Imprint™ 3

VPS Impression Material

Technical Product Profile

3M ESPE

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Introduction

3M ESPE is the worldwide leader in impression materials, and is renowned for its ongoing innovations in this market segment. Since the introduction of its first impression material more than 40 years ago, 3M ESPE has continuously improved and expanded its portfolio of VPS and polyether impression materials to serve virtually all customer needs and impression indications, techniques and delivery choices.

With Imprint™ 3 VPS Impression Material, the next generation of innovative VPS impression materials is now available to dental professionals. The Imprint 3 product line consists of several new precision impression materials:

Three tray materials delivered in the Pentamix™ Automatic Mixing Unit are available — a real putty material (ISO 4823 type 0) and two heavy body consistencies in regular set and fast set. The heavy body consistencies are also available in the hand-held Garant™ Dispenser. The Imprint 3 impression product line also includes wash materials in three different consistencies — a light body, a somewhat thicker regular body and an even thicker ultra-regular body. These consistencies are available in regular set and fast set. A monophase, medium-bodied material delivered in the Garant dispenser, Imprint 3 VPS monophase material, completes the new portfolio.

The Imprint 3 impression materials are suitable for all types of precision impressions. They set the stage for uncompromising impression accuracy and quality, the prerequisites for excellent fitting restorations.

Imprint 3 impression materials offer all of the features a state-of-the-art precision impression material needs to precisely capture the preparation margins. Imprint 3 impression material is very hydrophilic, and offers excellent flowability to the tooth and gingiva while retaining the drop resistance dentists expect from the Imprint brand. When developing this state-of-the-art impression material, 3M ESPE put special focus on minimizing the risk of distortion upon mouth removal — a potential source of poor fitting restorations. Imprint 3 impression materials withstand the stretching and compressive forces an impression is exposed to upon removal from the mouth better than other leading VPS impression materials. Imprint 3 impression material has a high stretching potential and a high tensile strength for greater toughness to resist tearing. And, it recovers nearly 100% after stretching and compression.

These features result in Imprint 3 impression material offering the best balance of clinically relevant properties among leading brands — providing the ideal foundation for obtaining precise impressions and less potential for distortion upon mouth removal along with the best potential for accurate fitting restorations — the first time.

With the Imprint™ 3 Penta™ Putty Impression Material, dentists who preferred putty type tray materials in the past for their impression taking — typically mixed by hand — can now benefit from the advantages of the Pentamix mixing unit delivery system. Automatic dosing and mixing, homogeneity of the mix, and the absence of voids, allow you to enjoy the convenience of automatic mixing with out forfeiting the feel and characteristics of hand-mixed putty. Imprint 3 Penta putty offers characteristics like: controlled resistance when inserting the tray, and the ability to shape the mixed putty in the tray with your fingers or an instrument. Also, due to the extrusion force and dynamic mixing, the putty is warmed when extruded into the tray, which will accelerate the setting time of the wash material when combined with the putty.

History of Precision Impression Materials

The first impression methods using wax, plaster and zinc oxide eugenol pastes were succeeded by true precision impression materials some 80 years ago (1925) with the introduction of hydrocolloids (see Fig.1) Today hydrocolloids are still used to some extent when taking precision impressions, although their popularity is in decline. On the other hand, the polysulphides, which were introduced 25 years later (1950), have almost lost their importance for precision impressions today.

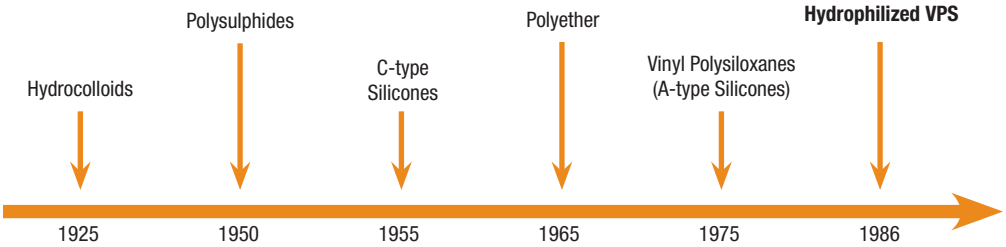


Fig. 1: History of precision impression materials.

In the mid 1950s, a class of material that was not originally intended for intraoral use first made its appearance in the world of dentistry: C-silicones (condensation-cured). The main disadvantages of these products were, and still are, their hydrophobicity, and their intrinsic shrinkage as condensation-curing involves the release of a volatile by-product.

A decade later, in 1965, the polyether was introduced by ESPE (today 3M ESPE). This is an addition-cured intrinsic hydrophilic impression material that is vastly superior to hydrocolloids and C-silicones in terms of its mechanical properties (e.g., tear strength). Furthermore, 3M ESPE polyether impression materials have virtually no shrinkage as an addition-curing mechanism does not release volatile by-products, and their first-class hydrophilicity is well established.

Another 10 years later, in 1975, the first vinyl polysiloxanes (VPS) were used as impression materials. Because these materials were addition-cured, volatile by-products were not released. However, they were still hydrophobic due to their chemical nature. In 1986, a new composition material was introduced that reduced the hydrophobicity intrinsic to the material's molecular structure. The addition of hydrophilizers (surfactants) results in an increase in hydrophilicity of the mixed material with time. Since then, the development of more effective surfactants and the possibility to increase the concentrations of surfactants in the VPS formulations led to an increase in VPS wettability in recent years.

Development of Automatic Application Systems for 3M™ ESPE™ Impression Materials

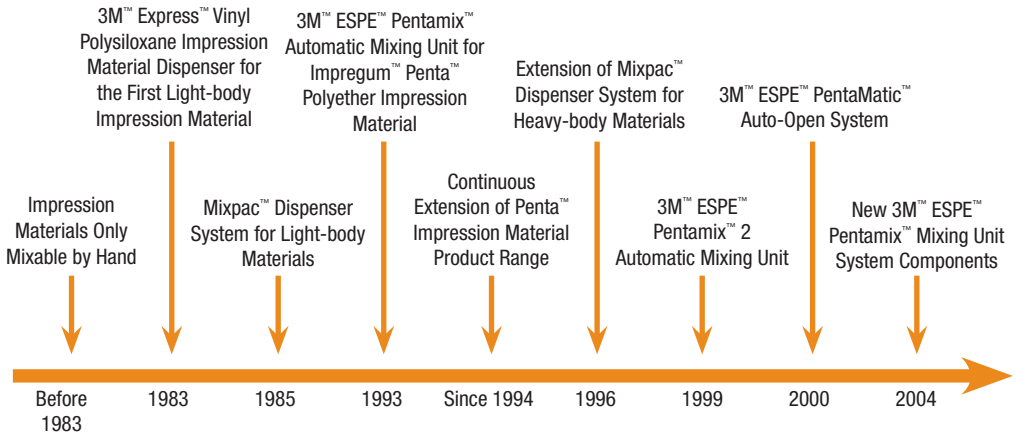


Fig. 2: Development of automatic application systems for 3M™ ESPE™ Impression Materials.

The world's first application system for the automatic mixing of impression materials was launched by 3M (today 3M ESPE) in 1983 in the form of the 3M™ Express™ Dispenser for the first Express™ Light-Body Impression Material (Fig. 2). Two years later, in 1985, the introduction of the Mixpac™ Dispenser System (produced by ConProTec, Inc.), enabled automatic mixing of other light-body materials.

With the launch of the Pentamix™ Automatic Mixing Unit in 1993, 3M ESPE set a further milestone in the history of automatic mixing systems, bringing about a revolutionary change in automatic dispensing for the impression procedure in dental offices. The development of Penta™ Products for delivery in the Pentamix mixing unit started with Impregum™ Penta™ Polyether Impression Material. In the following years the Penta impression material product range was continuously extended.

In 1996, the Mixpac dispenser system was extended to include heavy-body materials. 1999 saw the introduction of the 3M™ ESPE™ Pentamix™ 2 Automatic Mixing Unit, catering to the wish of many practitioners for a faster unit. A year later, in 2000, this was followed by the launch of the PentaMatic™ Auto-Open System, an automatic opening mechanism for the foil bags.

The introduction of three new Pentamix mixing unit system components in 2004 has allowed the Penta product range to be expanded to include the putty material segment. Imprint™ 3 Penta™ Putty Impression Material is the first 3M ESPE putty available for delivery using the Pentamix mixing unit.

Motivation Behind the Development of Imprint™ 3 Impression Material

While there are several reasons why a final restoration does not fit when inserted in the patient's mouth, the precision of an impression plays a key role — it has to provide an exact copy of the intraoral situation taken under any clinical condition. The large number of bad fitting restorations show this key requirement for clinical success can be improved upon.

In order to make impression taking more reliable, developments of VPS impression materials in recent years has mainly focused on the improvement of two parameters:

- an increase in hydrophilicity
- an increase in tear strength

Clinically, high hydrophilicity results in better wettability of the tooth surfaces, and improved performance in a moist environment. A high tear strength reduces the risk that the impression material tears upon removal.

Also, the impression material has to withstand all the forces (mainly stretching and compression) it is exposed to upon removal from mouth. Otherwise the impression will experience a permanent deformation, called distortion. Distortions are a common source for bad fitting restorations, and are not always visible until the finished restoration is completed and ready for final seating.

When developing Imprint™ 3 VPS Impression Materials, special focus has been put on creating a material that is less prone to distortions. This has been achieved by a new chemical formulation including a new network former that enables a strongly increased crosslinking density. The result is an elastomer with a special property profile, which includes:

- high stretching potential → allows the set impression to be removed from the sulcus in the presence of undercuts
- high toughness: the ability to absorb a high amount of energy before tearing → strongly reduces the risk of tear-offs
- > 99.8% recovery after stretching and compression forces → prevents permanent deformation (distortion)

Additionally, the Imprint 3 impression materials offer all the other important features a state-of-the-art precision impression material must have — a very high hydrophilicity and excellent flow characteristics.

All these features taken together make Imprint 3 VPS an impression material with the best balance of overall relevant properties among leading brands.

Many Imprint 3 impression materials can be used in the Pentamix™ Automatic Mixing Unit — enabling easy, push-button mixing and dispensing of a homogeneous void-free material. Now, with Imprint™ 3 Penta™ Putty, dentists who prefer to use putty for impressioning can take advantage of the benefits of the Pentamix mixing unit. Due to their very high viscosity, these materials have been traditionally mixed by hand, potentially incurring the associated disadvantages such as non-homogeneity, contamination and the presence of voids in the mix.

