



3M Science.
Applied to Life.™

3M™ Imprint™ 4
VPS Impression Material

Technical Data Sheet

Contents

1. 3M – Great impressions	3
2. Portfolio overview	4 – 5
2.1 Recommended materials for the 1-step technique	
2.2 Recommended materials for the 2-step technique	
3. Material composition	6 – 7
4. Shortest intra-oral setting time through active self-warming	8 – 10
4.1 Time saving opportunity	
4.2 Accelerated setting and active self-warming	
5. Hydrophilicity	10 – 11
6. Physical and mechanical properties	12
6.1 Tensile strength	
6.2 Overview mechanical properties	
7. Clinical results	13 – 14
8. Clinical case	15



3M — Great impressions

Since the introduction of the first elastomeric impression materials decades ago, 3M has constantly improved and expanded its impressioning portfolio. Today, it offers a variety of high-performance vinyl polysiloxane (VPS) and polyether impression materials, fast and easy-to-use mixing devices and other impression-related products and accessories. Numerous awards from trade publications and positive feedback from thousands of loyal customers agree: all 3M dental products are designed to reliably make superior impressions for perfectly fitting final restorations, helping dental professionals to optimize their impression procedures.

With the introduction of 3M™ Imprint™ 4 VPS Impression Material, 3M offers a product line for exceptionally precise impressions: the innovative VPS material allows for an unprecedented short intra-oral setting time due to its active self-warming — caused by a unique chemical reaction. This 3M exclusive technology significantly accelerates the setting of the material, resulting in noticeable time savings. And because the reaction starts at the end of the working time, you can take the time you need to make your impressions.

Features and benefits at a glance

- **Active self-warming**
For accelerated setting
- **Shortest intra-oral setting time**
For real time-saving
- **Adequate working time**
For a stress-free procedure
- **Hydrophilicity**
For excellent flow and finest detail reproduction
- **Fresh material colors**
For enhanced readability
- **Pleasant minty taste**
For more patient comfort



Indications









Imprint 4 VPS Impression Material is especially developed and designed for all kinds of precision impressions using the 1-step and 2-step impression techniques, i.e. crown and bridge, inlay and onlay, implant, and orthodontic impressions.

Portfolio overview

Available in a wide range of viscosities – from putty to ultra-light body – 3M™ Imprint™ 4 VPS Impression Material offers essential benefits for the 1-step and 2-step impression techniques. All tray materials – including putty – are available for fast and convenient automatic mixing with the 3M™ Pentamix™ 3 and 3M™ Pentamix™ 2 Automatic Mixing Unit from 3M.

The working and setting times of Imprint 4 “Super Quick” and “Regular” setting materials are perfectly aligned when using the recommended material combinations:

Recommended materials for the 1-step technique

Tray material	Color	Recommended wash material	Color
3M™ Imprint™ 4 Penta™ Putty Putty consistency		3M™ Imprint™ 4 Regular	
3M™ Imprint™ 4 Penta™ Heavy 3M™ Imprint™ 4 Heavy Hydrophilic heavy body		3M™ Imprint™ 4 Light	
		3M™ Imprint™ 4 Regular	
3M™ Imprint™ 4 Penta™ Super Quick Heavy 3M™ Imprint™ 4 Super Quick Heavy Fast setting hydrophilic heavy body		3M™ Imprint™ 4 Super Quick Light	
		3M™ Imprint™ 4 Super Quick Regular	

For the **1-step technique**, the ideal tray material should be hydrophilic so it can perform well in the moist intra-oral environment plus it has a somewhat lower hardness in the set stage so that it can easily be removed from the patient’s mouth. Imprint 4 heavy body VPS materials have been designed to fully meet these requirements. If an increased flowability of the wash material is desired, the light viscosities are recommended. If it is more important for the wash material to remain in place at the tooth, the regular viscosities are recommended. In addition, all Imprint 4 wash materials are hydrophilic to capture finest details in the moist intra-oral environment.

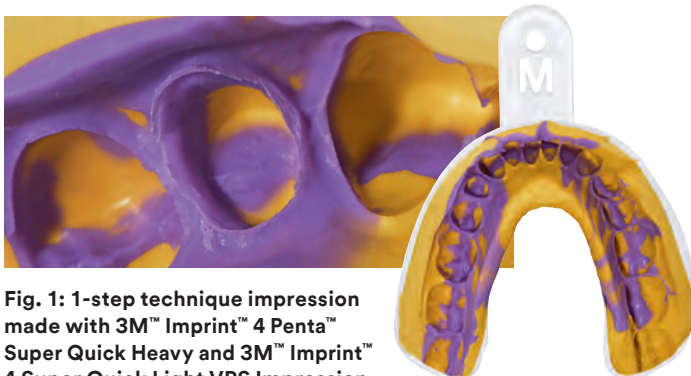


Fig. 1: 1-step technique impression made with 3M™ Imprint™ 4 Penta™ Super Quick Heavy and 3M™ Imprint™ 4 Super Quick Light VPS Impression Material.

