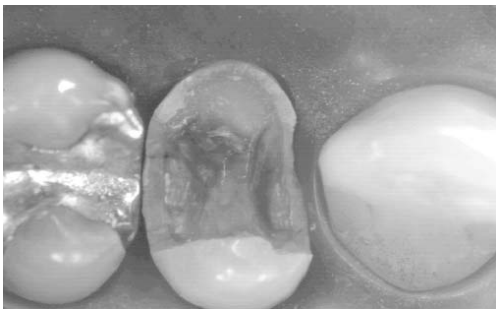
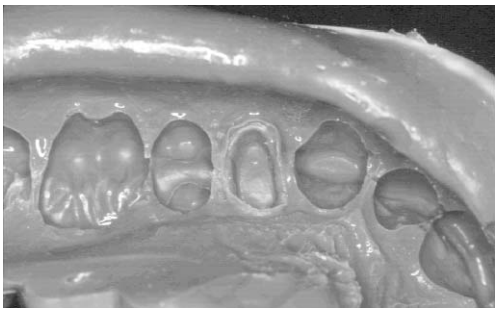


Fig. 38:
Completed preparation, occlusal

Fig. 39:
Impression with Impregum Penta Soft; the preparation margin is reproduced exactly and the detail is very easy to recognise



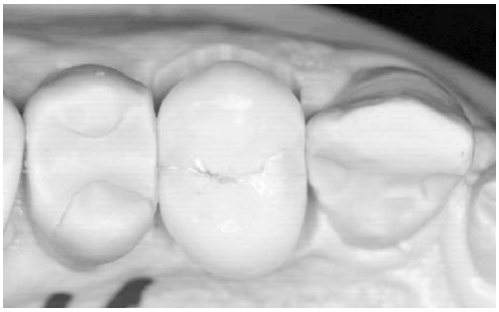


Fig. 40:
Crown on the master cast

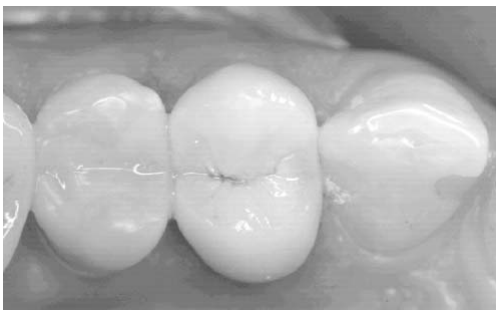


Fig. 41:
Crown (14) after permanent cementing. Tooth 15 was restored with composite

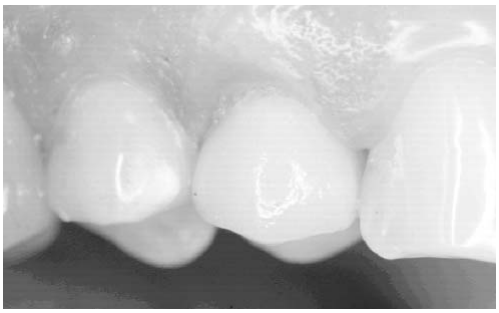


Fig. 42:
After completion of treatment, buccal view

Clinical Case Report – Stainless-Steel Post and Crown

(Clinical pictures by Dr. Volker Bonatz, Landau)

After post preparation on tooth 15, an impression is taken with 3M™ ESPE™ Impregum™ Penta™ DuoSoft™ (Fig. Bonatz 41, Fig. Bonatz 42). On the basis of this first impression, a model is made and a stainless-steel post manufactured (Fig. Bonatz 43). After final insertion of the stainless-steel post (Fig. Bonatz 44), another impression is taken with Impregum Penta DuoSoft The partially subgingival preparation is easily recognisable in the impression (Fig. Bonatz 45). The precision impression is the basis for an exact fitting crown with excellent aesthetics, as can be seen in the intraoral situation after final cementation (Fig. Bonatz 46, Fig. Bonatz 47, Fig. Bonatz 48).

Fig. 43:
Pin preparation ...

Fig. 44:
… in the Impregum DuoSoft impression

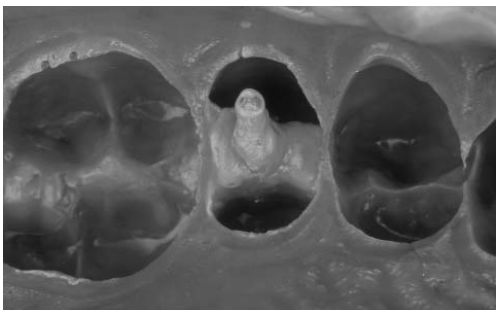


Fig. 45:
excellent edge stability of the stump due to easier removal of Impregum DuoSoft

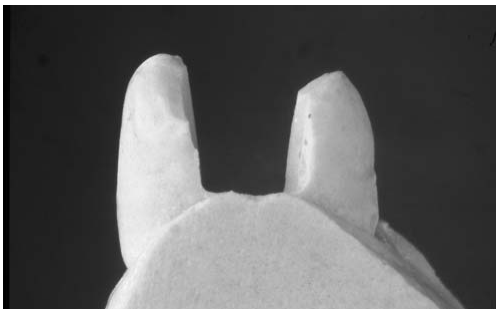


Fig. 46:
the inserted gold alloy pin and ...

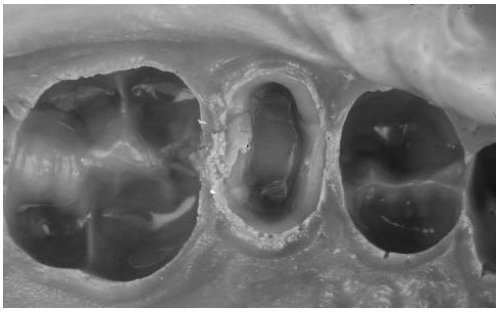


Fig. 47:
… impression of the partially subgingival preparation

Fig. 48:
Master model ...

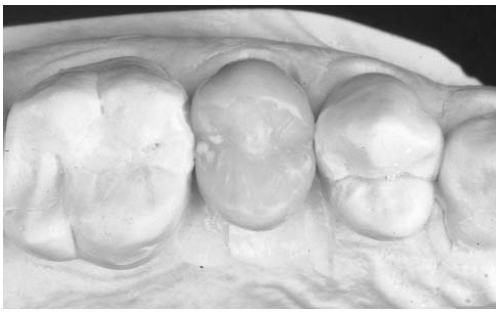


Fig. 49:
… with finished crown ...

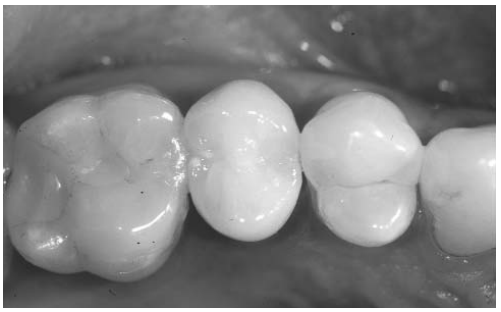


Fig. 50:
… and the intraoral situation

Clinical Case Report – Anterior Crowns

(Clinical pictures by Dr. Volker Bonatz, Landau)

After preparation of anterior teeth 12 to 21, an impression is taken with Impregum Penta DuoSoft (fig. 51, fig. 52). The excellent detail reproduction and very good defining of the preparation margins are clearly visible in the impression. The preparations are fitted with temporary crowns fabricated chairside (fig. 53). A control model and master cast with accurate detail reproduction (fig. 54, fig. 55) are essential for producing the restorations (fig. 56, fig. 57, fig. 58).