Imprint™ 3 VPS Impression Materials Working and Setting Times

Product	Color	Viscosity (low – high)	Working Time at 23°C/74°F min:sec	Intraoral Syringe Time min:sec	Intraoral Setting Time min:sec
Quick Setting					
Imprint™ 3 Penta™ Quick Step Heavy Body			1:15		2:30
Imprint 3 Quick Step Heavy Body			1:15		2:30
Imprint 3 Quick Step Ultra-Regular Body			1:30	0:40	2:30
Imprint 3 Quick Step Regular Body			1:30	0:40	2:30
Imprint 3 Quick Step Light Body			1:30	0:40	2:30
Regular Setting					
Imprint 3 Penta Putty			1:30		3:00
Imprint 3 Penta Heavy Body			2:00		3:30
Imprint 3 Heavy Body			2:00		4:00
Imprint 3 Monophase (Medium Body)			1:00		4:00
Imprint 3 Ultra-Regular Body			2:00	1:00	3:30*
Imprint 3 Regular Body			2:00	1:00	3:30*
Imprint 3 Light Body			2:00	1:00	3:30*

*Intraoral setting time is 3:00 min. when used in combination with Imprint 3 Penta Putty.

Indications

All dual-phase impressions, e.g. crown, bridge, inlay and onlay preparations, implant abutments, orthodontic impressions and related impressions such as a matrix for provisional restorations, tooth reduction guides, study models and bleaching trays.

The quick-setting products are especially suited for single-unit and two-unit impressions.

Overview of Imprint™ 3 VPS Impression Material Product Characteristics

Product Composition

Components

The following tables provide an overview of the qualitative composition of the Imprint™ 3 Penta™ Putty, Imprint™ 3 Heavy Body and Imprint™ 3 Wash Materials.

Imprint™ 3 Penta™ Putty

Base	Catalyst
Silane-treated quartz silica	Silicate fillers
Vinyl polydimethylsiloxane	Vinyl polydimethylsiloxane
White mineral oil	White mineral oil
Dimethyl methyl hydrogen polysiloxane	Platinum catalyst
Pigments	

Imprint™ 3 Heavy Body Materials

Base	Catalyst
Silane-treated quartz silica	Silicate fillers
Vinyl polydimethylsiloxane	Vinyl polydimethylsiloxane
Dimethyl methyl hydrogen polysiloxane	Poly (methylsiloxane)
Poly (methylsiloxane)	Silane-treated silica
Silane-treated silica	Platinum catalyst
Pigments	Pigments
Polyethylene glycol, siloxane terminated	

Imprint™ 3 Medium Body (Monophase) Materials

Base	Catalyst
Quartz silica	Vinyl polydimethylsiloxane
Vinyl polydimethylsiloxane	Quartz silica
Trade secret	Silane-treated silica
Silane-treated silica	
Hydroxy Polydimethylsiloxane	
Pigments	

Imprint™ 3 Wash Materials

Base	Catalyst
Vinyl polydimethylsiloxane	Quartz silica
Quartz silica	Vinyl polydimethylsiloxane
Dimethyl methyl hydrogen polysiloxane	Silane-treated silica
Silane-treated silica	Pigments
Polyethylene glycol, siloxane terminated	Platinum catalyst

Setting Reaction

All Imprint™ 3 VPS Impression Materials are pure addition-cured silicones (vinyl polysiloxanes, VPS). The setting reaction which cures the material involves platinum-catalyzed hydrosilylation (Fig. 3). Here hydrogen polysiloxanes are added to the double bonds of vinyl polysiloxanes under the catalytic influence of traces of a platinum compound in the ppm range.

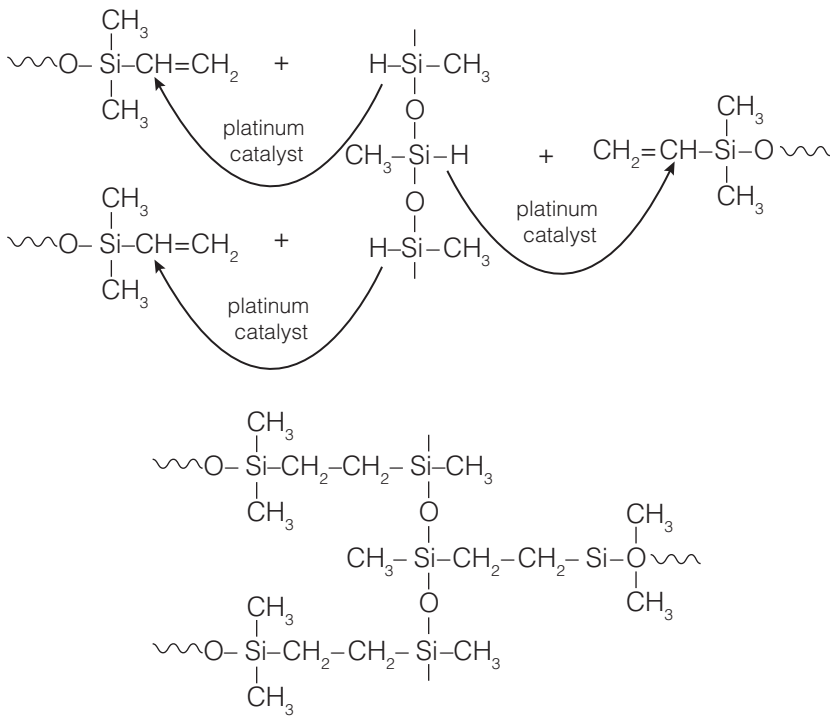


Fig. 3: Setting reaction of addition-cured silicones.

In chemical terms, this reaction is purely an addition reaction in which no by-products are released. As a result, there are no volatile by-products to cause shrinkage of the elastomer, something that is seen, for example, in the case of condensation-cured silicones. The high dimensional stability is one of the benefits of VPS materials.

Imprint™ 3 Penta™ Putty — A Real Putty Material

Chemical Matrix

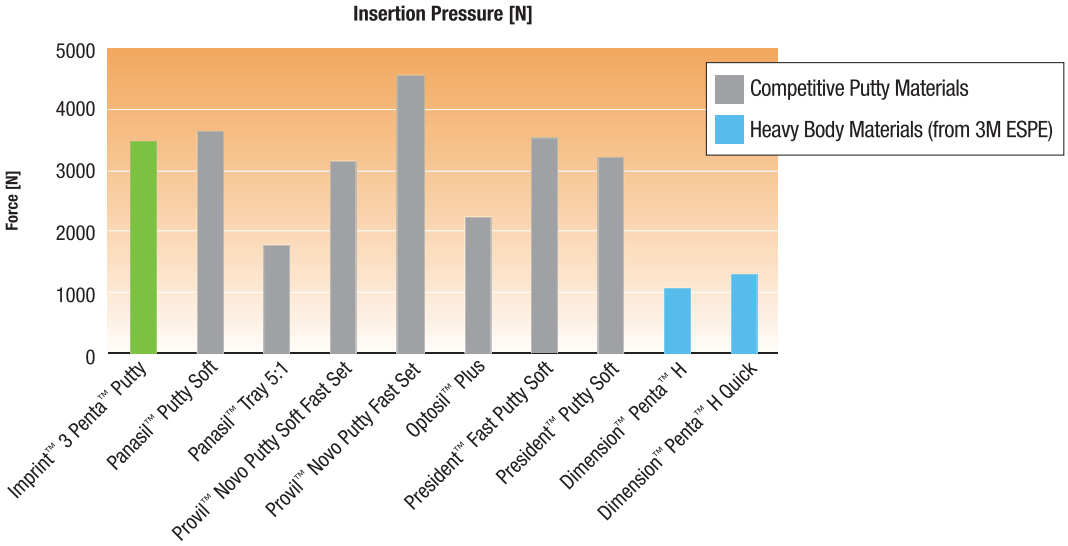
Imprint™ 3 Penta™ Putty is a purely addition-cured silicone (VPS) consisting of:

- A combination of vinyl polysiloxanes of varying chain lengths
- A combination of different hydrogen polysiloxanes
- Platinum catalyst
- A combination of fillers on a silicon dioxide basis
- A combination of plasticizers

Fig. 4: Superior mixing quality of Imprint™ 3 Penta™ Putty with the Pentamix™ Automatic Mixing Unit.

The mixing of a real putty consistency in the Pentamix™ Automatic Mixing Unit[1] (Fig. 4) could only be realized by a unique combination of reactive polysiloxanes and fillers that is new to putties. This is an innovative way to rheologically enable the use of such high-viscosity pastes in the Pentamix mixing unit, without having to forfeit any of the customary putty characteristics. The innovative polymer combinations reduce the forces on the Pentamix mixing unit. From the customer's viewpoint, however, the usual high putty consistency is retained.

The high putty consistency has been confirmed in a study using a newly designed test apparatus which measures the resistance presented by a mixed paste to penetration by a test specimen. Although it can be mixed using the Pentamix mixing unit, Imprint 3 Penta putty provides dentists with insertion characteristics familiar of putties, as illustrated in this study. (Fig. 5).



Source: 3M ESPE internal data

Fig. 5: Insertion resistance of various impression materials. Source: I. Wagner et al, Insertion forces of conventional and new automixed putty impression materials, Joint Meeting of the Continental European, Israeli and Scandinavian Divisions of the IADR (August 25 – 28, 2004, Istanbul, # 140), and 3M ESPE internal data.