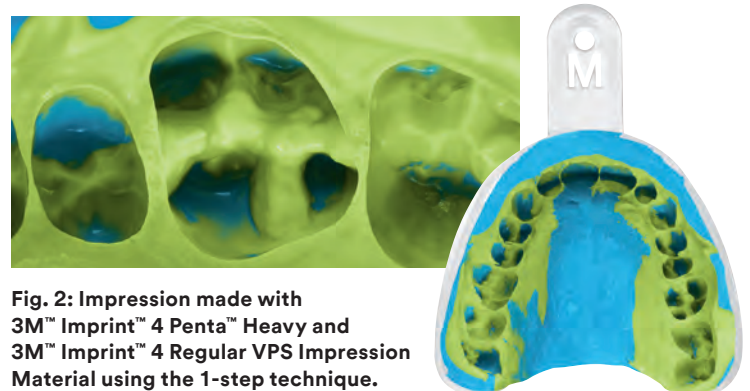





Fig. 2: Impression made with 3M™ Imprint™ 4 Penta™ Heavy and 3M™ Imprint™ 4 Regular VPS Impression Material using the 1-step technique.

Recommended materials for the 2-step technique

Tray material	Color	Recommended wash material	Color
3M™ Imprint™ 4 Penta™ Putty Putty consistency		3M™ Imprint™ 4 Super Quick Light	
		3M™ Imprint™ 4 Light	

In the **2-step technique**, it is important for the tray material to allow high insertion pressure so the wash material can be pushed deep into the sulcus. Plus, tray materials need to have good carving properties as well as high hardness in the set stage. The wash material must be able to generate very thin layers on the set tray material. The ideal solution is a wash material with low viscosity and high structural viscosity (thixotropy), allowing it to flow very well when pressure is applied. Therefore, 3M™ Imprint™ 4 Super Quick Light and Light consistency washes are ideally suited for the 2-step technique in combination with 3M™ Imprint™ 4 Penta™ Putty.

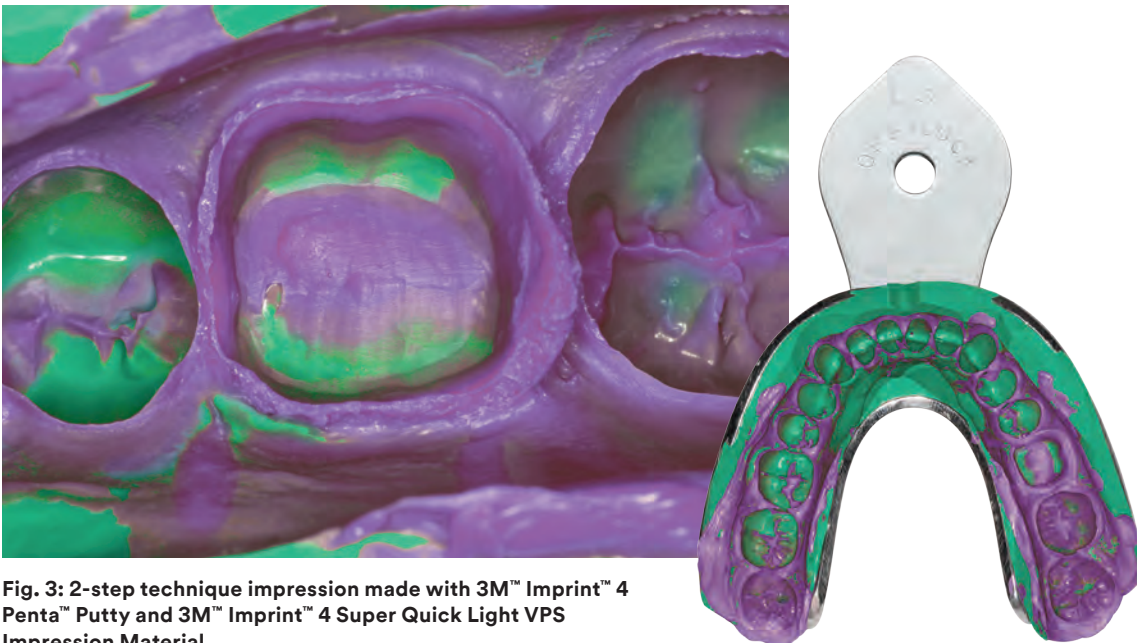


Fig. 3: 2-step technique impression made with 3M™ Imprint™ 4 Penta™ Putty and 3M™ Imprint™ 4 Super Quick Light VPS Impression Material.

