3M ESPE

Espertise™

3M ESPE SCIENTIFIC FACTS

Impregum™ Penta™ Soft Quick Step

Polyether Impression Material

A New Generation of Polyethers from 3M ESPE: Faster Impressions with Maximum Precision and Convenience

Technical Data Sheet

Introduction

■ Introduced in the mid-1960s, polyethers have since become indispensable for impression taking. The precision provided by these materials is well respected. At the heart of polyether impression materials is a series of key attributes – intrinsic hydrophilicity, unique rheology, as well as a snap setting behavior. Through a continuous innovation process, polyethers have become significantly easier to handle. Automatic mixing in the 3M™ ESPE™ Pentamix™ unit provides for exactly dosed material that is homogeneous and void free. With the launch of the Impregum Penta Soft product line in 2000, major improvements have been achieved with respect to removal and taste.

With the launch of the Impregum Soft Quick Step line, 3M ESPE is answering the market demand for a fast-setting polyether impression material, especially suited for one and two unit cases.

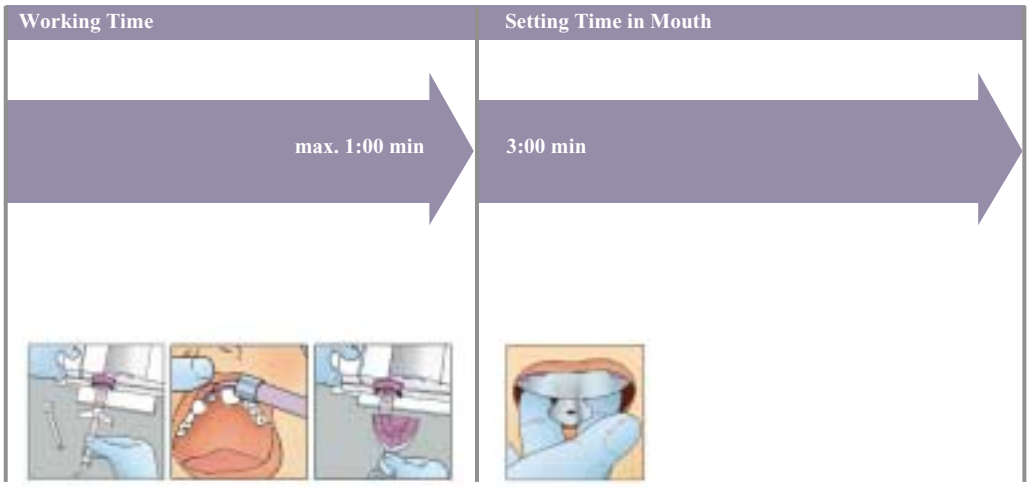
Overview over the NEW Generation Polyether Soft Impression Materials

Impression Technique	Normal setting Best suited for multiple unit cases	Fast setting Best suited for one and two unit cases
Monophase	Impregum Penta Soft MB	Impregum Penta Soft Quick Step MB
One-step two-viscosities	Impregum Penta Soft HB + Impregum Garant Soft LB	Impregum Penta Soft Quick Step HB + Impregum Soft Quick Step LB

Indications

Product	Indications
Impregum Penta Soft Quick Step MB	• Impressions of inlay, onlay, veneer, crown and bridge preparations • Fixation and implant impressions Best suited for impressions of 1-2 unit cases
Impregum Penta Soft Quick Step HB **Impregum Soft Quick Step LB**	• Impressions of inlay, onlay, veneer, crown and bridge preparations • Fixation and implant impressions Best suited for impressions of 1-2 unit cases

Reduced Working and Setting Times with Impregum Soft Quick Step Materials



■ The new Impregum™ Soft Quick Step from 3M ESPE products have a maximum working time of 1 minute and a setting time in the mouth of 3 minutes. For those who previously used 3M ESPE polyether materials, this results in considerable time savings of at least one-third.