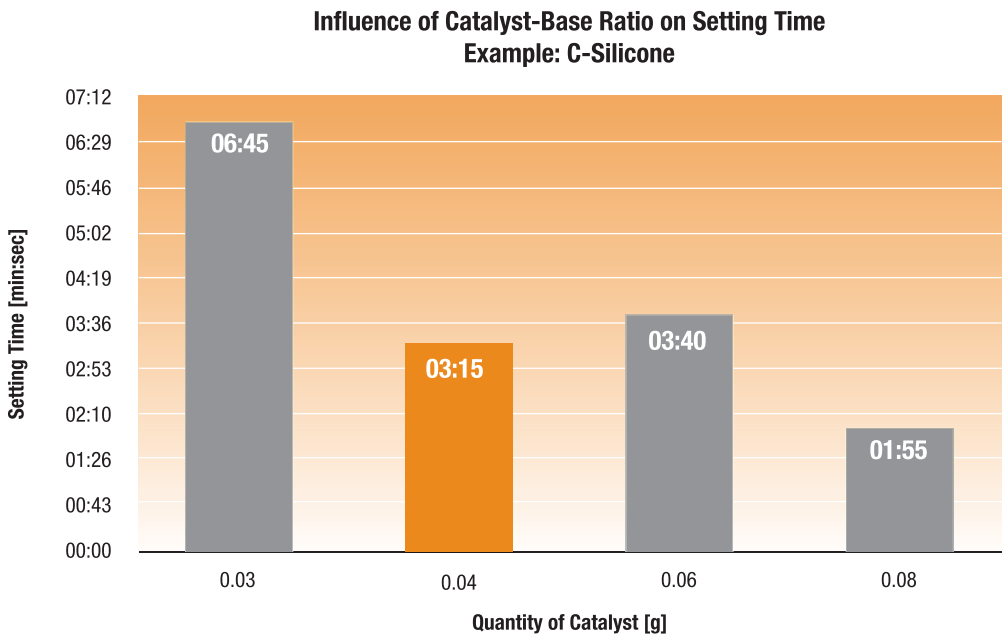
[1] Imprint™ 3 Penta™ Putty should only be mixed in the Pentamix™ Automatic Mixing Unit with a metal cartridge

The property profile of Imprint™ 3 Penta™ Putty has been realized by a combination of vinyl polysiloxanes of different chain lengths. Long-chain vinyl polysiloxanes increase the viscosity and result in high putty consistency. The addition of short-chain vinyl polysiloxanes result in very high final rigidity and thus a good carving of the impression material as well as fast intraoral setting.

Fig. 6: Superior mixing quality of Imprint™ 3 Penta™ Putty with the Pentamix™ Mixing Unit (left) compared with a putty mixed by hand (right, Express™ STD Putty).

The automatic mixing of Imprint 3 Penta putty in the Pentamix™ Automatic Mixing Unit ensures homogeneous mixing quality despite a high paste viscosity. This results in a mixing quality which is largely free from streaks and voids in a manner that is typical of materials mixed in the Pentamix mixing unit. Fig. 6 compares the cut surfaces of Imprint 3 Penta putty (test specimen on left) and a hand-mixed specimen of Express™ STD Putty (test specimen on right).

Every setting reaction is susceptible to fluctuations in dosing, i.e., unintentional variations in the ratios between the base and catalyst. In practice this may often result in major changes in the setting time. Such effects are largely eliminated by the automatic dispensing of Imprint 3 Penta putty impression material in a constant volume ratio. Consistent dosing of the base paste and catalyst enables uniform setting behavior over the entire foil bag. The following figure shows the influence of overdosing/underdosing of the catalyst on the setting time of the mixed material in the case of a condensation-cured, hand-mixed putty silicone. As one can see in Fig. 7, underdosing by 25% doubles the setting time.



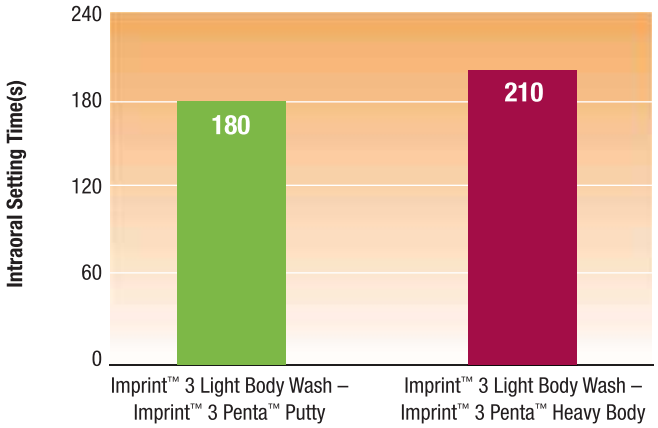
Source: 3M ESPE internal data

Fig. 7: Effect of overdosing/underdosing of catalyst on a standard condensation-cured putty silicone (0.04 g = exact proportion).

Thermally-Active Properties

In contrast to other tray impression materials, Imprint™ 3 Penta™ Putty offers a unique benefit: it accelerates the intraoral setting time of any VPS wash material combined with it.[1] This thermally-active behavior results from the fact that Imprint 3 Penta putty exits the Pentamix™ Mixing Unit at about mouth temperature. Because the putty is already warm when the tray is seated in the mouth, the wash material warms up faster than with other impression materials. Polymerization of the VPS wash material — which is strongly temperature-dependent — is accelerated. As a result, the intraoral wash setting time is shortened while the working time remains unchanged. This is demonstrated in Fig. 8 in which the intraoral setting time of Imprint™ 3 Light Body Wash Material is compared when combined with Imprint 3 Penta putty (thermally active) and Imprint™ 3 Penta Heavy Body (not thermally active). With Imprint 3 Penta putty as tray material, the intraoral setting time for Imprint 3 light body wash material is reduced by 30 seconds.

Imprint 3 Penta putty is designed to be used with regular-setting wash materials and combines the clinical benefit of having a long wash syringing time (1 minute intraoral) with the increased productivity and patient comfort from faster mouth removal of the impression.



Source: 3M ESPE internal data

Fig. 8: Comparison of intraoral setting time of Imprint™ 3 Light Body Wash Material when combined with Imprint™ 3 Penta™ Putty and Imprint™ 3 Penta™ Heavy Body. When combined with the thermally-active Imprint 3 Penta putty, the intraoral setting time for the wash material is reduced by 30 seconds.

Benefits of Imprint™ 3 Penta™ Putty Impression Material

Material Properties	Pentamix™ Mixing Unit Delivery
Customary putty-like consistency and insertion force when seating tray	Standardized, consistently homogeneous mixing quality as well as absence of streaks and voids (Fig. 6)
High final rigidity	Hygiene and cleanliness of mixing process
Easy carving of initial impression for 2-step technique	Precise dosing
Thermally-active properties	Long-term storage of pastes due to hermetic air seal in extremely airtight foil bags

[1] Simultaneous (1-step) impression technique only

Comparison of Handmix and Pentamix™ Automatic Mixing Unit Procedures

Procedures	Handmix Procedure Express™ STD	Automix Procedure Imprint™ 3 Penta™ Putty
Preparation		
Material required		
Dosing		
Dosing of putty base material		N/A
Dosing of putty catalyst		N/A
Dosed putty material (base and catalyst on mixing pad)		N/A
Mixing		
Taking up dosed materials		N/A
Starting mixing of base and catalyst		N/A
Mixing (kneading)		N/A
Base and catalyst paste mixed		N/A
Filling the Tray		
Preparation of Pentamix™ Mixing Unit—Attachment of red Penta™ Mixing Tip	N/A	
Even filling of impression tray by pressing button	N/A	
Rolling and subsequent insertion of mixed material into impression tray		N/A
Even distribution (N/A with Imprint™ 3 Penta™ Putty) and shaping* material in the impression tray with finger		

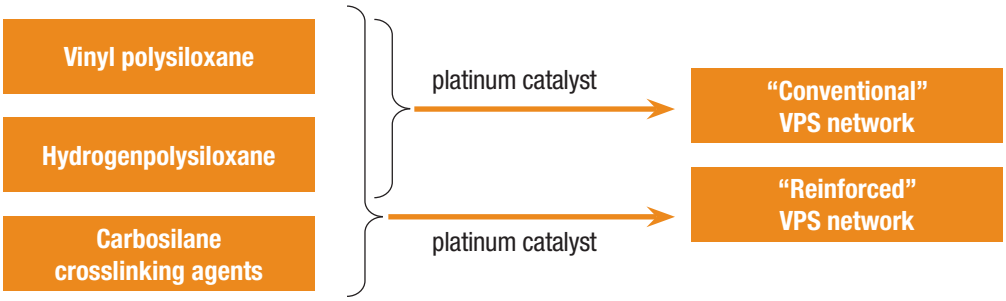
* Important: use gloves that do not inhibit setting of VPS material.

Imprint™ 3 VPS Wash Materials

The special characteristics of the Imprint™ 3 VPS Wash Materials have primarily been achieved by the development of a new network former. This substance, which in chemical terms belongs to the class of siloxane resin-free unsaturated carbosilanes, is new to addition-cured silicone impression materials.

Reactive System

In addition to the conventional components of an addition-cured silicone, the Imprint 3 VPS wash materials also contain reactive carbosilane crosslinking agents that modify the network produced on setting:



The incorporation of carbosilanes in the polymer network results in a chemical matrix with a strongly increased crosslinking density (Fig. 9). This increase in the crosslinking density improves the mechanical characteristics of the elastomer produced and can be seen in the greatly increased tensile strength and toughness of the cured impression (for detail see below).