Material composition

3M™ Imprint™ 4 VPS Impression Material is an addition-cured silicone (vinylpolysiloxane, VPS). The setting reaction which cures the material is based on platinum-catalysed hydrosilylation. The unique features of Imprint 4 material are mainly the result of the development of a novel setting accelerator as well as a pioneering wetting enabler.

In addition to conventional components, all Imprint 4 heavy body and wash materials contain different reactive unsaturated carbosilane (UCS) compounds. The proven polyfunctional UCS crosslinker known from 3M's Imprint™ 3 VPS Impression Material is utilized as network builder, providing the material with a strong reinforced network. Additionally, a newly developed monofunctional UCS is also used as a setting accelerator.

Exemplified formulation of Imprint 4 VPS Impression Material:

Base	Catalyst
Vinyl polydimethylsiloxane	Vinyl polydimethylsiloxane
Dimethyl (methyl hydrogen) polysiloxane	Silica filler
Silica filler	Silane-treated silica
Silane-treated silica	Platinum catalyst
Polyethylene glycol, siloxane terminated	Pigments
	Polyfunctional UCS crosslinker
Polyfunctional UCS crosslinker	
Monofunctional UCS setting accelerator	
Peppermint flavor	

It is well known that increasing temperatures accelerate chemical reactions, and this is especially true for the setting reaction (hydrosilylation) of VPS impression materials in general.

With Imprint 4 VPS material, 3M has integrated a second mechanism which causes the active **self-warming** of the impression material. This is done by capping reactive components with a novel UCS setting accelerator. Due to the carefully chosen reactivity of the UCS setting accelerator, the warming reaction does not start until the end of the working time. This means the working time of the material is not adversely affected by self-warming but the intra-oral setting gets the additional “kick”. The result is a significant reduction of the intra-oral setting time, providing Imprint 4 Super Quick materials with the shortest intra-oral setting time compared to competitive VPS precision impression materials.