Composition

■ The following table provides an overview of the qualitative composition of the fast-setting 3M ESPE polyether materials:

Base	**Catalyst**
Polyether macromonomer	Initiator (cationic polymerization initiator)
Fillers	Fillers
Plasticizer (high and low viscosity)	Plasticizer
Pigments	Pigments
Peppermint Flavorings	
Triglycerides	
Accelerators	

The composition differs from the Impregum™ Soft products from 3M ESPE primarily in the accelerator components. The effective formula, which ensures easier removal and better taste, than earlier generation polyethers remains the same.

Initial Clinical Results: Internal 3M ESPE Application Test

The Impregum Soft Quick Step products were used by 67 dentists in the United States, Germany, Switzerland, France, Italy and the United Kingdom as part of a 2-months clinical application program.

During the test period, the dentists produced a total of 1330 precision impressions; of these, 664 were taken with Impregum Penta Soft Quick Step MB and 660 with Impregum Penta Soft Quick Step HB / Impregum Soft Quick Step LB. Both materials were primarily used to produce impressions for full crown, inlay/onlay implant and bridge restorations.

The new polyether materials received very favorable clinical ratings from the dentists. They offer the same high level of quality as the earlier 3M ESPE polyether materials, but with the added significant benefit of setting quickly.

In particular, the detail reproduction of the impressions and the optimal fit of the completed restorations are worth noting. With respect to these two criteria, 97% of all impressions were rated excellent or good.

Impregum Penta Soft Quick Step products are suitable for use with all standard tray types, both metal and plastic varieties.

The dentists would use the new materials in the future for approximately one half to two thirds of their polyether impressions (and the existing polyether materials for one third to one half), primarily for small clinical cases preferably for 1 – 2, but with up to 3 preparation units.

Clinically Relevant Characteristics

Discussion

Impression materials have to meet exacting requirements in order to reproduce preparations in the moist environment within the mouth with precision and true to dimension.

The key material properties include:

- ○ Hydrophilic behavior prior to setting
- ○ Excellent rheological properties/flow behavior throughout the working time
- ○ Clinically comfortable setting behaviour
- ○ Dimensional accuracy

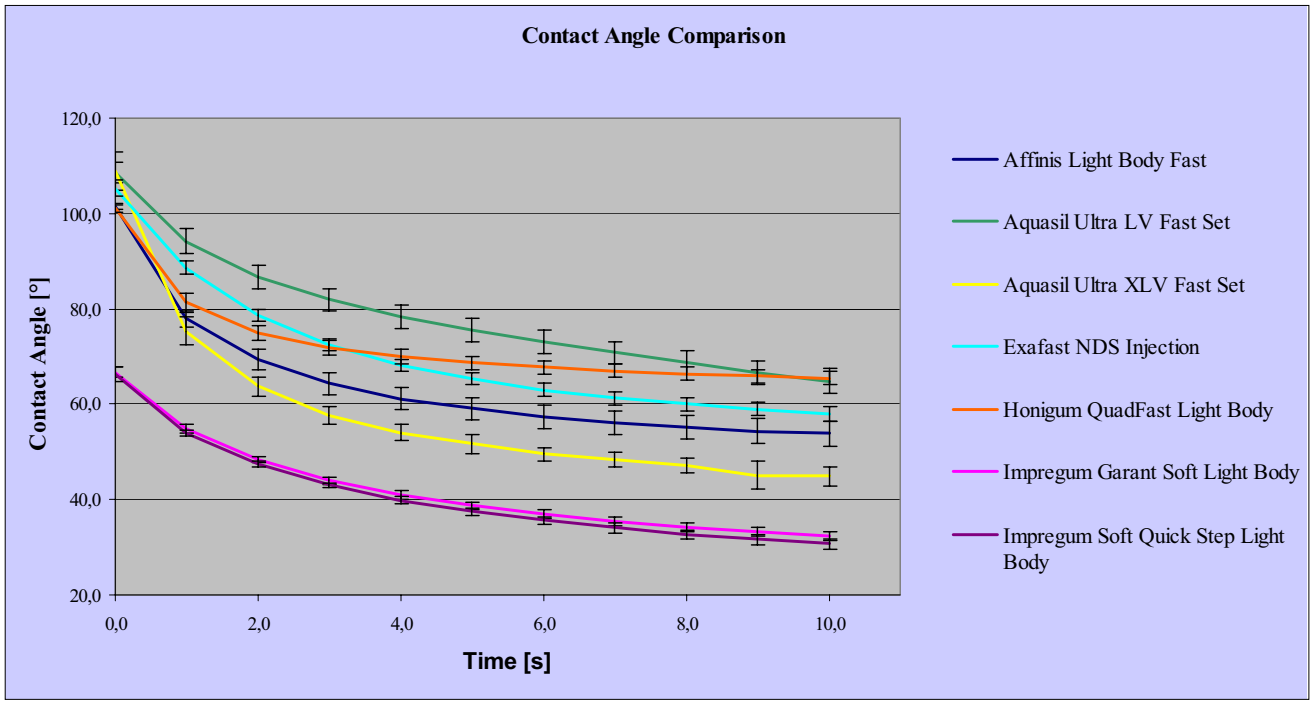
These parameters will be discussed in the following sections.