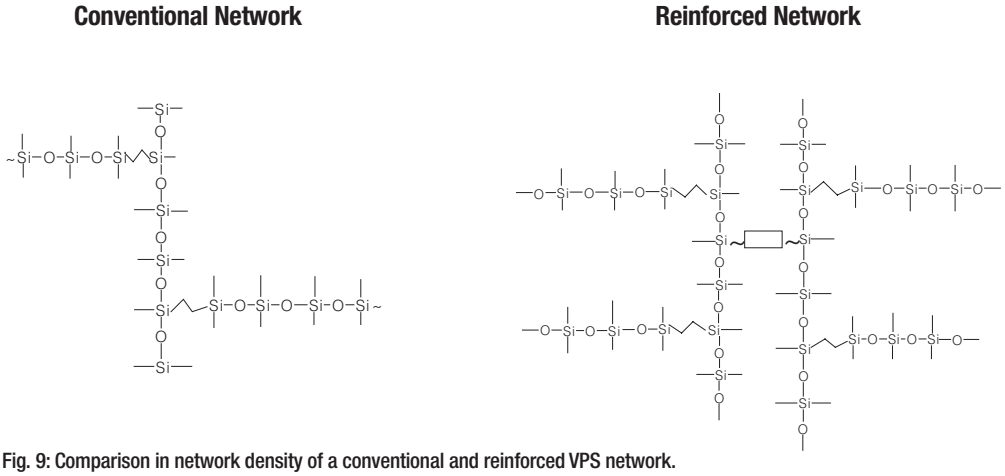


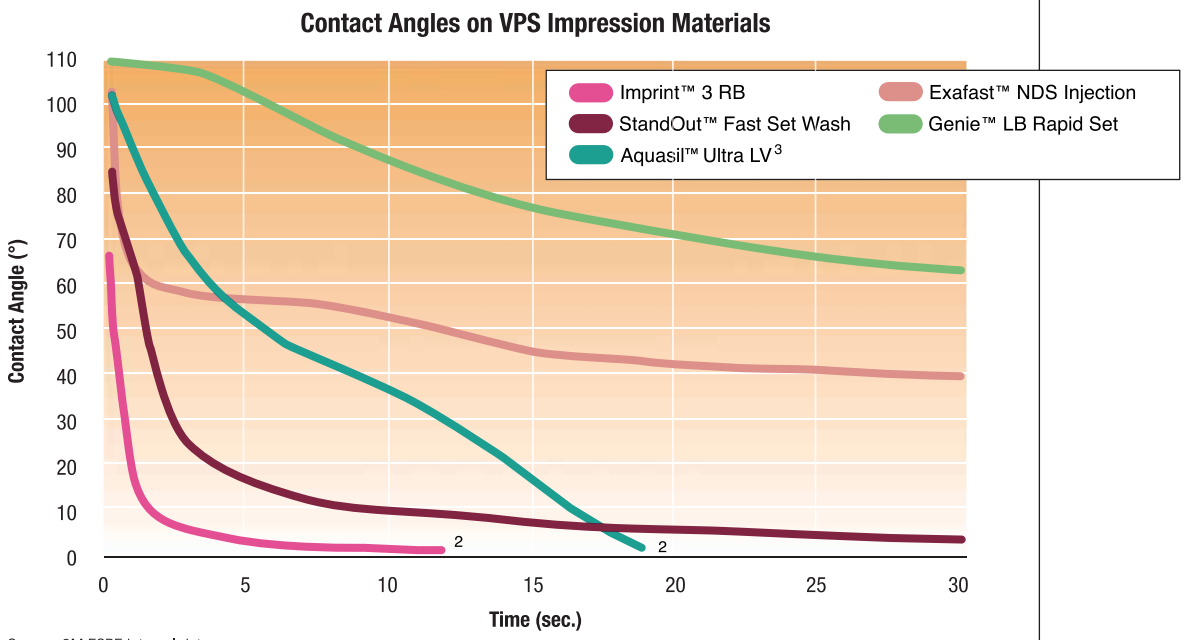
Fig. 9: Comparison in network density of a conventional and reinforced VPS network.

Clinically-Relevant Properties of Imprint™ 3 VPS Wash Materials

The overall goal of an impression is to create an exact copy of the dentition, especially the detailed reproduction of the preparation margins — a prerequisite for excellent fitting restorations. To capture the margin, an impression material needs to have excellent properties in the unset stage, especially hydrophilicity and flowability. To avoid any kind of permanent deformation when the impression is removed from the mouth, an impression material needs extraordinary properties in the set stage. The Imprint™ 3 VPS impression materials meet these requirements — even under challenging clinical conditions.

1. Capture the Margin Through Strong Hydrophilicity and Very Good Flowability:

a.) Hydrophilicity: The hydrophilicity of an impression material can contribute to the successful reproduction of detail in a moist environment. The method most often used to determine the hydrophilicity of an impression material is the contact angle measurement. In this test a drop of water is placed on the surface of the impression material and the spreading of the drop across the surface is observed. The spreading of a drop of water on Imprint 3 VPS materials is extremely rapid. Fig. 10 shows that Imprint 3 VPS impression materials show a much lower contact angle than all of the other leading VPS materials tested. Clinically, this reflects the potential for better wettability of the preparation surfaces and better performance in the oral environment. Impressions made with Imprint 3 VPS products show very good detail reproduction, even under challenging clinical conditions.



Source: 3M ESPE internal data

Fig. 10: More hydrophilic: Imprint™ 3 Regular Body VPS Impression Material has one of the lowest contact angles tested on set VPS impression materials.[1]

b.) Flow Properties: 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 preparation. Fig. 11 shows the flow around the tooth preparation of Imprint™ 3 Quick Step Light Body Wash Material (Imprint 3 VPS washes are also available in a slightly thicker, regular body, viscosity as well as an even thicker viscosity, ultra-regular body).

Fig. 11: Flow to tooth and gingiva of Imprint™ 3 Quick Step Light Body Wash Material.

[1] Source: 3M ESPE internal data. For test procedure details, call 3M ESPE at 1-800-634-2249

[2] Test detection limit

[3] Based on mathematical model representing the measured data

2. Reproduce the Margin Accurately through Distortion-Free Mouth Removal:

When an impression is removed from the mouth, it is exposed to two principal forces, elongation and compression. Imprint 3 impression material has a unique ability to withstand these forces.

Impression material characteristics that are necessary to withstand mouth removal are:

Ability to Elongate and Compress → Elongation and Compression Potential
Ability to Avoid Tearing → High Tensile Strength
Ability to Recover from Elongation and Compression → Recovery from Deformation

a.) Toughness: In order to avoid tearing, an impression material not only has to have a high tensile strength, but also a high elongation potential that allows the material to stretch upon removal. The combination of these two parameters is described as toughness (Fig. 12). It is defined as the total amount of energy an impression material can absorb until it tears. Toughness is the best measure of an impression material's ability to withstand the forces it is exposed to during mouth removal without tearing.

Fig. 12 also shows that Imprint 3 wash materials display a toughness value higher than most leading VPS materials tested. Clinically, this means that Imprint 3 VPS impressions are less likely to tear upon mouth removal.

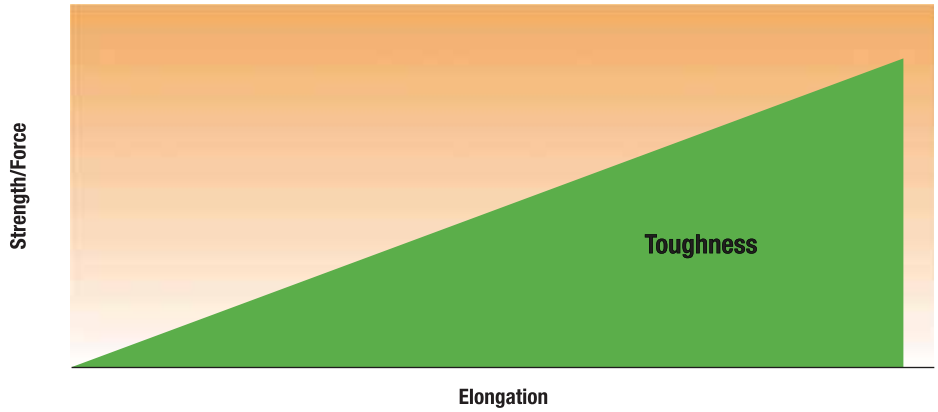
b.) Recovery from Deformation and Elongation (Memory): While Imprint 3 impression materials have high potential to resist tearing, this alone is not enough to reproduce an impression free of distortion. To achieve this, an impression material must show excellent recovery from the compressive and elongation forces it experiences upon mouth removal.

Although all modern VPS impression materials fulfill sufficient recovery from compression (ISO test), **they may lack in an adequate recovery from elongation**. High recovery from elongation is important for the areas around the preparation margin, especially a deep sulcus, undercuts, and interproximal spaces. In these places, the impression material is exposed to strong elongation forces upon mouth removal.

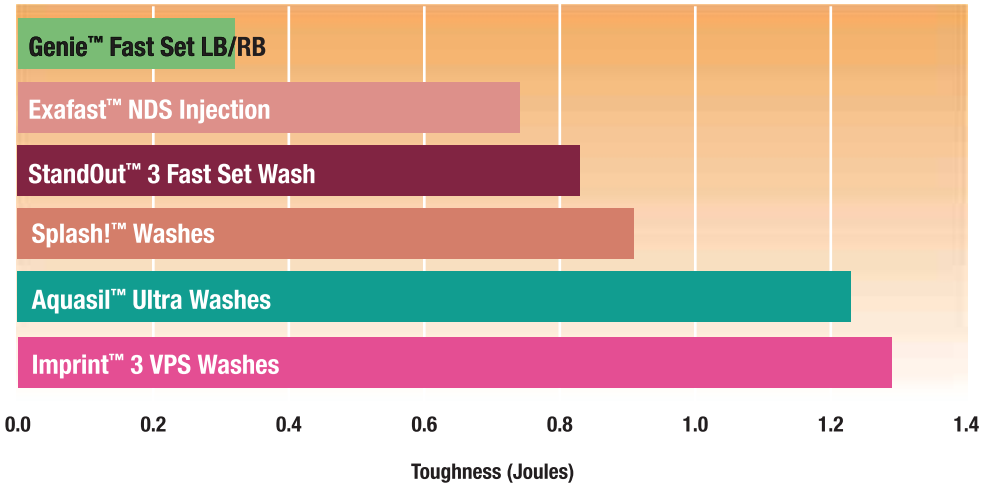
Imprint 3 wash materials show — by far — the best elastic recovery from stretching. This can be demonstrated using a sophisticated method for analyzing the recovery from elongation — the Memory Test.

In this test, paddle-shaped specimens of different VPS materials were cured at mouth temperature for the manufacturer's recommended setting time, stretched by 150%, and then allowed to recover. After two hours, the samples were measured for recovery from elongation. Fig. 13 shows that Imprint 3 impression materials have the best memory (99.8%) among all leading impression materials tested.

Clinically this means that even under strong elongation forces, Imprint™ 3 Impression Materials can maintain their original dimensions. In this test, the other leading VPS impression materials exhibit a permanent deformation of up to >5%, increasing the chance of distorted and potentially poor-fitting restorations. The nearly 100% memory for the Imprint 3 impression materials is also a benefit for the dental technician when removing the cast from the impression.