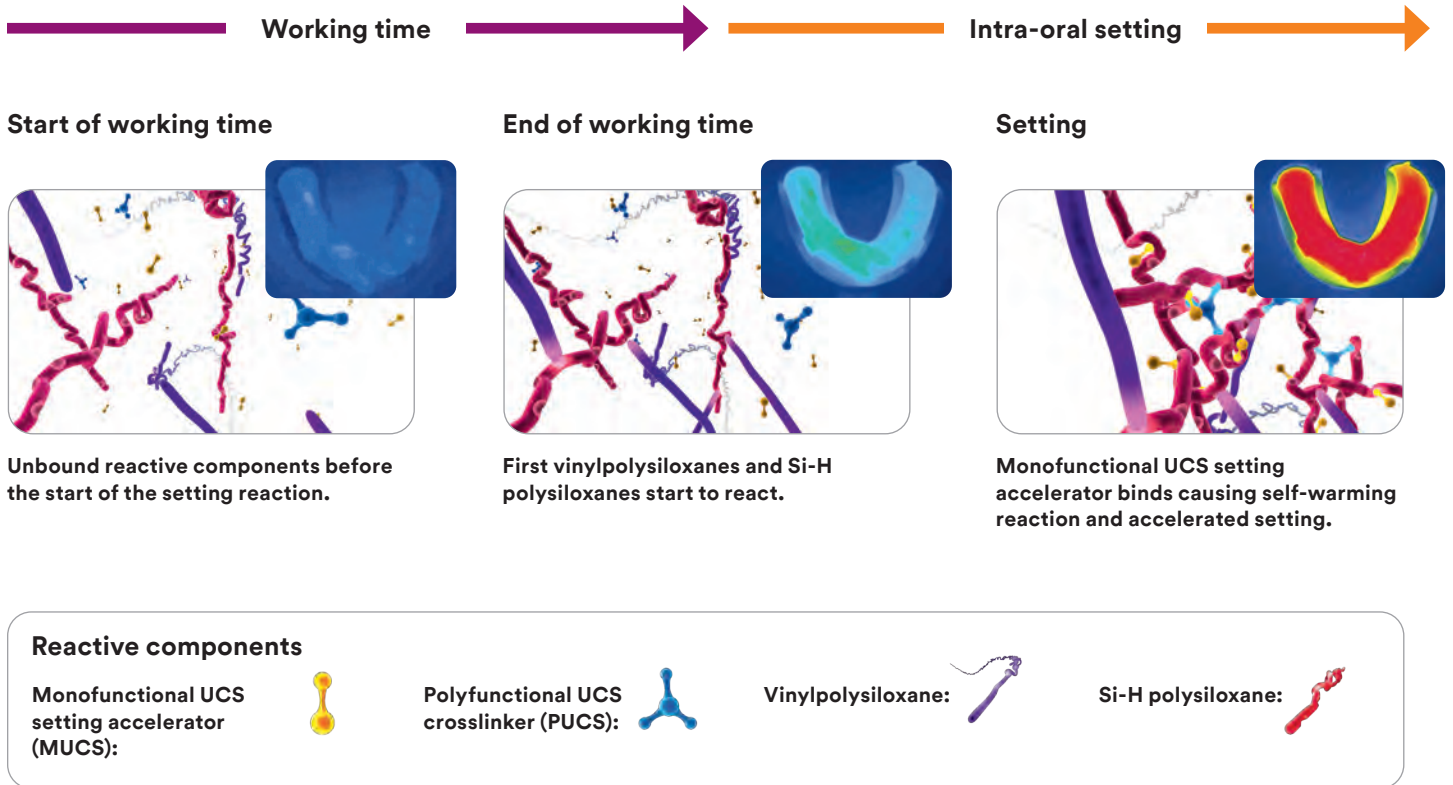


Fig. 4: Schematic representation of the setting reaction of 3M™ Imprint™ 4 VPS Impression Material.

Shortest intra-oral setting time through active self-warming

3M™ Imprint™ 4 VPS Impression Materials are available in two setting regimes with exceptionally short intra-oral setting times while adequate working times are maintained.

The “Super Quick” materials are the ideal solution for 1- or 2-unit cases. A working time of up to 1:15 minutes at room temperature and up to 35 seconds of intra-oral working time allow ample time for this most common indication.

With a working time of up to 2:00 minutes at room temperature and up to 1:00 minute intra-orally, the “Regular” setting materials offer more working time – which is especially valuable for larger cases.

The tray can be inserted immediately after loading and once the tray is seated it is not necessary to add any unused working time. The indicated intra-oral setting times are always valid. There is no minimum working time – the total setting time is the intra-oral setting time plus the working time actually used.

3M™ Imprint™ 4 Penta™ Putty Material with a kneadable consistency for automatic mixing in the 3M™ Pentamix™ System provides enough working time – up to 1:30 minutes – plus an intra-oral setting time of 2:30 minutes. In combination with Imprint 4 wash materials, significant time can be saved, especially if the 2-step technique is used.

Imprint 4 “Super Quick” setting materials

- Shortest **intra-oral setting time** available on the market
- Ideally suited for **1- or 2-unit** cases

Imprint™ 4 “Regular” setting materials

- Long working time of 2:00 minutes for larger cases
- **Significantly reduced intra-oral setting time**

Time saving opportunity

Due to its exceptionally short intra-oral setting times, Imprint 4 VPS material helps to save time – especially the Super Quick heavy/wash combination. The below graph shows the time saving of Imprint 4 Super Quick wash materials compared to competitive VPS materials. The indicated times were defined for a case with a working time of 20 seconds, e.g. loading and seating a dual arch/double bite tray (e.g. Premier® Triple Tray®) with simultaneous intra-oral syringing of the wash material.