I. Hydrophilicity – Clinically Relevant During Syringing

The hydrophilicity of an impression material contributes significantly to the precision and reproduction of detail. Most of the materials available on the market today are labelled hydrophilic. However, they are subject to considerable, highly relevant clinical differences:

3M ESPE polyether materials are hydrophilic by the nature of their chemical makeup. This ensures that from the time the polyether is mixed until it sets, it is characterized by its tendency to favour moist surfaces, such as a preparation, and achieve precise reproductions. This is also known as intrinsic hydrophilicity.
By contrast, silicone impression materials, which are intrinsically hydrophobic, have to be made hydrophilic by adding surfactants, which are surface-active additives. This has several disadvantages. For one, when a impression material with surfactant comes into contact with moisture, the surfactant has to “migrate” to the surface. This prevents the hyrophilicity from fully developing at the very first contact with moisture. However, hydrophilicity is necessary when the material flows, e.g. while syringing or when seating the tray. At this very moment new surface of impression material is generated which is in contact with saliva. This is the point in time when hydrophilicity is needed for clinical success.

A frequently used method to determine the hydrophilicity is the contact angle measurement. This is very easy to do and widely used on impression materials after they have set. But – is a measurement of the set material really clinically relevant? As outlined before, hydrophilicity is most important during syringing and seating the tray. Therefore in recent studies [2, 3, 4] contact angles were conducted on impression materials in the unset stage, i.e. during the working time. Latest results are illustrated in the following diagram. [10]



During the working time at 45 seconds after start of mixing, a drop of water was placed on the impression material, and the contact angle of the drop was measured. The data is shown in one second increments.