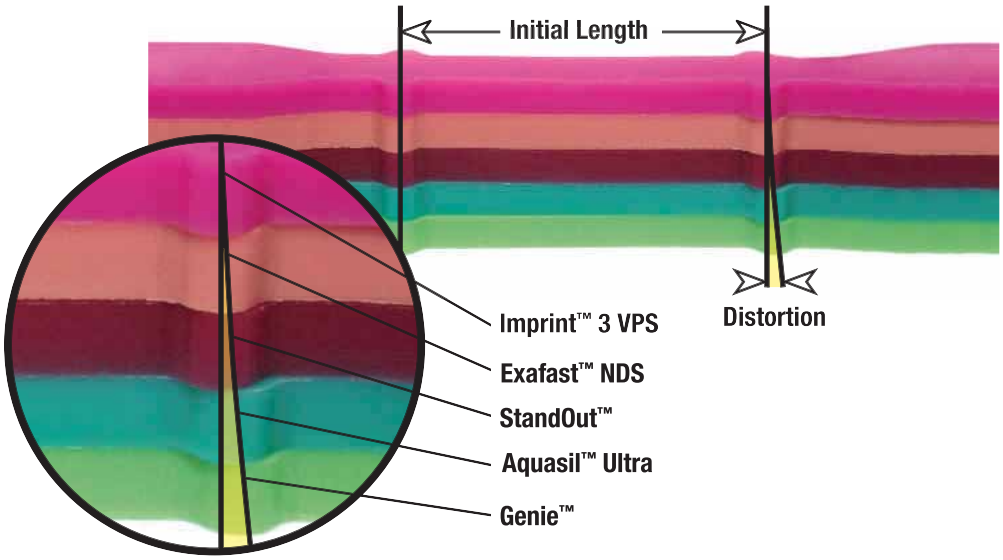


Source: 3M ESPE internal data



Source: 3M ESPE internal data

Fig. 12: Laboratory tests prove that Imprint™ 3 VPS Wash Materials show higher toughness values than other leading VPS products tested, making it less likely to tear upon removal.



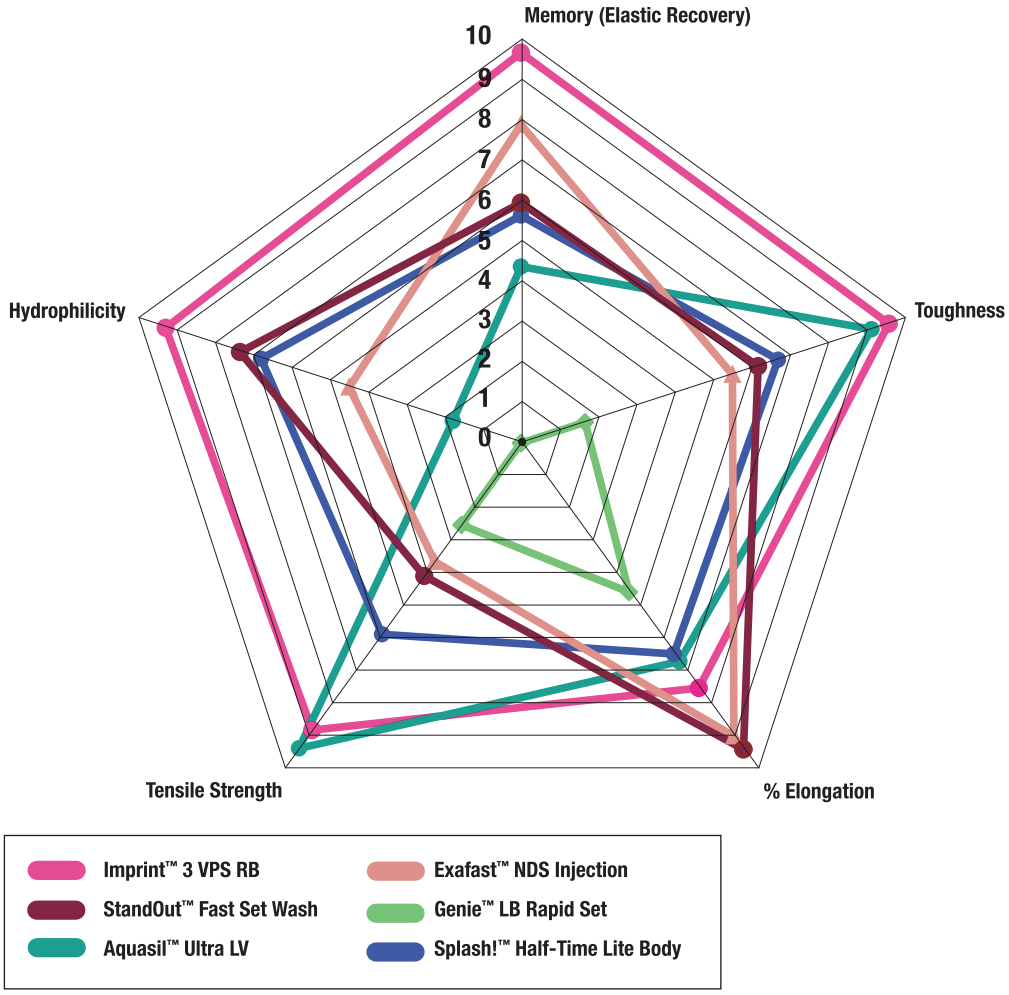
Source: 3M ESPE internal data

Fig. 13: **MEMORY TEST:** Lab tests prove Imprint™ 3 VPS Quick Step Light Body Impression Material is less likely to distort upon removal.

3. Get the Best Balance of Clinically Relevant Properties:

The combination of all clinically relevant properties: Tensile Strength, Elongation Potential, Toughness, Memory and Hydrophilicity are summarized in a star chart (Fig. 14). Imprint™ 3 VPS Impression Materials (pink) demonstrate outstanding overall performance in each of these areas; show a much larger total performance area than all other measured VPS materials; and have the **best** overall balance of clinically relevant properties of the VPS brands tested.

From a clinical perspective Imprint 3 impression material offers extraordinary potential for more accurate impressions and better-fitting restorations — a benefit for dentist, patient and the dental technician.



Source: 3M ESPE internal data

Fig. 14: Compilation of 5 clinically important impression material parameters: Tensile Strength, % Elongation, Toughness, Memory (Elastic Recovery), Hydrophilicity (2 second values on set material). Shown are Imprint™ 3 VPS and other leading VPS impression materials. Values for each parameter are given in a scale from 1 to 10 in which 1 = poor and 10 = excellent. Overall, Imprint™ 3 VPS Impression Materials show the best balance of properties — the biggest area in the diagram, and no value below 7.

Imprint™ 3 VPS Impression Materials Clinical Case Studies

Clinical Case 1: All-Ceramic Lava™ Crown Restoration

Clinical Case by Gunnar Reich, DMD, Munich, Germany

Initial situation: temporary restoration of tooth 14 after endodontic treatment.

Tooth 14 prepared for Lava™ Crown restoration, retraction cords in place.

Automatic filling of tray with Imprint™ 3 Penta™ Quick Step Heavy Body.

Intraoral syringing with Imprint™ 3 Quick Step Regular Body.

Precision impression with Imprint™ 3 Quick Step Heavy Body/Regular Body.

Close-up precision impression prepared tooth 14.

Final Lava™ Restoration on die model.

Final Lava™ Restoration in patient's mouth.

Initial situation: Endodontically-treated tooth 14 temporarily restored with Filtek™ Flow Composite. Tooth 14 required full crown restoration due to large occlusal defect and advanced crack at its mesial aspect. The patient wanted to have an all-ceramic restoration.

Treatment plan: After removal of temporary restoration, tooth 14 has been built-up with Filtek™ Z250 Restorative followed by a circular chamfer preparation for the Lava™ Crown. Precision impression with Triple Tray® (Premier) was taken with Imprint™ 3 Penta™ Quick Step Heavy Body and Imprint 3 Quick Step Regular Body. Impression for the temporary was made with 3M™ ESPE™ Directed Flow Impression Tray and Position™ Penta™ Quick Impression Material. Crown temporary was made with Protemp™ 3 Garant™ Temporization Material, and cemented with RelyX™ Temp NE Temporary Cement. Final Lava restoration was permanently cemented with RelyX™ Unicem Self-Adhesive Universal Resin Cement.

Clinical Case 2: Replacement of Insufficient PFM Crown by All-Ceramic Lava™ Crown

Clinical Case by Gunnar Reich, DMD, Munich, Germany

Initial situation: Insufficient PFM crown with large carious lesion at lingual aspect of tooth 19, lingual view.

Tooth 19 reinforced with two RelyX™ Fiber Posts, occlusal view.

Tooth 19 after core build-up and circular chamfer preparation for Lava™ Crown restoration, occlusal view.

Intraoral syringing with Imprint™ 3 Quick Step Regular Body.

Precision impression with Imprint™ 3 Quick Step Heavy Body/Regular Body.

Close-up precision impression prepared tooth 19.

Excellent fit of Lava™ Crown on die model.

Final Lava™ Crown in patient's mouth.

Initial situation: Insufficient 2-year-old PFM with large destruction of tooth 19 on its lingual aspect. Tooth 19 underwent endodontical treatment 1-1/2 years ago. The old crown was replaced by an all-ceramic Lava™ Crown.

Treatment plan: The old crown was removed, and the caries was completely excavated. Revision of the endodontic treatment was considered as not necessary based on X-ray examination and visual control. Two RelyX™ Fiber Posts were inserted in tooth 19 to stabilize the following core build-up with Filtek™ Z250 Restorative. Precision impression with Triple Tray® (Premier) was taken with Imprint™ 3 Quick Step Heavy Body and Imprint 3 Quick Step Regular Body. Crown temporary was made with Protemp™ 3 Garant™ Temporization Material, and cemented with RelyX™ Temp NE Temporary Cement. Final Lava restoration was permanently cemented with RelyX™ Unicem Self-Adhesive Universal Resin Cement.

Clinical Case 3: Replacement of Insufficient 8-Year-Old PFM Bridge by All-Ceramic Lava™ Restoration

Clinical Case by Gunnar Reich, DMD, Munich, Germany

Initial situation: buccal view.

Restored and prepared abutment teeth. Note the deep subgingival preparation.

Precision impression with Imprint™ 3 Penta™ Putty and Imprint™ 3 Regular Body with 360° reproduction of preparation margins.

Close-up of precision impression prepared tooth 31.

Position™ Penta™ Quick impression with Protemp™ 3 Garant™ temporary restoration.