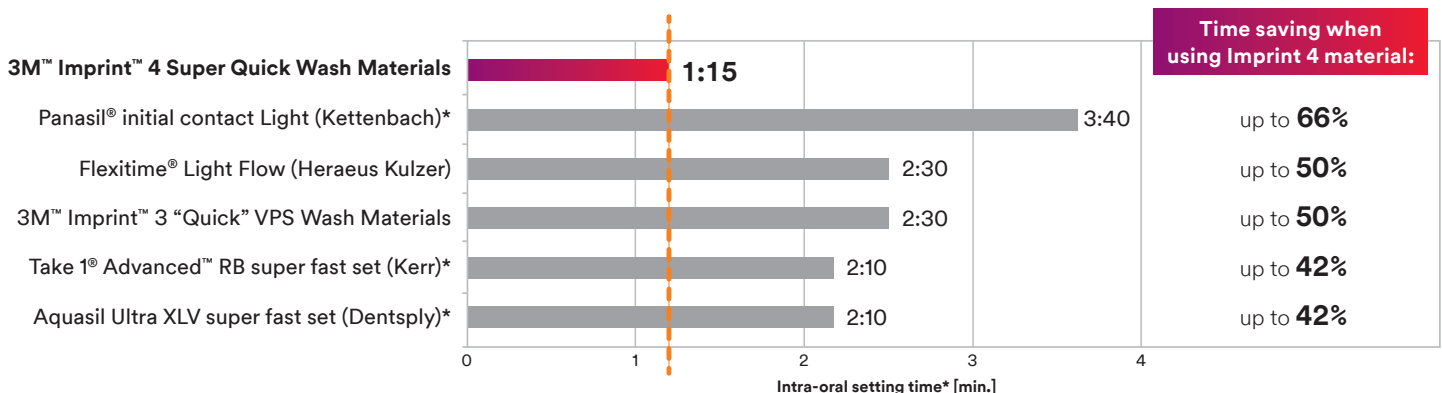


Fig. 5: Intra-oral setting times of leading VPS impression materials according to the respective manufacturers’ instructions for use in a single-unit case with 20 seconds’ working time.

* Manufacturer indicates total setting time. Calculated intra-oral setting time = total setting time minus 20 seconds working time.

Accelerated setting and active self-warming

With 3M™ Imprint™ 4 VPS Impression Material, a new dimension of setting behavior of VPS impression materials is reached by employing the temperature sensitivity of the hydrosilylation setting reaction. Imprint 4 material offers accelerated setting in the mouth whereas the working time remains unaffected. This setting behavior allows for a more efficient workflow: a reduced intra-oral setting time results in a time-saving procedure and less stress for dentists and patients alike.

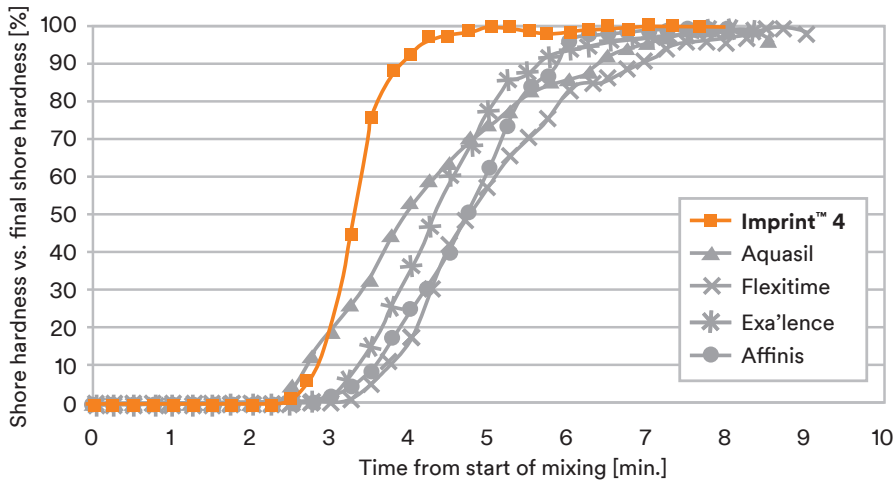
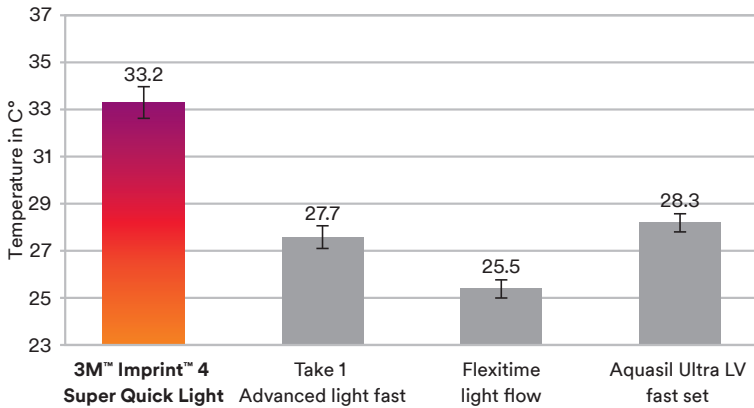


Fig. 6: Progression of setting reaction characterized by Shore hardness increase measured in different fast setting heavy bodies. Intra-oral setting times are shorter than those measured at room temperature (23°C/73.4°F). Materials tested: 3M™ Imprint™ 4 Super Quick Heavy, Aquasil Ultra Heavy Fast Set (Dentsply), Flexitime Heavy Body (Heraeus Kulzer), Affinis Fast Heavy Body (Coltène), EXA'lence HB fast set (GC). Source: J.C. Farr, H. Hoffmann, A. Maurer, P. Osswald, E. Wanek, Shore Hardness increase of Tray Materials during setting, CED IADR 2012, #674

The progression of setting is associated with an increase in material hardness. The maximum Shore hardness is reached at the end of the setting process. Thus, the faster the Shore hardness achieves its maximum, the faster the setting reaction is. Consequently, an increase in Shore hardness in relation to time is a reasonable method to measure the setting progression.* As shown in Fig. 6, Imprint 4 VPS material shows the steepest increase in Shore hardness and thus the fastest setting behavior.