Fig. 51:
Preparation of 4 front teeth

Fig. 52
in the Impregum DuoSoft impression

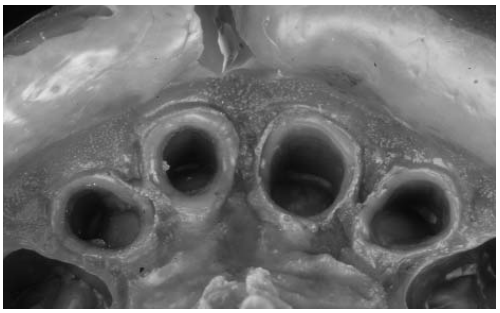


Fig. 53:
Chairside-made temporizations

Fig. 54:
High-detail reproduction of the control model

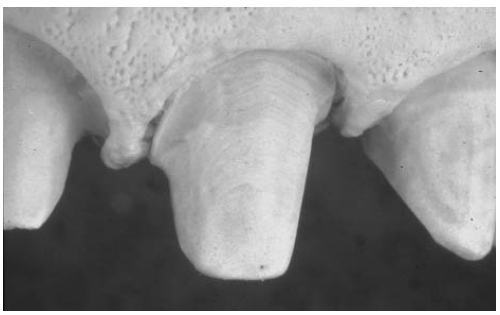


Fig. 55:
Master model ...

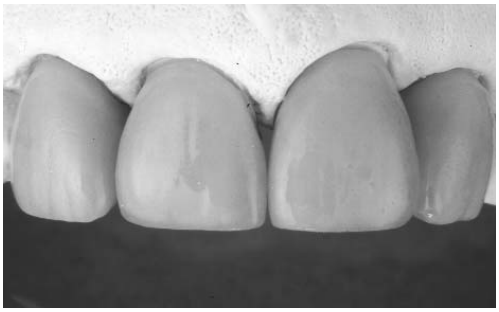


Fig. 56:
... with finished PMF crowns

Fig. 57:
Intraoral situation

Fig. 58:
Intraoral situation

Clinical Case Report-Porcelain Fused to Metal PFM) Crown

(Clinical pictures by Dr. Christoph Zawta, Meran)

The patient initially presented with a discoloured endodontically treated tooth 14 with an insufficient amalgam core build-up. After circular chamfer preparation two retraction cords were placed. The precision impression was taken with Impregum Soft medium-bodied consistency in the syringe and tray.
The precisely reproduction of the preparation led to a perfect adaptation of the PFM crown.

Fig. 59:
Buccal view of endodontically treated tooth 14

Fig. 60
Completed preparation with retraction cords

Fig. 61
Mixing of Impregum Soft

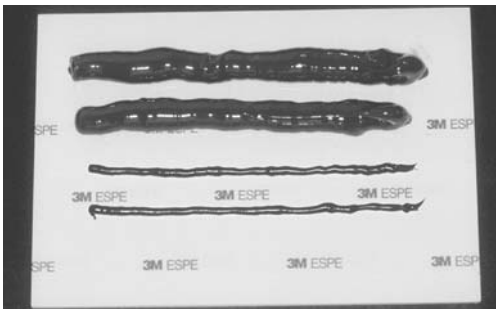


Fig. 62
Impression after removal from the mouth

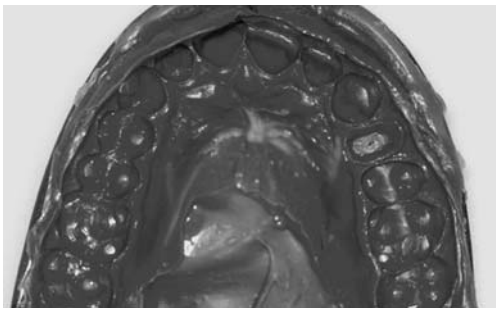


Fig. 63:
Detailed view of the impression tooth 14

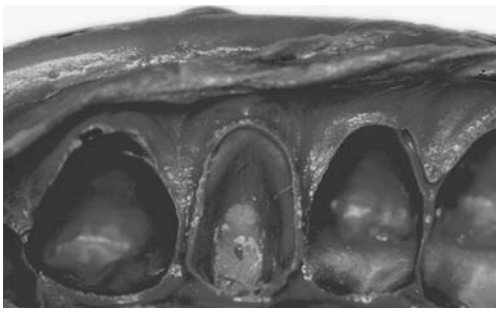


Fig. 64:
Upper jaw master cast

Fig. 65:
Detailed view

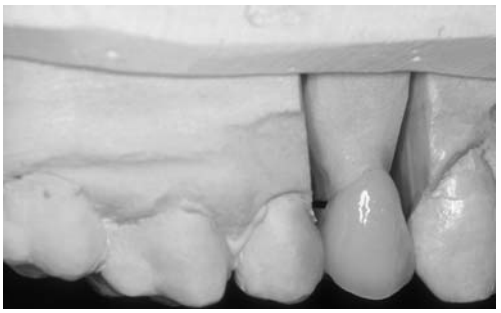


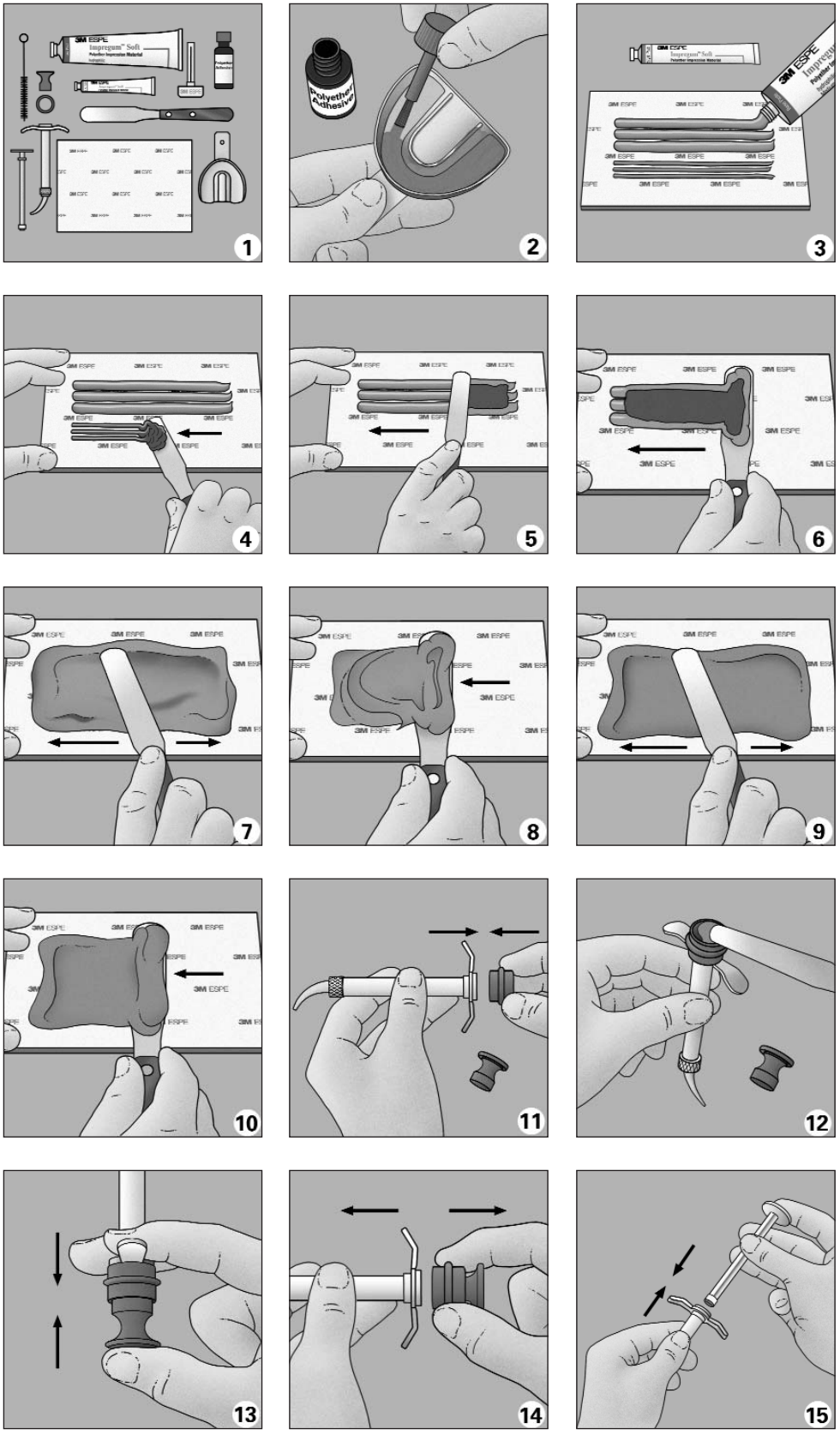
Fig. 66:
PFM crown on the master cast

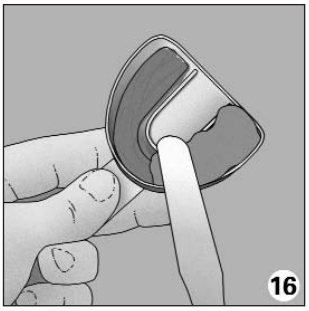
Fig. 67:
Detailed view, fissures coloured