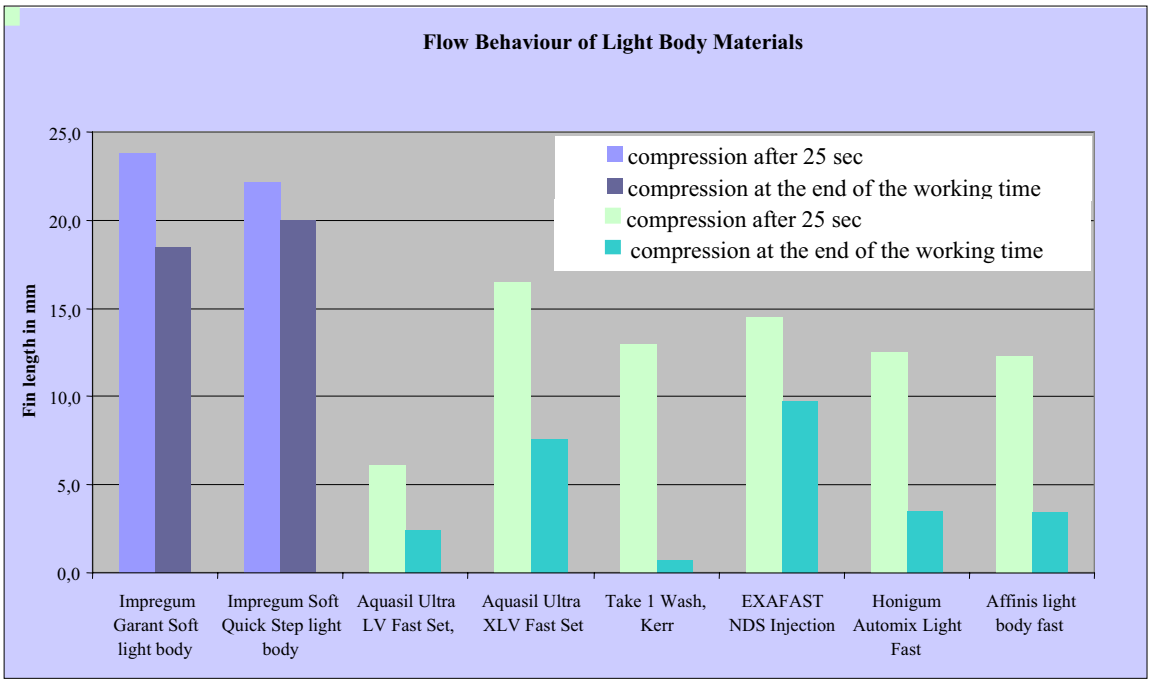
For the entire observation period, the Impregum™ Garant™ Soft Light Body and Impregum Soft Quick Step Light Body polyether materials from 3M ESPE exhibited significantly lower contact angles, and thus significantly higher hydrophilicity in the unset stage than all silicone materials that were measured. It is important to point out the initial hydrophilicity – the hydrophilicity at 0 seconds (first contact of water with material). At this point in time the initial contact angle of the Polyether materials is more than 30 degrees lower than those obtained for VPS materials. The results clearly reflect the chemical differences and support recent studies by Mondon, Rupp, Geis-Gerstdörfer et al. [2, 3, 4] and Walker et al. [7]. This might result into better clinical performance in the presence of moisture.

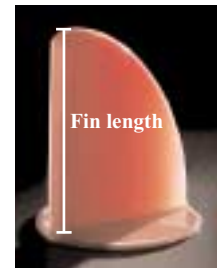
II. Flow Properties – Clinically Relevant During Entire Working Time

In addition to hydrophilicity, impression materials also require special rheological properties in order to ensure optimal wetting of the preparation surface areas after syringing around the preparations. The syringed impression material is pushed into the critical areas by the compression exerted by the tray material when the tray is inserted. With the exception of the two step putty wash technique, the applied compression is very low, especially in case of a deep sulcus or undercut areas, or when using techniques such as the dual arch technique.

For a study to be clinically relevant, the point in time when the flow properties are analysed also has to be considered. For example, a light or medium body material is applied to the preparation at the beginning of the working time, but the material is finally placed around the preparation at the end of the working time when the tray is seated.