* see also: Shore Hardness of VPS Materials from Unset to Set Consistency, M. Neglia, D. Nobrega, G. Kugel, R.D. Perry, Tufts University, Boston, MA, AADR2012, #1023



3M™ Imprint™ 4 VPS Impression Material’s active self-warming is responsible for the accelerated setting reaction in the mouth resulting in a short intra-oral setting time. Inside the mouth, the material warms up to body temperature (37°C/98.6°F) which also increases patient comfort during impression taking.

Fig. 7 shows that only Imprint 4 VPS impression material displays a significant temperature increase, compared to competitive VPS materials.

Fig. 7: Maximum temperature increase of different VPS impression materials, Measurements were taken at room temperature: maximum temperature is lower than in the mouth. Source: S. Bhatt, J. Bair, R. Perry, G. Kugel, Shore Hardness and Temperature of VPS Materials During Setting, submitted for publication at IADR 2013

Infrared images (Fig. 8) display temperature differences as colors. The temperature range was chosen between 21 °C /69.8 °F (dark blue) and 37 °C /98.6 °F (white). Again, only Imprint 4 material shows a visible rise in temperature to body temperature.

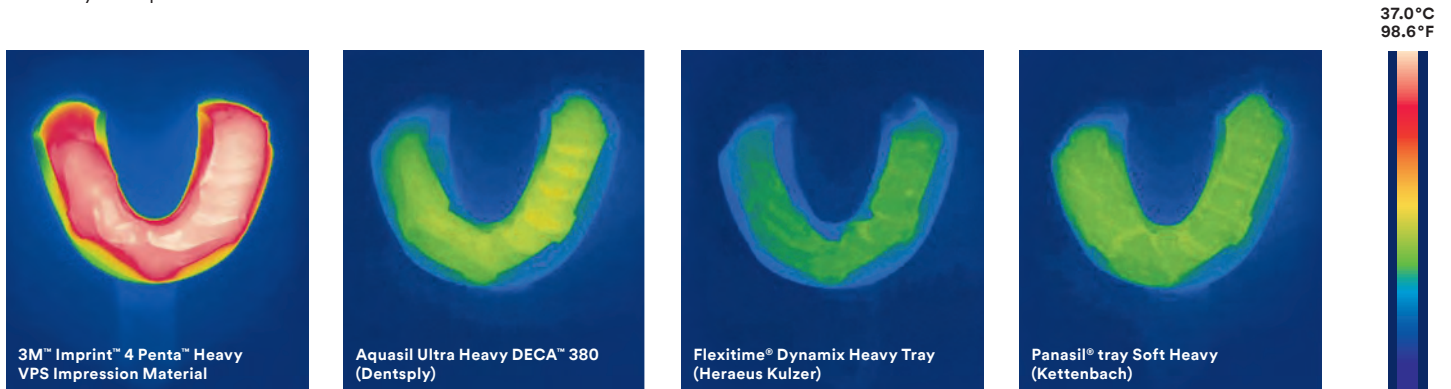


Fig. 8: Infrared images of 3M™ Imprint™ 4 Penta™ Heavy VPS Material, Aquasil Ultra Heavy DECA™ 380 (Dentsply), Flexitime® Dynamix Heavy Tray (Heraeus Kulzer) and Panasil® tray Soft heavy (Kettenbach). Only Imprint™ 4 Material shows a significant temperature increase. All images were acquired with a FLIR T640 infrared camera at room temperature (23°C /73.4°F). Images show the materials at the time of their maximum temperature. Source: 3M internal tests

Hydrophilicity

Highly detailed impressions are a prerequisite for perfectly fitting restorations. Detail reproduction capability must be maintained even under challenging conditions. Good flowability and wetting properties are key features for an impression material that performs outstandingly even in a moist environment. After setting, the hydrophilicity of an impression material is essential for model manufacturing. An impression with high wettability helps to create precise, void-free dental models without the need to use additional wetting agents when pouring.



Fig. 9: 3M™ Imprint™ 4 Wash Materials offer hydrophilicity without the use of additional wetting agents.