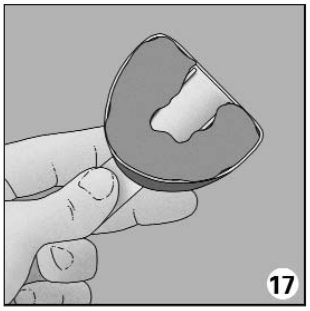
Fig. 68:
Finally cemented crown

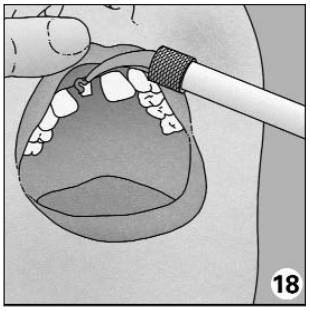
Technique Guides

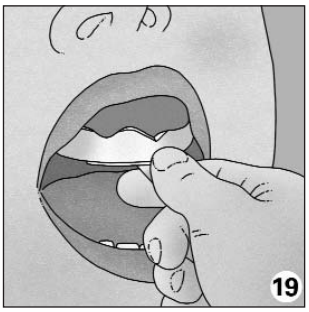
Impregum Soft medium-bodied consistency (handmix) – Step-by-step

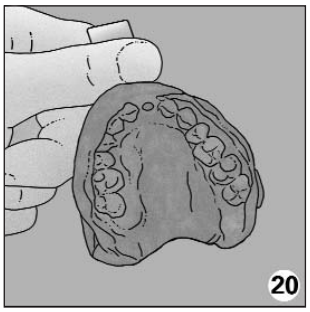


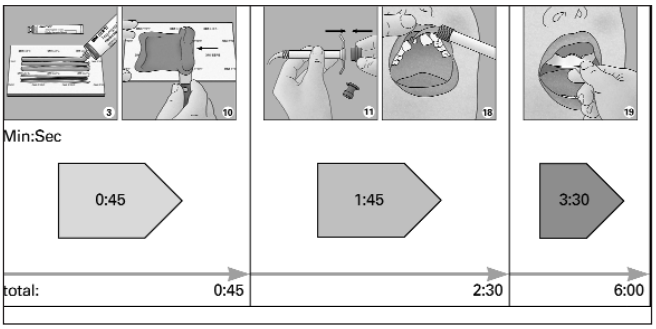

16


17

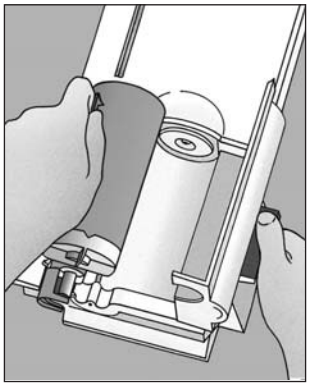

18


19

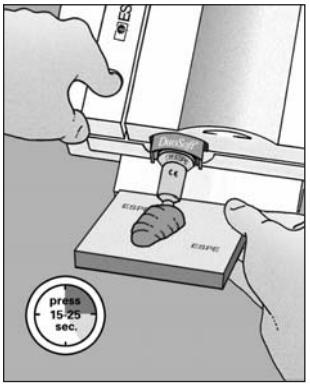

20


3
10
11
18
19
Min:Sec
0:45
1:45
3:30
total:
0:45
2:30
6:00

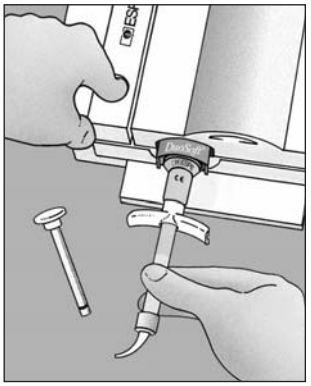
Impregum Penta Soft – Step-by-step



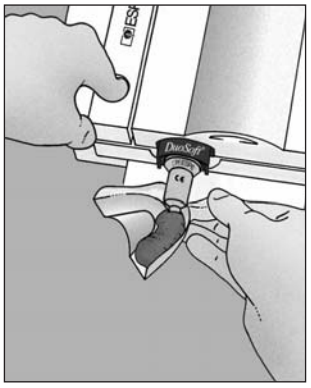
Insert the loaded Penta cartridge into the Pentamix unit



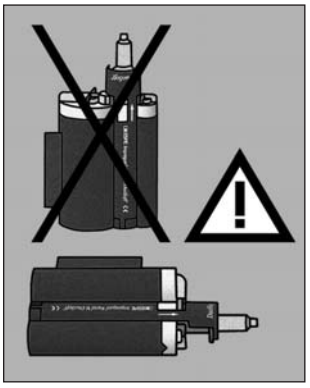
For initial use extrude a small amount of material and discard it



In the meantime, syringe impression material around the teeth



Begin filling the tray

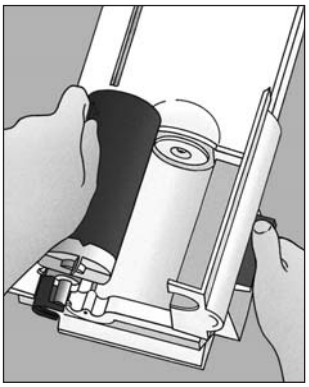


3M ESPE recommends horizontal storage of the ready-for-use cartridge

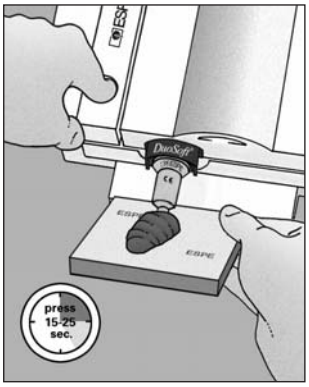
PentaMatic activation: Upon pression the button the PentaMatic foil bag opens fully automatically after 15-25 sec. (audible system). Only use 3M ESPE mixing tips that carry the CE mark

Impregum Penta H DuoSoft / Impregum Garant L DuoSoft Step-by-step

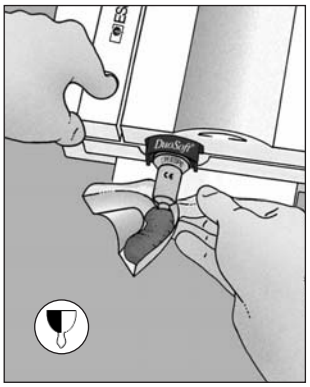
One-step tray wash technique



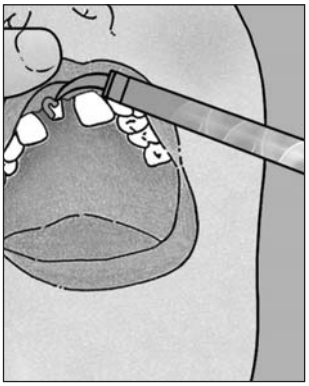
Insert the loaded Penta cartridge into the Pentamix unit