Excellent fit of Lava™ Framework on die model, buccal view.

Final bridge on die model, buccal view.

Seated Lava™ Bridge cemented with RelyX™ Unicem Self-Adhesive Universal Resin Cement, buccal view. Excellent marginal, proximal and occlusal fit.

Initial situation: Extended carious lesion under PFM bridge 29–31 mesiobuccally at tooth 29 due to poor fit (large marginal gap of >500µm). Tooth 29 experienced endodontical treatment 8 years ago.

Treatment plan: The old bridge was removed, and the caries completely excavated. X-ray and visual control displayed that revision of the endodontic treatment was not necessary as the root canal filling in situ was still in good condition and no apical inflammation process could be diagnosed. Tooth 29 was reinforced with a RelyX™ Fiber Post followed by a core build-up with Filtek™ Z250 Restorative. Then both bridge abutment teeth were prepared for the subsequent Lava™ Restoration. All impressions were taken with 3M™ ESPE™ Directed Flow Impression Tray. The seated restoration showed an excellent marginal, approximal and occlusal fit. It required only very minor occlusal adjustments.

Clinical Case 4: Paradigm™ C Glass Ceramic Inlay Restoration

Clinical Case by Gunnar Reich, DMD, Munich, Germany

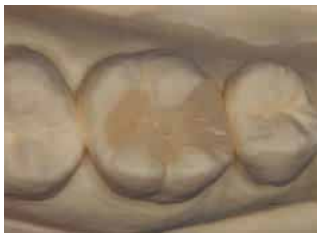
Initial situation: old amalgam filling at tooth 14 with insufficient margins.

Tooth 14 prepared for Paradigm™ C Glass Ceramic Restoration; retraction cord in place.

Intraoral syringing with Imprint™ 3 Quick Step Light Body.

Precision impression Imprint™ 3 Penta™ Quick Step Heavy Body/Light Body.

Close-up precision impression.



Paradigm™ C Glass Ceramic Inlay on die model.

Paradigm™ C Restoration permanently cemented with RelyX™ Unicem Self-Adhesive Universal Resin Cement— removal of excess cement.

Paradigm™ C Restoration in patient's mouth.

Initial situation: Old dual-surface (occlusal-mesial) amalgam filling at tooth 14 with insufficient margins. Restoration with new Paradigm™ C Glass Ceramic for the CEREC® InLab System.

Treatment plan: The old amalgam filling was removed. No recurrent caries has developed at tooth 14 despite its insufficient margins. The tooth was prepared for a dual-surface (OM) glass ceramic Paradigm™ C Inlay. Precision impression with Triple Tray® (Premier) was taken with Imprint™ 3 Penta™ Quick Step Heavy Body and Imprint 3 Quick Step Light Body. Inlay temporary was made with Protemp™ 3 Garant™ Temporization Material, and cemented with RelyX™ Temp NE Temporary Cement. Paradigm™ C Glass Ceramic Inlay was pretreated with HF and RelyX™ Ceramic Primer and permanently cemented with RelyX™ Unicem Self-Adhesive Universal Resin Cement.

Clinical Case 5: 10-unit PFM Bridge Restoration in the Upper Frontal Area

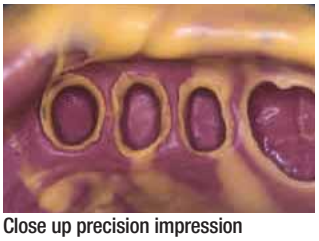
Clinical Case by Christoph Zawta, DMD, Merano, Italy

Initial situation: Insufficient PFM crowns, buccal view.

Teeth 4, 5, 6, 11,12 and 13 prepared for PFM bridge restoration, retraction cords in place.

Precision impression Imprint™ 3 Penta™ Heavy Body and Imprint™ 3 Light Body with 3M™ ESPE™ Directed Flow Impression Tray.

Close up precision impression teeth 11–13.



Close up precision impression teeth 4–6.

Framework on die model.

Excellent intraoral fit of framework.

PFM bridge (first firing) on die model — basal wax-up for optimized length-width ratio.

PFM bridge after final firing on die model.

Close-up final PFM bridge with pink colored ceramic in cervical area.

Close-up final restoration on die model — excellent fit.

Final restoration in patient's mouth.

Initial situation: Insufficient 12-year-old PFM crowns in the upper anterior region with exposed crown margins, opaque ceramic and reduced gingival harmony because of periodontal problems. The patient wanted to have a new restoration with an enhanced "red and white" esthetics.

Treatment plan: The old crowns were removed, and teeth 7, 8, 9 and 10 were extracted. After pre-preparation of teeth 4, 5, 6, 11, 12 and 13, a bridge temporary made of Protemp™ 3 Garant™ Temporization Material was placed. The temporary pontics were established 0.5mm shorter than the crestal bone to support the facial gingival margin. A systematic periodontal treatment was done. Six months later, the gingival situation and the pontic position were optimized. Tooth preparation was completed and a precision impression was taken with Imprint™ 3 Penta™ Heavy Body and Imprint 3 Light Body Impression Material.

Optimizing the length-width ratio, incisor pontics were fired with pink-colored ceramic in cervical area. The 10-unit PFM bridge was permanently cemented with RelyX™ Unicem Self-Adhesive Universal Resin Cement.

3M™ ESPE™ Imprint™ 3 VPS Impression Material Instructions for Use

Product Description

These Instructions for Use apply to the following VPS impression materials, which are arranged for One-Step Impression Technique. All products are manufactured by 3M ESPE.

Quick-Setting Products:

Product Name	ISO 4823	ISO 4823 Consistency	Paste Color	Mixing Ratio (Vol.)	Mixing Device
Imprint™ 3 Penta™ Quick Step Heavy Body	Type 1	heavy-bodied	blue green	5 : 1	Pentamix™ 2 Automatic Mixing Unit Pentamix™ 3 Automatic Mixing Unit
Imprint 3 Quick Step Heavy Body	Type 1	heavy-bodied	blue green	1 : 1	Dispenser
Imprint 3 Quick Step Light Body	Type 3	light-bodied	pink	1 : 1	Dispenser
Imprint 3 Quick Step Regular Body	Type 3	light-bodied	pink	1 : 1	Dispenser

Regular-Setting Products:

Product Name	ISO 4823	ISO 4823 Consistency	Paste Color	Mixing Ratio (Vol.)	Mixing Device
Imprint™ 3 Penta™ Putty	Type 0	putty	frog green	5 : 1	Pentamix™ 2 Automatic Mixing Unit Pentamix™ 3 Automatic Mixing Unit
Imprint 3 Penta Heavy Body	Type 1	heavy-bodied	burgundy	5 : 1	Pentamix™ Automatic Mixing Unit Pentamix™ 2 Automatic Mixing Unit Pentamix™ 3 Automatic Mixing Unit
Imprint 3 Medium Body (Monophase)	Type 2	medium-bodied	teal	1:1	Dispenser
Imprint 3 Heavy Body	Type 1	heavy-bodied	burgundy	1 : 1	Dispenser
Imprint 3 Light Body	Type 3	light-bodied	yellow	1 : 1	Dispenser
Imprint 3 Regular Body	Type 3	light-bodied	yellow	1 : 1	Dispenser

Imprint™ 3 Penta™ Putty and Imprint™ 3 Penta™ Quick Step Heavy Body can only be mixed in either the Pentamix™ 2 Automatic Mixing Unit or the Pentamix™ 3 Automatic Mixing Unit, manufactured by 3M ESPE. The two materials cannot be mixed in an earlier Pentamix mixing unit version due to the lower mixing speed of this device.

Imprint™ 3 Penta™ Heavy Body can be mixed in all versions of Pentamix mixing units. All other products are statically mixed and directly applied using the Garant™ Dispenser, manufactured for 3M ESPE.

These *Instructions for Use* should be kept for the duration of product use. For all other products mentioned, please refer to the corresponding *Instructions for Use*.

Indications

All dual-phase impressions, e.g., crown, bridge, inlay and onlay preparations, implant abutments, orthodontic impressions and related impressions such as a matrix for provisional restorations, tooth reduction guides, study models, bleaching trays, etc.

The quick-setting products are especially suited for single-unit and two-unit impressions.

Preparation

Impression Tray: All impression trays generally used for precision impressions are suitable, e.g., full arch, quadrant and dual-arch impression trays.

For sufficient adhesion, apply a thin layer of VPS tray adhesive, manufactured by 3M ESPE, on the tray and allow it to dry completely (5 – 15 minutes drying times are ideal).

Using Penta™ Impression Material:

- Place the Penta impression material foil bags into the designated metal-reinforced Penta™ Cartridges.
- Use the red Penta™ Mixing Tips, manufactured by 3M ESPE, for mixing any of the mentioned Penta tray materials.
- Check prior to mixing whether the red mix tip fits tightly onto the drive shaft of the Pentamix™ Automatic Mixing Unit.
- Turn the plungers of the Pentamix mixing unit downward until resistance is noticed using the hand-wheel; do not force.
- When using new foil bags: Initiate mixing and extrude, bleed the first few mls of the mix until it is uniform in color, then discard.
  - — Please see “Product Description” for paste color.
  - — Material that has set inside the Penta mixing tip should not be extruded by force as this may damage the Penta cartridge and Penta mixing tip and result in the formation of leaks. Discard each tip after use.
- Please follow the section “Impression Taking” for tray-filling procedure.

Using Garant™ Impression Material:

- Place the cartridge of the tray and wash material in dispensers. When using Penta impression material for tray filling, only place the cartridge of the wash material in the dispenser.
- Check before application that both cartridge openings are not clogged.
- Using new cartridges: Extrude a small amount of paste until both the base and catalyst paste flow out evenly.
- Attach a green mixing tip, manufactured for 3M ESPE, to the cartridge of the heavy-bodied impression material and/or a yellow mixing tip to the cartridge of the light-bodied impression material.
- For intraoral application of the light-bodied material, attach a yellow intraoral tip onto the yellow mixing tip.
- If needed: Enlarge the exit opening for the intraoral tip by cutting it with a scalpel.
- Make sure that base paste and catalyst are mixed completely and are being extruded in a uniform color.
  - — Please see “Product Description” for paste color.
  - — Material that has set inside the mixing tip should not be extruded by force as this may damage the cartridge and mixing tip and result in the formation of leaks. Discard each tip after use.