Physical and mechanical properties

Tensile strength

When an impression material is removed from the patient's mouth, it is exposed to high compressive and tensile forces. 3M™ Imprint™ 4 VPS Impression Material has a strong ability to withstand these forces due to its high tensile strength. This tensile strength is a result of a reinforced network formed with the polyfunctional UCS crosslinker. Tearing of impression material, especially at the margin, would result in an unsatisfactory impression and an insufficient marginal fit of restoration.

Figures 10 and 11 show that the preparation line is accurately captured by Imprint 4 material. No tearing of the impression material can be observed – even at the most critical areas where the material has flowed deep into the sulcus.



Fig. 10: Crown preparation on lower first premolar.



Fig. 11: Accurate and detailed impression of the situation. Impression made with 3M™ Imprint™ 4 Penta™ Super Quick Heavy and 3M™ Imprint™ 4 Super Quick Light Material in the 1-step technique.
(Photo courtesy of Dr. Gunnar Reich, Germany)

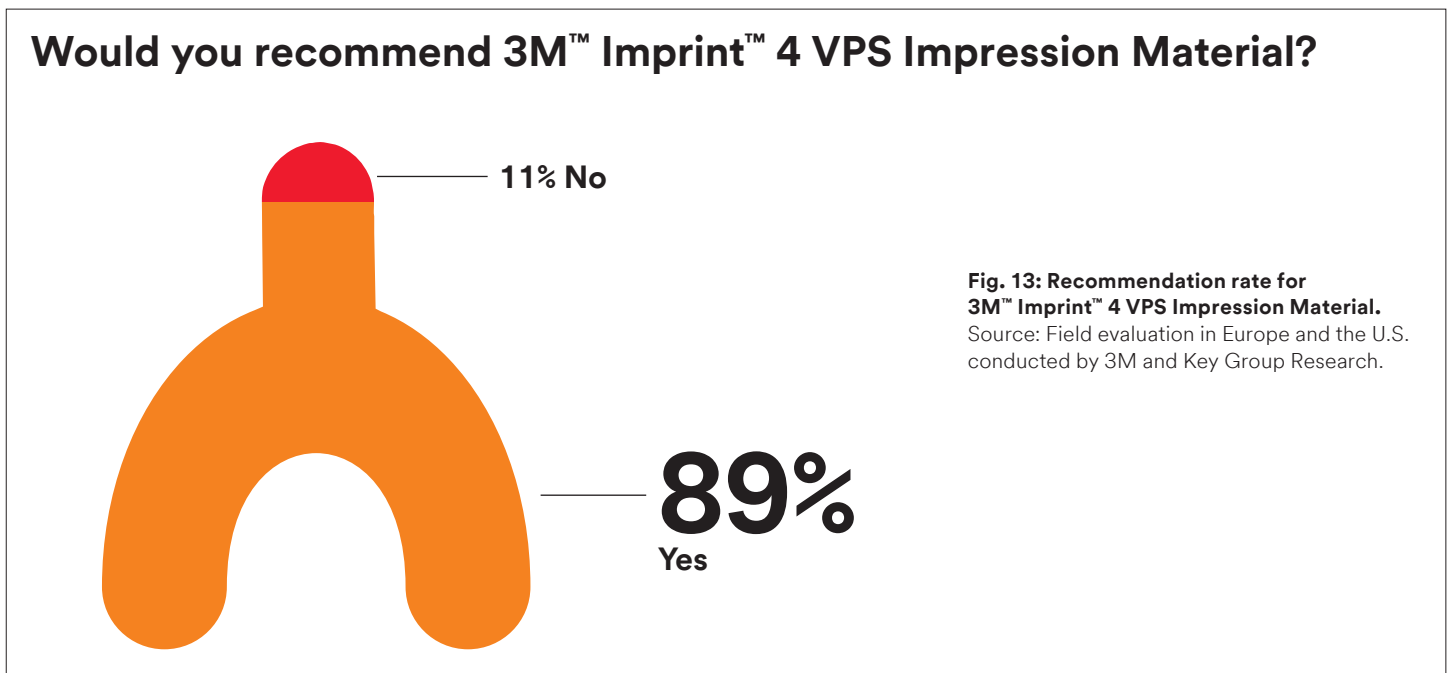
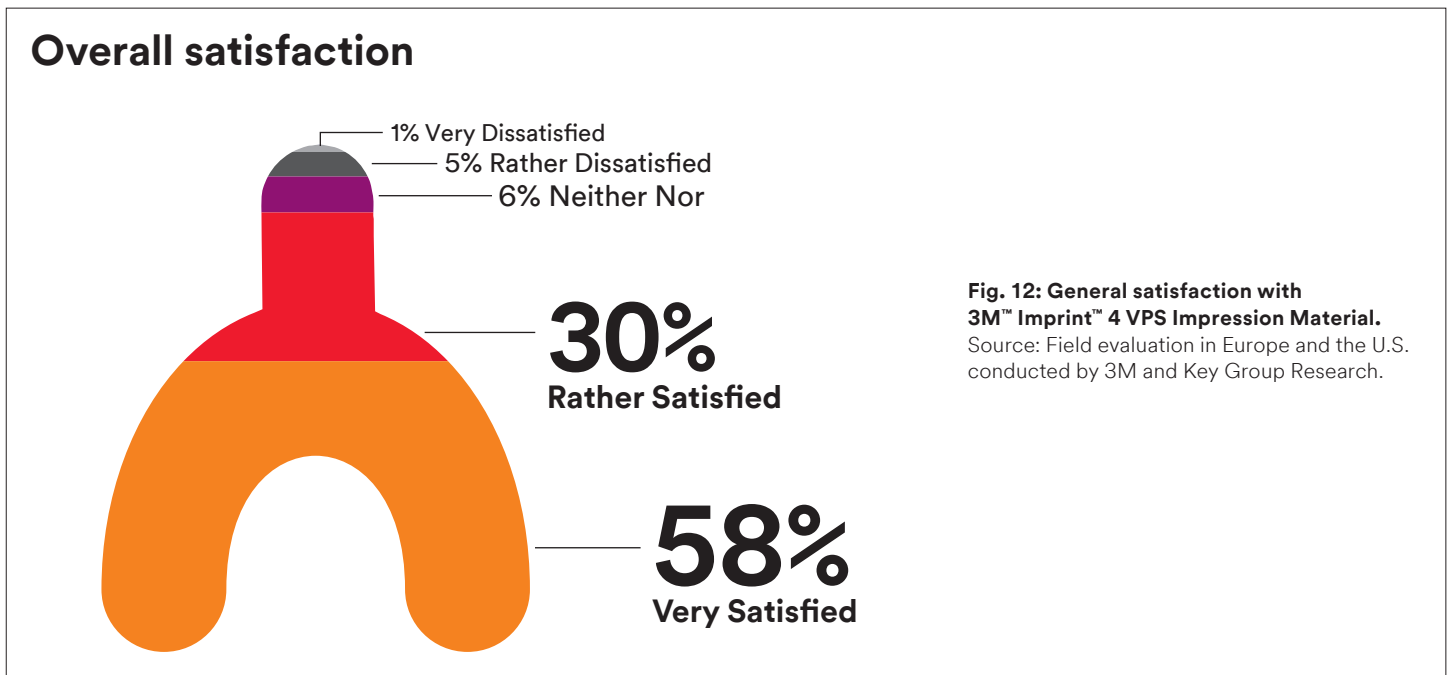
Overview mechanical properties