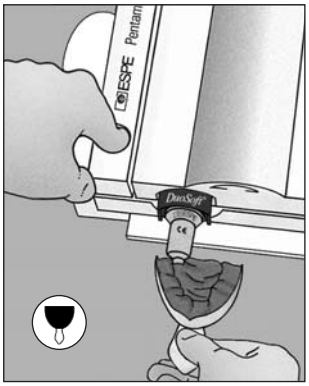
For initial use extrude a small amount of material and discard it



Begin filling the tray

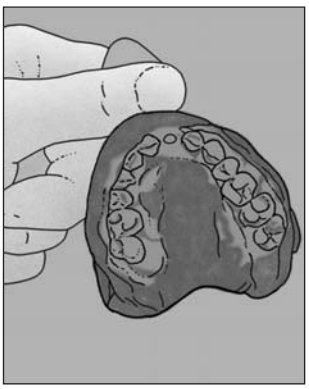


In the meantime, syringe impression material around the teeth

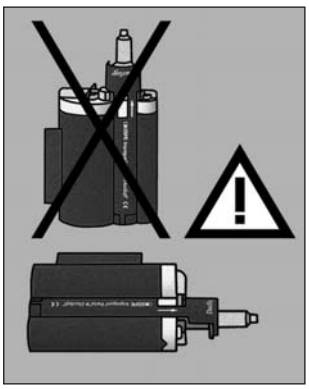


Finish filling the tray

Insert the impression tray in the mouth



Finished impression

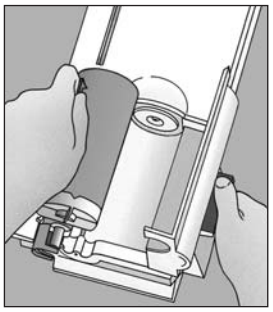


3M ESPE recommends horizontal storage of the ready-for-use cartridge

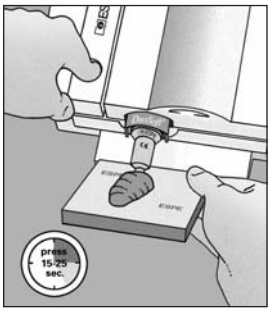
PentaMatic activation: Upon pression the button the Penta-Matic foil bag opens fully automatically after 15-25 sec. (audible system). Only use 3M ESPE mixing tips that carry the CE mark

Impregum Penta H DuoSoft / Impregum Penta L DuoSoft Step-by-step

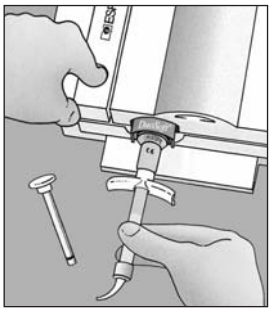
One-step tray wash technique



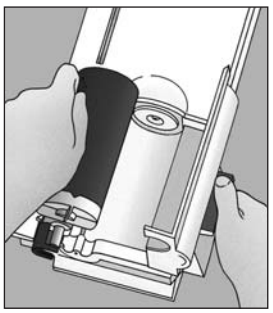
Insert the loaded Penta cartridge into the Pentamix unit



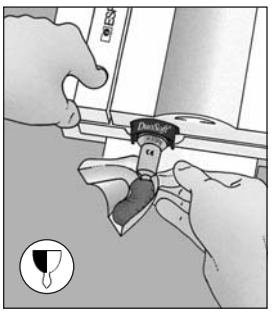
For initial use extrude a small amount of material and discard it



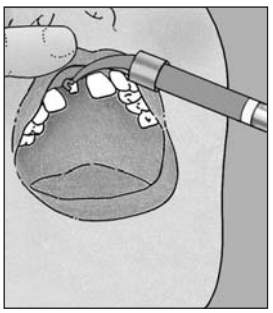
Fill the Penta elastomer syringe



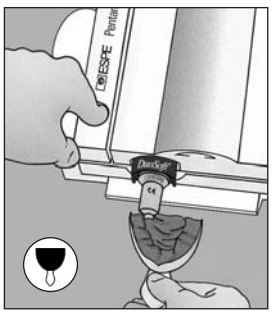
Change cartridge



Begin filling the tray

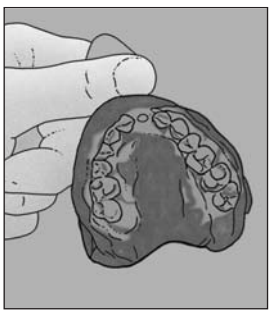


In the meantime, syringe impression material around the teeth

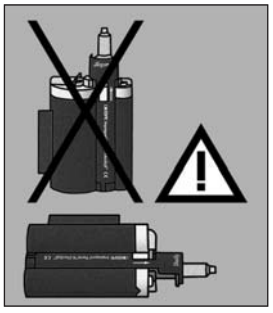


Finish filling the tray

Insert the impression tray in the mouth



Finished impression



3M ESPE recommends horizontal storage of the ready-for-use cartridge

PentaMatic activation: Upon pression the button the Penta-Matic foil bag opens fully automatically after 15-25 sec. (audible system). Only use 3M ESPE mixing tips that carry the CE mark

Preparation of the impression tray

Suitable trays are distortion-free, unperforated metal trays or custom plastic trays. In order to ensure sufficient adhesion, coat the tray with tray adhesives (Polyether Adhesive) at least 5 mins before it is filled.

In the case of edentulous jaws, the same trays can be used as for dentate jaws, because the all-important functional tray is produced individually afterwards and adapted in the mouth.

Preparation for impression and retractions

Treat subgingival crown preparations in advance with cords or rings dipped in a suitable retraction solution (e.g. Epipak solution). Retraction with epinephrine (adrenaline), 8-hydroxyquinoline sulphate and cords or rings containing iron-III-sulphate can inhibit the setting of Impregum Penta Soft. Retraction materials containing aluminium chloride/ sulphate are more suitable. Before the impression is taken, the preparation boundaries should be carefully rinsed after the cords are removed.

Situational influences

Polyether impressions should be stored in a cool dark place, and in particular should never be exposed to direct sunlight. Similarly, the product should neither be stored in water, under very moist conditions or at extremely low humidity levels, nor should it be used in conjunction with wetting agents.
If polyether materials are stored below room temperature, allow the material to regain room temperature before starting the mixing process.

Disinfection

As the impression material is in direct contact with the oral cavity and the prepared tooth, i.e. saliva and blood are present, for hygienic reasons it is necessary to disinfect the impression. For this purpose, an immersion bath disinfectant in a standard glutaraldehyde solution (e.g. Impresept) is recommended. After allowing this to work for 10 minutes, rinse the impression under running water for approx. 15 secs. Excessive disinfection periods, e.g. overnight, should be avoided for reasons of quality assurance.

Model production

The hydrophilicity of polyether as a result of its chemical structure ensures that its excellent flowability is retained on plaster which is reflected in the high quality of the model. The finished impression should be filled with a standard special hard plaster at the earliest after 30 mins and at the latest after 14 days. In order to obtain a void-free model we recommend that the impression be rinsed with water a short time before. Wetting agents should not and need not be used, since, in the case of polyethers, they impair the quality and are made superfluous by the material’s hydrophilic properties.

Instructions For Use

Impregum Soft

Product Description
Impregum Soft, manufactured by 3M ESPE, is a polyether impression material that is mixed by hand and is available in heavy-bodied, medium-bodied and light-bodied consistency. The base paste to catalyst mixing ratio is 7:1 by volume.
To ensure adequate adhesion to the tray, use Polyether Adhesive, also manufactured by 3M ESPE. This adhesive can be used on metal or methacrylate trays, but not with vinyl polysiloxane impression materials.