Retraction:

Suitable retraction agents include aluminum chloride, aluminium sulfate or ferric sulfate solutions.

- Keep the preparation area clear of any pooled or excess fluids while the impression is being taken.
- Hemostatic cords may be used for sub-gingival preparations.
- Thoroughly remove the residue of the retraction/hemostatic agent by rinsing before taking the impression.

Impression Taking:

- Block out undercuts or areas where gingival recession exists to prevent the impression material from “locking” onto the tooth structure. Failure to block-out may make tray removal difficult, or cause extraction of natural teeth or prosthesis. This is especially necessary when using Imprint™ 3 Penta™ Putty or any other rigid-setting impression material.

One-Step Technique using Penta Impression Material:

- At the start of mixing the Penta impression material, be sure to observe the entry of the paste into the mixing tip, and ensure that base paste and catalyst paste flow into the mixing tip evenly. The mixed paste must be extruded in a uniform color free of streaks.
  - — Please see “Product Description” for paste color.
- Load the impression tray prepared with adhesive, keeping the mixing tip constantly immersed in the paste to avoid air bubble formation.
- While the tray is being loaded, apply the syringe material from the bottom up around the cleaned and dried preparation. Depending on the number of units to be syringed, initiate application, so the tray loading and application of material around the preparation are completed at the same time.
  - — Be careful not to exceed the working time and intraoral syringe time of the respective material to avoid incomplete or inaccurate impressions.
- Slowly place the loaded tray in the mouth parallel to the long axes of the prepared teeth, and hold it in position passively.
- Allow the impression material to fully set, then remove the impression from the mouth.

One-Step Technique using the Garant™ Dispenser:

- Load the impression tray prepared with adhesive with the tray material, keeping the mixing tip constantly immersed in the paste to avoid air bubble formation.
- While the tray is being loaded, apply the syringe material from the bottom up around the cleaned and dried preparation. Depending on the number of units to be syringed, initiate application, so the tray loading and application of material around the preparation are completed at the same time.
  - — Be careful not to exceed the working time and intraoral syringe time of the respective material to avoid incomplete or inaccurate impressions.
- Slowly place the loaded tray in the mouth parallel to the long axes of the prepared teeth, and hold it in position passively.
- Allow the impression material to fully set, then remove the impression from the mouth.

After Impression Taking:

- Thoroughly examine and explore the sulcus of the prepared teeth and surrounding dentition. Remove any residual cured impression material from the mouth.

Hygiene:

- Place the impression in a standard disinfectant solution for the period of time recommended by the manufacturer. Do not leave the impression submerged in the disinfection solution for more than the specified amount of time.
- After disinfection, rinse and clean the impression of any remaining disinfection solution under running water for approximately 15 seconds.

Model Preparation:

- Allow the impression to set for two hours after removing from the mouth. There are no other time limitations for pouring.
- Pre-rinse the impression with water and remove excess standing water in order to obtain a bubble-free model. A silicone surfactant can be used before pouring.
- Prepare the cast for the impression using a conventional die or model stone.
- The impressions can be silver or copper plated.

Cleaning:

- **Dispenser:** Remove paste that has not set using an alcohol-soaked cloth. The dispenser handle and plunger can be autoclaved up to a temperature of 135°C (275°F). Disassemble the dispenser before autoclaving. Glutaraldehyde-based solutions can be used for disinfection; follow manufacture's instructions.
- **Impression Tray:** The adhesive can be removed from re-usable impression trays using acetone. Follow manufacture's instructions for handling acetone.

Notes:

- The oxygen inhibition layer of composite materials, e.g. fillings or core buildups, may impair or retard the setting of silicone impression materials, and should be removed completely.
- **Keep the filled Penta™ Mixing Tip attached to the other cartridge to serve as a closure until the next use.** Removing and replacing the spent Penta mixing tip may lead to carry-over of paste and ensuing formation of clogs.
- Vinyl polysiloxane impression materials must not be combined with condensation polymerization silicones or polyether impression materials.
- Trace amounts will impair the setting process.
- Disposable latex gloves impair the setting of silicone impression materials. Vinyl gloves are more suitable.
- Impressions should not come into contact with solvent-containing liquids, as this may result in swelling and imprecise modelling.

Incompatibilities: In susceptible individuals, sensitization to the product cannot be avoided. If allergic reactions are observed, discontinue use and remove the product completely.

Storage and Stability: Store the product at 15-25°C (59-77°F). Do not use after the expiration date. Store set impressions at 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.

Warranty: 3M ESPE warrants this product will be free from defects in material and manufacture. 3M ESPE MAKES NO OTHER WARRANTIES INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. User is responsible for determining the suitability of the product for user's application. If this product is defective within the warranty period, your exclusive remedy and 3M ESPE's sole obligation shall be repair or replacement of the 3M ESPE product.

Limitation of Liability: Except where prohibited by law, 3M ESPE will not be liable for any loss or damage arising from this product, whether direct, indirect, special, incidental or consequential, regardless of the theory asserted, including warranty, contract, negligence or strict liability.

Information as of November 2005.

Step-by-Step Guide

1. Fill the tray while the wash material is being syringed around the preparation.

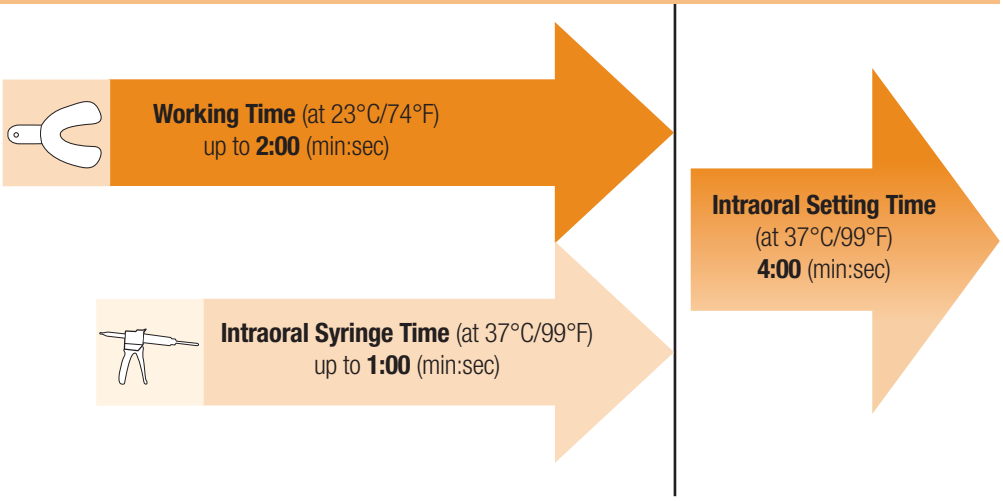
2. Syringe wash material around the clean, dry tooth preparation(s). Keep tip submerged in wash material to avoid air inclusions while syringing.

3. Insert and immobilize the tray. The tray must be seated before the end of the working time of the combined materials. Please see flow graphs on the next page for times.

4. After removal from the mouth, rinse, disinfect, and rinse the impression again. Wait 120 minutes to pour the stone model.

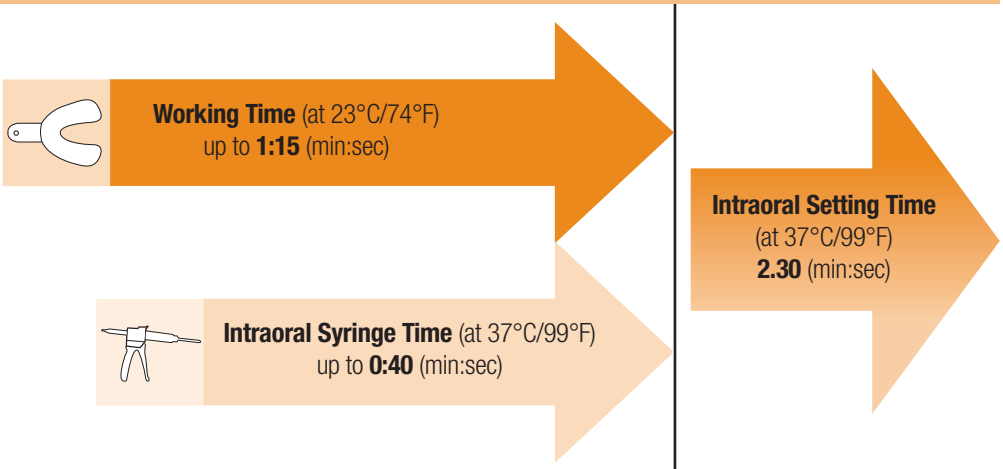
Imprint™ 3 Heavy Body

Imprint™ 3 Light Body/Regular Body



Imprint™ 3 Quick Step Heavy Body

Imprint™ 3 Quick Step Light Body/Regular Body



Frequently Asked Questions (FAQs)

1. Are Imprint™ 3 VPS Impression Material products compatible with other 3M™ ESPE™ VPS Impression Materials (Imprint™ II, Express™ and Dimension™ Products)?

From a chemical perspective all Imprint 3 VPS products can be combined with each other, and with other 3M ESPE VPS impression materials. The individual products may differ in their working and setting times, especially if we talk about regular-setting and fast-setting products. When two products with different working times are combined, the working time of the combination is determined by the material with the shorter working time, and the intraoral setting time is determined by the material with the longer setting time (for exact times see corresponding *Instructions For Use*).

Differences between the materials may occur for their pour times (minimum two hours after impression taking for all Imprint 3 impression materials and Imprint II products, 30 minutes for Dimension™ products, and 30 minutes for Express™ products). When products with different pour times are combined, the minimum pour time is determined by the material with the longer pour time.

2. What kind of impression trays are suitable for Imprint 3 impression material products?

All trays (full arch, quadrant and dual-arch impression trays) generally used for precision impressions are suitable (metal and plastic trays, unperforated and perforated trays, stock and custom trays). Generally, we recommend the use of rigid trays, especially for Imprint™ 3 Penta™ Putty.

For sufficient adhesion, apply a thin layer of VPS tray adhesive, manufactured by 3M ESPE, 5–15 minutes before filling the tray.

Dual-arch trays also require application of tray adhesive onto all surfaces — including the gauze — that come into contact with the impression material.