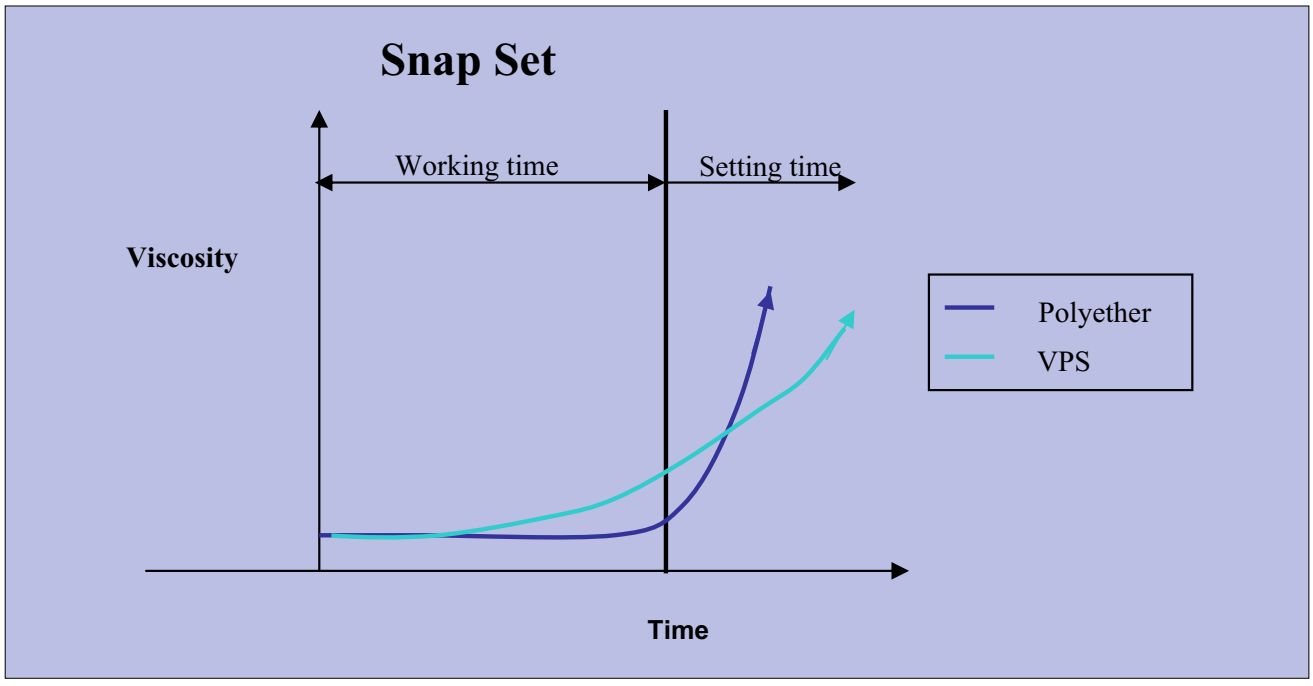
A sophisticated method for analysing flow properties is the Shark Fin test. [8]. To simulate more clinically relevant compression, the test was altered by reducing the weight of the device. Two test series were carried out for each material: Compression was applied 25 seconds after mixing begins (Test 1) and at the end of the working time indicated by the manufacture. The results of the study involving seven light body precision impression materials are illustrated in the following graph [9].





Both polyether impression materials exhibit significantly better flow properties than the VPS materials, at the beginning as well as at the end of the working time. It is also important to note that the flow properties of the polyether materials remain comparatively throughout the working period.

This can be explained with the snap-set behaviour, which is typical for polyether impression materials, they offer a characteristic profile which is particularly suitable for clinical use. This is shown in the following graph:



The brief transition between working time and setting, which is typical for polyether, is referred to as Snap Set.

III. Reproduction of Detail – Clinically Relevant Conditions

Numerous studies were able to demonstrate that polyether materials achieve a particularly good reproduction of details, especially under clinically relevant moist conditions. [5, 6, 7]

Not only in clinical dentistry, but also in scientific research inside and outside the dental field, polyether is usually preferred over silicone to produce models with optimal reproduction of detail. For instance, polyether materials are most often used for the replica technique. [12 – 15]. Alternatively, SEM evaluations can be done by investigating polyether impressions directly. [6]

Physical / Technical Data [11]

Property		Impregum Penta Soft Quick Step medium body	Impregum Penta Soft medium body	Impregum Penta	Aquasil Ultra Monophase
Consistency A+B (ISO 4823:2000)	mm	36	36	36	37
Reproduction of detail (ISO 4823:2000)	-	fulfilled	fulfilled	fulfilled	fulfilled
Linear dimensional change after 24 hrs. (ISO 4823:2000)	%	-0,4	-0,4	-0,3	-0,4
Compatibility with dental gypsum (ISO 4823:2000)	-	fulfilled	fulfilled	fulfilled	fulfilled
Recovery from deformation (ISO 4823:2000)	%	> 98	> 98 *	> 98 *	> 98
Deformation under pressure (ISO 4823:2000)	%	2,6	5,2 *	2,9 *	4,9
Shore A after 24 hrs. (DIN 53505)	-	53-57	47-52	58-61	61
Tear strength (DIN 53504)	MPa	2,3 ± 0,2	1,8 ± 0,2	2,5 ± 0,2	4,2 ± 0,4
Elongation (DIN 53504)	%	330 ± 25	300 ± 55	253 ± 21	285 ± 28

* clinical typical times: working time 2:00
intraoral setting time 4:00

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