☞ For more details on the products mentioned below, see each product's Instructions for Use. Keep these instructions as long as you continue to use the product.

Areas of Application
- All types of precision impressions

Preparation
Rigid, imperforate metal trays or individual plastic trays are particularly suitable.
– To ensure adequate adhesion, spread a thin layer of polyether adhesive on the tray and allow to dry completely (at least 30-60 seconds, ideally 15 minutes).

Retraction
Aluminum hydroxychloride- or aluminum sulfate-based solutions are suitable retraction agents. Retraction using cords or rings containing epinephrine (adrenaline), 8-hydroxy quinoline sulfate and iron (III) sulfate can interfere with the setting of polyether impression materials.
– Keep the areas from which the impression is to be taken dry.
– For subgingival preparations use cords or rings as necessary.
– Before taking the impression, thoroughly rinse and dry the area to remove the rest of the retraction agent.

Dosing and Mixing
– Place strands of base paste and catalyst of equal length on a mixing pad. Using too much or not enough catalyst will not affect the working time, but will adversely affect the quality of the impression.
– Mix the pastes with a spatula for about 45 seconds. Wipe any unmixed paste remaining on the spatula on the edge of the pad; pick up the paste again and spread it until it is a uniform color. Never mix by stirring, as bubbles may form.

Times
These working times apply at 23°C/74°F. Higher temperatures decrease the total working time, lower temperatures increase it.

	Heavy-Bodied Consistency min:sec	Medium-Bodied Consistency min:sec	Light-Bodied Consistency min:sec
Mixing	00:30	00:45	00:30
Working from beg. of mixing	02:30	02:30	03:00
Setting from beg. of mixing	05:30	06:00	06:00
Time in the mouth*	03:30	03:15	03:00

* When products are combined, the longer time applies.

Taking the Impression

Monophase technique
- Using the filling device, fill the Elastomer Syringe, manufactured for 3M ESPE, with the mixed paste of Impregum Soft medium-bodied consistency.
- Then fill the tray prepared using Polyether Adhesive.
- Syringe the sulcus or cavity from the deep part out. Always keep the tip of the intraoral tip immersed in the material and touching the tooth surface during application.
- Immediately after syringing, position the filled tray in the mouth and hold it there without pressure until the material has set.

Double-Mix Technique
- Using the filling device, fill the Elastomer Syringe with the mixed paste of Impregum Soft light-bodied consistency.
- Then fill the tray prepared using Polyether Adhesive with Impregum Soft heavy-bodied consistency.
- Syringe the sulcus or cavity from the deep part out. Always keep the tip of the intraoral tip immersed in the material and touching the tooth surface during application.
- Immediately after syringing, position the filled tray in the mouth and hold it there without pressure until the material has set.

Functional Impression
- Fill the individual tray prepared using adhesive with Impregum Soft heavy-bodied consistency or Impregum Soft medium-bodied consistency. Position the tray in the mouth and have the patient make functional movements.
- If necessary, use Impregum Soft light-bodied consistency subsequently for detailed impressions.

Hygiene
- Place the impression in a standard disinfectant solution for the amount of time recommended by the manufacturer. Leaving the impression in the disinfectant for too long can damage it.
- After the impression has been disinfected, rinse it under running water for about 15 sec.

Pouring a Model
- To prevent bubbles, rinse the impression with water and dry it shortly before filling. Do not use surfactants, they reduce the quality of polyether impression materials and are not necessary.
- After at least 30 minutes and before 14 days have elapsed, fill the impression with standard special-purpose hard plaster. Polyether impression materials can be silvered, but copper-plating is not possible.

Cleaning

Paste that has not set can be removed using ethanol or by washing with soap and water. Acetone can be used to clean the adhesive from metal trays.

- Do not apply polyether adhesives to textiles, plastic plates, varnished surfaces, etc., since we cannot guarantee that no residue will remain after removal.
- Use polyether adhesives in well-ventilated areas. In case of contact with the skin, wash with water.

Notes

- Due to increased viscosity, the pastes cannot be taken from the tube at temperatures below 16°C/61°F. When returned to room temperature, they become workable again with no loss of quality.
- Direct sunlight and humid storage conditions damage the impression. Avoid very high or low relative humidity (>70% or <30%).
- Polyether impressions should never come in contact with liquids containing solvents. This could result in swelling and make the model inaccurate.
- Polyether impression materials can be combined only with each other, not with silicone impression materials.
- Bottles containing Polyether Adhesive should not be overfilled (by adding remaining portions of other bottles), since the glass can crack if warmed even slightly.
- Polyether Adhesive does not always adhere sufficiently to individual trays made of other synthetics or to base plates.

Intolerance

The possibility that sensitive persons may become sensitized through use of the product cannot be excluded. Should allergic reactions occur, stop using the product and remove it completely.

Technical Data

Impregum Soft meets ISO 4823, Type 1-3.

	Heavy-Bodied Consistency	Medium-Bodied Consistency	Light-Bodied Consistency
Strain in compression:	4.3%	3.4%	4.1%
Elastic recovery:	98.8%	98.7%	98.5%
Linear dimensional change (after 24 h):	-0.4%	-0.3%	-0.4%

Storage and Shelf Life

Do not store the product at temperatures above 25°C/77°F.
Do not use after the expiration date.
Store impressions in a cool dark place (temperatures below 30°C/86°F).

Customer Information

No person is authorized to provide any information which deviates from the information provided in this instruction sheet.

Guarantee

3M ESPE guarantees this product to be free of material and manufacturing defects.
3M ESPE ASSUMES NO FURTHER LIABILITY AND GIVES NO IMPLICIT GUARANTEE OF MARKETABILITY OR SUITABILITY FOR A PARTICULAR PURPOSE. The user is responsible for the use of the product, including use in accordance with the requirements. Should defects in the product appear before expiration of the guarantee, your only claim and 3M ESPE's only obligation is repair or replacement of the 3M ESPE product.

Limitation of Liability

Insofar as allowed by law, 3M ESPE assumes no liability for losses or damages caused by this product, regardless of whether they are direct, indirect, special, collateral or resultant damages and regardless of the legal basis, including guarantee, contract, negligence or intention.

Revised 07/02

Impregum Penta Soft

Product Description
Impregum Penta Soft is a medium consistency polyether impression material for the mixing device, Pentamix. The mixing ratio is 5 volumes base paste: 1 volume catalyst. Due to its lower Shore hardness, the impression material is suitable for use with impressions with slight undercuts even without an additional blocking out.The bags are sealed with a PentaMatic sealing cap. The PentaMatic sealing cap automatically opens the bag once sufficient pressure is established by the plunger of the Pentamix. For details on Pentamix and accessories, Polyether Adhesive,
Epipak, Penta Elastomer syringe, and Impresept please refer to the corresponding Instructions for Use.

Areas of application
Impression of inlay, onlay, crown, and bridge preparations
Functional impressions
Implant impressions

Preparation

Impression trays
Suitable are rigid non-perforated metal trays or custom plastic trays. For sufficient adhesion, apply a thin layer of Polyether adhesive to the tray and allow to dry completely (at least 30-60 sec – test with a finger, 15 min drying time are ideal).
Pentamix/Penta cartridge/poly bag: Place Impregum Penta Soft in the designated cartridge only! Poly bags equipped with a PentaMatic sealing cap exclusively must be used with 3M ESPE Penta mixing tips embossed with the colorless “3M ESPE” logo. Mixing tips embossed with the black “3M ESPE” logo must not be used. Discard the first 3 cm of paste extruded from newly filled cartridges prior to the first use for impression taking. The colour of the dispensed paste must be uniform. If a new mixer is installed when the cartridge is inserted, check whether the drive shaft is engaged before you start mixing.