For the 3M™ ESPE™ Directed Flow Impression Tray, the application of a tray adhesive is not necessary.

3. Reasons for poor bonding of wash material to the tray material:

Cause	Solution
Classes of materials not compatible	Do not combine Imprint 3 VPS products with C-silicones, alginates, hydrocolloids, polyethers
Temporary restoration was produced directly before impression taking, or impression was also used as temporary work key	Produce temporary restoration after impression has been taken, or create separate temporary work key
Wash material already in setting phase when tray is seated	Do not exceed working times for tray and wash materials
2-step technique only: preliminary impression was not clean enough	Carefully clean preliminary impression with warm water, and dry it completely

4. What is the cause of smeary impression surfaces in the preparation area?

Such smeary layers are an indicator that the impression material has not set properly. The primary reason is contact with chemicals, e.g. sulphur from latex gloves, acrylate and methacrylate residues that inhibit polymerization.

Such effects are often not seen until casting, where adhesion of plaster to the impression or the adhesion of impression material to the plaster cast can occur. We recommend the following precautions to avoid such effects:

Cause	Solution
Placement of a composite restoration or composite core build-up material just performed	Finish, clean, isolate restoration or core build-up materials
Temporary restoration produced directly before precision impression taking	Clean affected teeth surface with solvents, e.g. orange oil, isopropyl alcohol, ethanol and cotton swab → to best avoid inhibition caused by temporary restoration materials, take the precision impression before fabricating the temporary
Not all traces of hemostatic solutions removed	Dilute or remove hemostatic solution by rinsing with water spray
Use of latex gloves → sulphur from gloves transferred to either retraction cord, impression material, teeth or soft tissue	Check latex gloves for compatibility or use nitrile* gloves which are recommended for VPS material
Use of surface anaesthetic containing adrenaline	Ask patient to rinse out well
Contact with C-silicones, e.g. when blocking out	Use VPS or light-cured plastic for blocking out

* Some nitrile gloves may contain traces of sulfur.

5. Does the working time of the materials depend on the temperature?

Like all VPS materials, the working time for Imprint™ 3 VPS Impression Materials depend on temperature. At room temperatures above 25°C (77°F), the working times for all Imprint 3 impression materials are much shorter compared to the values given in the *Instructions For Use*. The shorter working time may reduce syringing of the typical amount of prepared teeth with the impression material. Also, the whole impression taking procedure becomes rushed.

If the materials have been exposed to temperatures above 25°C (77°F), we recommend placing the Imprint 3 impression materials in a refrigerator at 8°C – 10°C (46 – 50°F) and bringing them into the warm operatory approximately 1 hour before impression taking. We strongly advise against mixing the paste in the Pentamix™ 2 Automatic Mixing Unit or Pentamix™ 3 Automatic Mixing Unit directly after removal from the refrigerator without warming it up beforehand. The higher viscosity of the cold paste (<18°C, 64°F) will increase the dispensing forces, causing heavy wear on the Pentamix mixing unit, especially when Imprint™ 3 Penta™ Putty is used.

6. How to avoid the formation of voids in the plaster model:

The most common reasons for the formation of voids in the plaster model are:

- Casting the impression too early and
- Excessive surface tension of the impression

Voids will form if casting is carried out too early. This is due to the release of hydrogen gas into the surface of the plaster from the polymerization reaction of the molecules. This chemical reaction is completed in about 2 hours after impression taking. On cooler days, and using cold disinfection solutions, this may take longer.

The surface tension of silicone impressions can be reduced by the use of silicone wetting agents applied shortly before casting. Follow manufacture's instructions for the use of the wetting agent.

7. Pentamix™ Automatic Mixing Unit— Tips and Tricks for Pentamix mixing unit first time users:

a.) General questions on the Pentamix mixing unit:

Pentamix™ Automatic Mixing Unit: What to do when...	Causes	Solutions
Unit does not start	Plunger is in bottom or top position.	Turn plunger away from bottom or top position by using adjustment knob.
Paste not dispensed	Cartridge is empty. Foil bag openings glued up with cross-contaminated impression material. Plunger is blocked.	Insert new foil bags. Clean foil bag openings. Check that handwheel moves freely.
Unit does not switch off	Start button is jammed.	Press start button again; if necessary remove mains plug and release start button.
Paste flows too slowly or not at all	Paste temperature too low.	Bring up to room temperature, min. 18°C (65°F).
Cartridge cannot be inserted into unit	Plungers not in top position. Cartridge locking lever not closed.	Move up plungers by turning handwheel clockwise as far as it will go and hold. Close cartridge locking lever.
Initially dispensed material not homogeneous in color	There has been a minimal change in the length of the foil bags through the cartridges being stored vertically outside the unit.	Store cartridges horizontally. Always check mixing quality for a uniform color typical of paste.
Material not homogeneously mixed	Penta™ Mixing Tip not properly fastened onto drive shaft. → rotor inside the Penta mixing tip not turning	Attach new Penta mixing tip after cartridge is placed inside the Pentamix mixing unit. Push Penta mixing tip onto drive shaft and then into corresponding holes in the cartridges. If necessary, rotate mixing tip on drive shaft for proper seating.

b.) Questions related only to Imprint™ 3 Penta™ Putty:

Pentamix™ Automatic Mixing Unit: What to do when...	Causes	Solutions
Penta™ Mixing Tip gets warm so that the working time of the impression material is shortened.	The unit operated a long time without impression material being dispensed, because:	
	A new foil bag was opened.	When a new foil bag is opened, don't release the Pentamix mixing unit's activation button until after paste is dispensed in a uniform color, but be sure to load tray immediately.
	The plunger was not in contact with the foil bag when activation button was pressed.	Before pressing the Pentamix mixing unit's activation button, turn down handwheel until plunger is in contact with foil bag.
	The tray filling procedure was interrupted by releasing and pressing the Pentamix mixing unit's activation button multiple times while the tray was loaded.	Load the tray in a single operation without releasing the Pentamix mixing unit's activation button.

8. Can Imprint 3 Penta putty foil bags be used with the plastic Penta™ Cartridges?

"No" — Due to the high viscosity of the paste/putty, greater forces are exerted on the cartridge walls while expressing the Imprint 3 Penta Putty material compared with other 3M™ ESPE™ Penta™ Impression Materials. The former plastic Penta cartridges, which still can be found in many dental offices, will expand at the wall sides when subjected to increased pressure, possibly causing the foil bag to become jammed between the cartridge and plunger. This would make it difficult or even impossible to turn back the plunger or adjustment knob. Or, it may deliver the jammed paste too slowly or not at all, resulting in poor mixing quality. In the long term, the plastic cartridges would not withstand the high stresses and would break.

Only use Imprint 3 Penta Putty with 3M ESPE Penta cartridges equipped with inner tubes made of steel. These Penta cartridges do not expand laterally and will prevent damage to the Pentamix mixing unit, and/or poor mix quality of the impression material as described.

Summary

With the Imprint™ 3 VPS Impression Material product line, 3M ESPE has set a new standard for impressioning. The products set the stage for uncompromising impression quality, the prerequisite for excellent fitting restorations — the best basis for a good relationship between dentist, patient and dental technician.

Imprint 3 impression material offers all of the features a state-of-the-art impression material must have to precisely capture the intraoral situation in all aspects, and to remove the impression without distortions. This has been realized by a series of outstanding properties the materials offer:

- very high hydrophilicity
- excellent flow characteristics
- high elongation potential
- very high tensile strength
- excellent toughness
- excellent recovery from elongation and compression

Together, all of these properties make Imprint 3 impression material the impression material with a best balance of clinically-relevant properties — a key factor for clinical success under any clinical conditions.

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V. Porsfeld, C. Wiedig, J. Fetz, J. Zech, E.-M. Popp

Physical/Technical Data

		Tray Materials					Monophase Materials	Wash Materials					
Property	Unit	Imprint™ 3 Penta™ Putty	Imprint™ 3 Penta™ Heavy Body	Imprint™ 3 Penta™ Quick Step Heavy Body	Imprint™ 3 Heavy Body	Imprint™ 3 Quick Step Heavy Body	Imprint™ 3 Medium Body	Imprint™ 3 Light Body	Imprint™ 3 Quick Step Light Body	Imprint™ 3 Regular Body	Imprint™ 3 Quick Step Regular Body	Imprint™ 3 Quick Step Ultra Regular Body	Imprint™ 3 Ultra Regular Body
Consistency A+B (ISO 4823:2000)	mm	34	31	31	31	33	37	43	41	39	39	39	38
Linear dimensional change (ISO 4823:2000)	%	-0.3	-0.3	-0.2	-0.3	-0.3	-0.3	-0.4	-0.1	-0.3	-0.3	-0.4	-0.4
Recovery from deformation (ISO 4823:2000)	%	99.4	99.6	99.6	99.6	99.6	99.8	99.8	99.8	99.7	99.7	99.7	99.7
Strain in compression (ISO 4823:2000)	%	2.0	1.7	1.6	2.0	1.9	2.7	4.5	4.4	4.0	3.8	4.3	4.1
Tensile strength at mouth removal (3M ESPE AG internal)	MPa						2.4	4.5	4.4	4.2	4.6	4.1	5.0
Toughness at mouth removal (3M ESPE AG internal)	J							1.25	1.29	1.18	1.44	0.77	1.21
Recovery from elongation at mouth removal (3M ESPE AG internal)	%							-0.10	-0.07	-0.03	-0.02	0.20	0.29
Shore hardness after 15 min. (DIN 53505)	—	76	70	69	70	64	53	50	50	51	52	50	51
Shore hardness after 24 hrs. (DIN 53505)	—	78	74	71	75	75	59	54	55	55	56	55	56
Contact angle after 2 sec., cured (3M ESPE AG internal)	°							13	12	12	24	16	25

Compatibility with gypsum (ISO 4823:2000) and reproduction of detail (ISO 4823:2000) are fulfilled for all tray and wash materials.

Note: The data do not represent ranges of values but are individual values, each relating to a specific production batch.

Notes

Notes

3M ESPE

Dental Products

3M Center
Building 275-2SE-03
St. Paul, MN 55144-1000
USA
1-800-634-2249

3M Canada

Post Office Box 5757
London, Ontario N6A 4T1
Canada
1-888-363-3685

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