Retraction
Areas from which impressions are to be taken should be kept dry. In subgingival preparations, haemostatic threads or rings may be used. Solutions based on aluminium hydroxide chloride or aluminium sulphate, e.g. Epipak, are suitable retraction agents. Prior to taking the impression, completely remove all residual retraction agent by rinsing and drying. Retraction with threads or rings containing epinephrine (adrenaline), 8-hydroxyquinoline sulphate or iron (III) sulphate may impair the setting of polyether impression materials.

Dosing and Mixing
Dosing and mixing are performed automatically in the Pentamix.

Times

Processing time	Setting time	Residence time
from start of mixing*	min : sec	02:45
from start of mixing*	min : sec	06:00
in the mouth	min : sec	03:15

These are the processing times at 23°C. Higher temperatures shorten, and lower temperatures prolong total processing times.
* Start of mixing = entry of paste into the mixing cannula.

Impression Taking

Monophase technique
For application around the preparation attach the Penta Elastomer syringe to the Penta mixing cannula of the Pentamix device, and fill the syringe. Then load the tray previously prepared with adhesive. The mixing cannula should be kept immersed in the material at all times. Apply the material into the sulcus or cavity from bottom up, keeping the tip of the application nozzle immersed in the material and in contact with the tooth surface at all times. Depending on tray size, the application of the material should be initiated only once the tray is half-loaded in order to ensure that the tray can be positioned in the mouth immediately after injection. Otherwise the syringe material may set more rapidly than the tray material causing distortion of the impression. To remedy initial adhesion ("setting the valve"), especially with upper jaw impressions, remove the tray from the gingiva on one side in a posterior position. If this proves difficult it may be necessary to carefully blow some air or water between the impression and the gingiva.

Functional impression
After preparing the custom tray with adhesive, load the tray with paste mix, position it in the mouth, and ask the patient to perform functional excursions. If required, use Permadyne Penta L or Permadyne Garant 2 :1 for precise impression taking (correction).

Hygiene
Place the impression in a standard disinfectant solution, e.g. Impresept*, for the period of time recommended by the manufacturer, i. e.10 min in the case of Impresept. Excessive disinfection may damage the impression. After disinfection, rinse the impression under running water for approx. 15 sec.* Impresept is commercially available only in Germany, Austria, and Switzerland.

Model Preparation
Prepare a cast from the impression with a specialised stone plaster no earlier than 30 min and no later than 14 days after impression taking. To avoid introducing bubbles into the model, briefly rinse with water and dry. Do not use surfactants as these impair the quality of polyether impres-sions, and are not required! Polyether impressions can be silver-coated, whereas copper-coating is not feasible.

Cleaning
Paste that has not set may be removed with ethanol or by rinsing with water and soap. The adhesive can be removed from metal trays with acetone.

Notes
At temperatures below 18°C, the viscosity of the pastes may increase sufficiently to cause difficulties upon mixing in the device. After keeping the pastes at M18°C for one day the processability is re-established without compromising quality. Direct exposure to sun and moist storage conditions damage the impres-sion. Extremely high or low humidity (>70% or <30%) should be avoided. Polyether impressions should not be exposed to solvent-containing liquids, as this may result in swelling and imprecise modelling. Polyether materials may be combined with other polyether materials, but not with silicone materials.

Incompatibilities
In susceptible individuals, sensitization to the product cannot be excluded. Use of the product should be discontinued if allergic reactions are observed.

Technical Data
Impregum Penta DuoSoft complies with ISO 4823 Type 2, medium consistency.

Strain in compression:	4,0%
Recovery from deformation:	98,5%
Linear dimensional change (after 24 h):	-0,3%

Storage and Stability
Do not store the product above 25°C.
Do not use after the expiry date.
Store impressions dry and below 30°C in the dark.

Impregum Penta H DuoSoft – Impregum Penta L DuoSoft

Product Description
Impregum Penta H and L DuoSoft are high and low consistency polyether impression materials, respectively, to be used with the mixing device, Pentamix. The mixing ratio is 5 volumes base paste:1 volume catalyst.
Due to its lower shore hardness, the impression material is suitable for use with impressions with slight undercuts even without additional blocking out.
The bags are sealed with a PentaMatic sealing cap. The PentaMatic sealing cap automatically opens the bag once sufficient pressure is established by the plunger of the Pentamix.
For details on Pentamix and accessories, Polyether adhesive, Epipak, Elastomer syringe, and Impresept, please refer to the corresponding Instructions for Use.

Areas of Application
Impression of inlay, onlay, crown, and bridge preparations
Functional impressions

Preparation

Impression trays
Rigid non-perforated metal trays or custom plastic trays are suitable.
For sufficient adhesion, apply a thin layer of Polyether adhesive to the tray and allow to dry completely (at least 30-60 sec – test with a finger, 15 min drying time are optimal).

Pentamix/Penta DuoSoft cartridge/poly bag:
Impregum Penta H and L DuoSoft materials in the corresponding designated cartridges only!
Only poly bags equipped with a PentaMatic sealing cap must be used with Penta mixing tips embossed with the colorless “ESPE” logo. Mixing tips embossed with the black “ESPE” logo must not be used.
Discard the first 3 cm of paste extruded from newly filled cartridges prior to the first use for impression taking. The color of the dispensed paste must be uniform.
If a new mixing tip is installed when the cartridge is inserted, check whether the drive shaft is engaged before you start mixing.

Retraction
Areas from which impressions are to be taken should be kept dry.
In subgingival preparations, hemostatic threads or rings may be used. Solutions based on aluminium hydroxide chloride or aluminum sulphate, e.g. Epipak. are suitable retraction agents. Prior to taking the impression, completely remove any residual retraction agent by rinsing and drying.
Retraction with threads or rings containing epinephrine (adrenaline), 8-hydroxyquinoline sulphate or iron (III) sulphate may impair the setting of polyether impression materials.

Dosing and Mixing
Dosing and mixing are performed automatically in the Pentamix device.

Times

Processing time from start of mixing*	min:sec		
Setting time from start of mixing*	min:sec		
Residence time in the mouth**	min:sec		
Impregum Penta H DuoSoft	2:30	6:00	3:30
Impregum Penta L DuoSoft	3:15	6:30	3:15

These are the processing times at 23°C. Higher temperatures shorten, and lower temperatures prolong, total processing times.
* Start of mixing = entry of paste into the mixing cannula.
** For product combinations, longer times are valid.

Impression Taking

Double-mixing technique
For application around the preparation, attach the Penta Elastomer syringe to the Penta mixing cannula of the Pentamix device, and fill with Impregum Penta L DuoSoft. Subsequently, change cartridges and load Impregum Penta H DuoSoft onto the tray previously prepared with adhesive.
While loading the tray, apply the mixture into the sulcus or cavity from bottom up, always keeping the tip of the application nozzle immersed in the material and in contact with the surface of the tooth.
Immediately after application around the preparation, position the loaded tray in the mouth, and hold it there without applying pressure until setting is complete.
Depending on the tray size, initiate application around the preparation once the tray is half-loaded to ensure that the tray can be positioned in the mouth as soon as the application around the preparation is completed. Failing this, the syringe material will set more rapidly than the tray material, leading to distortions of the impression.
To remedy initial adhesion (“setting the valve”), especially with upper jaw impressions, remove the tray from the gingiva on one side in a posterior position. If this proves difficult it may be necessary to carefully blow some air or water between the impression and the gingiva.

Functional Impression
After preparing the custom tray with adhesive, load Impregum Penta H DuoSoft onto the tray, place the tray in the desired location in the mouth, and have the patient perform functional excursions. If required, use Impregum Penta L DuoSoft or ESPE Impregum Garant L DuoSoft for precise impression taking (correction).

Hygiene
Place the impression in a standard disinfectant solution, e.g. Impresept*, for the period of time recommended by the manufacturer, i.e. 10 min in the case of Impresept. Excessive disinfection may damage the impression. After disinfection, rinse the impression under running water for approx. 15 sec.* Impresept is not available in all countries.

Model Preparation
Prepare a cast from the impression with a commercial specialized stone plaster no earlier than 30 min and no later than 14 days after taking the impression. To avoid introducing bubbles into the model, briefly pre-rinse with water, and dry. Do not use surfactants as these impair the quality of polyether impressions, and are not required! Polyether impressions can be silver-coated, whereas copper-coating is not feasible.

Cleaning
Paste that has not set may be removed with ethanol or by rinsing with water and soap. The adhesive can be removed from metal trays with acetone.

Notes
At temperatures below 18°C, the viscosity of the pastes may increase sufficiently to make mixing in the device difficult. After keeping the pastes at 18°C for at least one day the processability is re-established without compromising quality.
Direct exposure to sun and moist storage conditions damage the impression. Extremely high or low humidity (>70% or <30%) should be avoided.
Polyether impressions should not be exposed to solvent-containing liquids, as this may result in swelling and imprecise modelling.
Polyether materials may be combined with other polyether materials, but not with silicone materials.

Incompatibilities
In susceptible individuals, sensitization to the product cannot be excluded. Use of the product should be discontinued if allergic reactions are observed.

Technical Data
Impregum Penta DuoSoft complies with ISO 4823 Type 1, high consistency, or Type 3, low consistency.

	high consistency	low consistency
Strain in compression:	3.1%	3.3%
Recovery from deformation:	98.4%	98.9%
Linear dimensional change (after 24 h):	-0.2%	-0.3%

Storage and Stability
Do not store the product above 25°C.
Do not use after the expiry date.
Store impressions dry and below 30°C in the dark.

Impregum Garant L DuoSoft

Product Description
Impregum Garant L DuoSoft is a low consistency polyether impression material supplied in the Garant 2 cartridge. The mixing ratio is 2 volumes base paste:1 volume catalyst. Due to its lower Shore hardness, the impression material is suitable for use with impressions with slight undercuts even without additional blocking out.
For details on Garant 2 Dispenser, Polyether adhesive,
Epipak and Impresept, please refer to the corresponding Instructions for Use.

Areas of Application
Impression of inlay, onlay, crown, and bridge preparations
Functional impressions

Preparation
Garant 2 dispenser/cartridge:
Upon use of a new cartridge and with each new mixing process, start without attaching the mixing tip by extruding a small quantity of paste until both components emerge uniformly. Remove clogged paste, if necessary. Subsequently, install the ESPE Garant 2 Mixing Tip White and ESPE Garant 2 application tips white.

Impression trays
Rigid non-perforated metal trays or custom plastic trays are suitable.
For sufficient adhesion, apply a thin layer of Polyether adhesive to the tray and allow to dry completely (at least 30-60 sec - test with a finger, 15 min drying time are optimal).

Retraction
Areas from which impressions are to be taken should be kept dry.
In subgingival preparations, hemostatic threads or rings may be used. Solutions based on aluminum hydroxide chloride or aluminum sulphate, e.g. Epipak, are suitable retraction agents. Prior to taking the impression, completely remove any residual retraction agent by rinsing and drying. Retraction with threads or rings containing epinephrine (adrenaline), 8-hydroxyquinoline sulphate or iron (III) sulphate may impair the setting of polyether impression materials.

Times

Processing time from start of mixing*	min:sec		
Setting time from start of mixing*	min:sec		
Residence time in the mouth**	min:sec		
Impregum Garant L DuoSoft	2:00	5:30	3:30
Impregum Penta H DuoSoft	2:30	6:00	3:30

These are the processing times at 23°C. Higher temperatures shorten, and lower temperatures prolong, total processing times.
* Start of mixing = entry of paste into the mixing cannula.
** For product combinations, longer times are valid.

Impression Taking

Double-mixing technique
Load the selected material onto the impression tray according to the corresponding manufacturer instructions. At the same or a later time, apply Impregum Garant L DuoSoft around the dry preparation from bottom up, keeping the tip of the application tip immersed in the material at all times, and in contact with the surface of the tooth.
Without delay, place the loaded tray in the mouth and hold it in place without applying pressure until setting is complete. If required, fill a separate Elastomer syringe directly from the mixing tip without attaching the application tip.
To remedy initial adhesion ("setting the valve"), especially with upper jaw impressions, remove the tray from the gingiva on one side in a posterior position. If this proves difficult it may be necessary to carefully blow some air or water between the impression and the gingiva.

Functional impression
After taking a functional impression with a high or medium consistency polyether material, use Impregum Garant L DuoSoft for precise impression taking (correction).

Hygiene
Place the impression in a standard disinfectant solution, e.g. Impresept*, for the period of time recommended by the manufacturer, i.e. 10 min in the case of Impresept. Excessive disinfection may damage the impression. After disinfection, rinse the impression under running water for approx. 15 sec.
* Impresept is not available in all countries.

Model Preparation
Prepare a cast from the impression with a commercial specialized stone plaster no earlier than 30 min and no later than 14 days after taking the impression. To avoid introducing bubbles into the model, briefly pre-rinse with water, and dry. Do not use surfactants as these are dispensable and impair the quality of polyether impressions! Polyether impressions can be silver-coated, whereas copper-coating is not feasible.

Cleaning
Paste that has not properly set may be removed with ethanol or by rinsing with water and soap. The adhesive can be removed from metal trays with acetone.

Notes
Turning or reattaching the mixing cannula without subsequent impression taking may lead to carry-over of paste and clogging.
At storage temperatures below 12°C, the pastes may contract such that precise dosing cannot be guaranteed even at room temperature.
Direct exposure to sun and moist storage conditions may damage the impression.
Extremely high or low humidity (>70% or <30%) should be avoided.
Polyether impressions should not be exposed to solvent-containing liquids, as this may result in swelling and imprecise modelling.
Polyether materials may be combined with other polyether materials, but not with silicone materials.

Incompatibilities
In susceptible individuals, sensitization to the product cannot be excluded. Use of the product should be discontinued if allergic reactions are observed.

Technical Data
Impregum Garant L DuoSoft complies with ISO 4823 Type 3, low consistency.

Strain in compression:	5.7%
Recovery from deformation:	98.6%
Linear dimensional change (after 24 h):	- 0.3%

Storage and Stability
Store the product at 12-25°C. Do not refrigerate!
Do not use after the expiration date.
Store impressions dry and below 30°C in the dark.

Tips and Tricks

Removing the impression from the mouth	• either loosen with a finger at the edge of the impression to allow air underneath the impression to overcome the lower pressure • or carefully force air or water between the impression and the teeth with an air syringe.
Casting of the impression	The impression should not be filled with plaster until at least 30 mins after removal.
Further improvement in removing plaster casts from the impression	Moisten the impression before pouring in the plaster mixture. All areas not containing model information can be covered with paraffin or vaseline.
Removing the model from the impression	Warm the tray in a wax boiling unit or on a radiator. A max. temperature of 40 - 45°C must not be exceeded.
Removing the impression from the tray	Immerse the tray briefly in hot water at a temperature of 60 – 70°C

Summary

Impregum Soft are polyether impression materials for precision impressions. They fulfil all the demands made on a modern impression material.
The Impregum Soft product range shows the following characteristics:

- easier to remove due to reduced final hardness
- improved taste
- hydrophilic behaviour before (initial hydrophilicity) and after setting, even after disinfection
- accurate reproduction of detail and dimensional stability
- intrinsic viscosity
- good flowability to crevices
- good recovery after deformation
- precise setting behaviour (snap set)
- wide range of indications

The Impregum Soft product range combines all the good qualities of polyether impression materials and the highest level of convenience for dentists, patients and dental technicians and offers ideal conditions for clinical success.

References

[1] Anusavice K. J.,
"Phillips‘ Science of Dental Materials", 10th Edition, W. B. Saunders, Philadelphia, 1996.

[2] Hembree H., Andrews J. T.,
"Accuracy of a polyether impression material", Ark Dent J, 47, 10-1, 06/1974.

[3] Meiners H., Lehmann K. M.,
"Klinische Materialkunde für Zahnärzte", Carl Hanser Verlag, München Wien, 1998.

[4] Peutzfeldt A., Asmussen E.,
"Effect of disinfecting solutions on accuracy of alginate and elastomeric impressions", Scand J Dent Res 97, 470-475, 1989.

[5] Meiners H., Rohring R.,
"Kompatibilität des Desinfektionsmittels Impresept mit Abformmassen", dental-labor, XXXVIII, Heft 9, 1223-1224, 1990.

[6] Stoll R., Segschneider F., Stachniss V., Jürgensen R.,
"Zur Formhaltigkeit hydrophiler Abformmaterialien nach Behandlung mit einem Desinfektionsmittel", Dtsch Zahnärztl Z 46, 718-721, 1991.

[7] Kern M., Rathmer R. M., Strub J. R.,
"Three-dimensional investigations of the accuracy of impression materials after dis-infection", J Prosthet Dent 70, 449-456, 1993.

[8] Lepe X., Johnson G. H.,
"Accuracy of polyether and addition silicon after long-term immersion disinfection", J Proth Dent 78, 245-249, 1997.

[9] Espe Dental AG (Hrsg.),
"Precision Impression – A Guideline for Theory and Practice", 62, 1999.

[10] Phillips K., Lepe X., AW T. C., Johnson G. H.,
"Accuracy of Impregum Penta and Impregum Penta Soft with Disinfection", IADR #3875, 04/2000.

[11] McCabe J. F., Arikawa H.,
"Rheological Properties of Elastomeric Impression Materials Before and During Setting", J Dent Res 77(11), 1874-1880, 11/1998.

[11a] McCabe J. F., Carrick T. E.,
"Rheological Properties of Elastomers during Setting", J Dent Res 68(8), 1218-1222, 1998.

[11b] McCabe J. F., Arikawa H.,
"Rheological Properties of Elastomeric Impression Materials Before and During Setting", J Dent Res 77(11), 1874-1880, 1998.

[12] Dunne J. T., Zech J.,
"Investigations on the Force Required for Removal of Polyether Impressions", IADR #2436, 04/2000.

[13] Mondon M, Ziegler Ch., Reusch B.,
"Surface Wettability during the Curing Process of Impression Materials", AADR, #618, 2001.

[14] Langenwalter E. M., Aquilino S. A., Turner K. A.,
"The dimensional stability of elastomeric impression materials following disinfection", J Prosth Dent 63,270-276, 1990.

[15] Phillips K., Aw T. C., Johnson G. H.,
"Accuracy of Three Monophase Impression Materials with Immersion Disinfection", AADR, #1678, 2001.

[16] Lammert U., Nave S., Wöstmann B.,
"A comparative study of two new polyether impression materials", AADR, #972, 2001.

[17] Jia W., Sorensen J. A.,
"Wet Detail Reproduction And Dynamic Contact Angle Of Impression Materials", AADR, #1679, 2001.

[18] Kim M.S., Doherty E. H., Kugel G.,
"Flow Under Pressure of Four Impression Materials Using Shark-Fin Device", AADR, #624, 2001.

Technical Data Sheet

Tab. 6:
Physico-technical data of Impregum Penta Soft

Properties	Limit	Impregum Penta Soft	Impregum Penta
DIN EN 24823 (Typ 2) ISO 4823 (Typ 2) Total working time* [min:sec]	> 1:30	2:40	3:00
Viscosity [mm]	31-39	35	34
Recovery after deformation [%]	96,5 - 100	98,4	98,5
Deformation under pressure [%]	2,0 -20	4,4	3,2
Linear change of size [%]	< - 1,5	- 0,4	- 0,3
Compatibility with plaster Line [mm] (visibility of line)	0,020	fulfilled	fulfilled
Accuracy of detail [mm] (visibility of line)	0,020	fulfilled	fulfilled
DIN 53 505: Shore A hardness after:			
15 min	---	40	46
1 h	---	47	55
24 h	---	50	61
Internal Tests			
Flowability to the crevices	---	27	21
Contact angle [°]			
after 10 sec	---	56	48
after 3 min	---	43	31

* = ISO test data for the total working time can differ from actual working time in practice, which explains any possible differences in instructions for use.

Times

	Working time incl. mixing* [min:sec]	Setting time (from begin of mix)* [min:sec]	Residence time in mouth [min:sec]
Impregum Penta Soft	02:45	06:00	03:15
Impregum Penta	02:45	06:00	03:15

* Start of mixing = entry of paste into the mixing tip.

At a room temperature of 23° C, the following preparation times will be available. Higher temperatures will reduce the working time; lower temperatures will increase the working time.

Properties	Limit	Impregum Penta H DuoSoft	Impregum Penta L DuoSoft	Impregum Garant L DuoSoft
DIN EN 24823 (Type 2) ISO 4823 (Type 2) Total working time* [min:sec]		2:15	3:00	3:00
Viscosity [mm]		33	39	40
Recovery after deformation [%]	96,5 - 100	98,5	99,0	98,6
Deformation under pressure [%]		2,8	3,3	5,7
Linear change of size [%]	< - 1,5	- 0,3	- 0,4	- 0,4
Compatibility with plaster Line [mm] (visibility of line)		fulfilled	fulfilled	fulfilled
Accuracy of detail Line [mm] (visibility of line)		fulfilled	fulfilled	fulfilled
DIN 53 505: Shore A hardness after:				
15 min	---	43	46	35
1 h	---	48	51	47
24 h	---	49	52	48
Internal Tests Flowability to the crevices	---	16	27	27

* = ISO test data for the total working time can differ from actual working time in practice, which explains any possible differences in instructions for use.

Times

	Working time incl. mixing* [min:sec]	Setting time (from begin of mix)** [min:sec]	Residence time in mouth [min:sec]
Impregum Penta H DuoSoft	02:30	06:00	03:30
Impregum Penta L DuoSoft	03:15	06:30	03:15
Impregum Garant L DuoSoft	02:00	05:30	03:30

* Start of mixing = entry of paste into the mixing tip.
** For product combinations, longer times are valid.
At a room temperature of 23° C, the following preparation times will be available. Higher temperatures will reduce the working time; lower temperatures will increase the working time.

Properties	Impregum Soft heavy body	Impregum Soft medium body	Impregum Soft light body
DIN EN 24823 ISO 4823-00 Total working time* [min:sec]	03:00	3:00	3:15
Consistency [mm]	35	35	39
Recovery from deformation [%]	98,8	98,7	98,5
Strain in compression [%]	4,3	3,4	4,1
Linear dimensional change [%]	-0,4	- 0,3	- 0,4
Compatibility with gypsum [mm] (visibility of line)	fulfilled	fulfilled	fulfilled
Detail reproduction Line [mm] (visibility of line)	fulfilled	fulfilled	fulfilled
DIN 53 505: Shore A hardness after:			
15 min	39	41	45
1 h	46	48	51
24 h	49	49	52
Internal Tests Shark fin test	18	21	28

* = ISO test data for the total working time can differ from actual working time in practice, which explains any possible differences in instructions for use.

Times

	Working time incl. mixing* [min:sec]	Setting time (from begin of mix)** [min:sec]	Residence time in mouth [min:sec]
Impregum Soft heavy body	02:30	05:30	03:30
Impregum Soft medium body	02:30	06:00	03:15
Impregum Soft light body	03:00	06:00	03:00

* Start of mixing = entry of paste into the mixing tip.
** For product combinations, longer times are valid.
At a room temperature of 23° C, the following preparation times will be available. Higher temperatures will reduce the working time; lower temperatures will increase the working time.

3M ESPE

3M ESPE AG · ESPE Platz · 82229 Seefeld · Germany
E-Mail: info3mespe@mmm.com · Internet: http://www.3mespe.com

70200951583/01(09.02)