The following table provides an overview on the mechanical properties of selected Imprint 4 tray and wash materials:

Properties	3M™ Imprint™ 4 Penta™ Heavy (B#0015/C#0017)	3M™ Imprint™ 4 Light (B#0081/C#7513043)
Consistency A+B [mm] (ISO 4823)	32	44
Elastic recovery [%] (ISO 4823)	99.4	99.8
Strain in compression [%] (ISO 4823)	2.5	4.2
Detail reproduction (ISO 4823)	Pass	Pass
Linear Dimensional Change [%] (ISO 4823)	- 0.39	- 0.36
Shore hardness after 15min (ISO 7619-1)	65	50
Shore hardness after 24hs (ISO 7619-1)	69	52
Tensile strength after 24hs [MPa] (3M internal)	–	3.21
Contact angle set material (drop age of 10s) [°] (3M internal)	11	9

Clinical results

In an in-office evaluation, more than 3000 impressions were taken with 3M™ Imprint™ 4 VPS Impression Material. 300 dentists from four countries – Germany, France, Italy, and the U.S. – participated in the evaluation. The dentists’ feedback confirms the very high clinical acceptance: 88% of the testers were very satisfied or satisfied with Imprint 4 VPS material (Fig. 12). **89% would recommend Imprint 4 VPS impression material to their colleagues** (Fig. 13).



The short intra-oral setting time, combined with adequate working time (Figs. 14 and 15), was mentioned as one of the most significant application benefits. Impression accuracy including high detail reproduction (Figs. 16 and 17) was another reason for dentists' overall satisfaction with Imprint 4. Imprint 4 material delivers extremely detailed and precise impressions thanks to its hydrophilicity, and thus allows for reliable and high-quality impression taking even under challenging moist conditions.

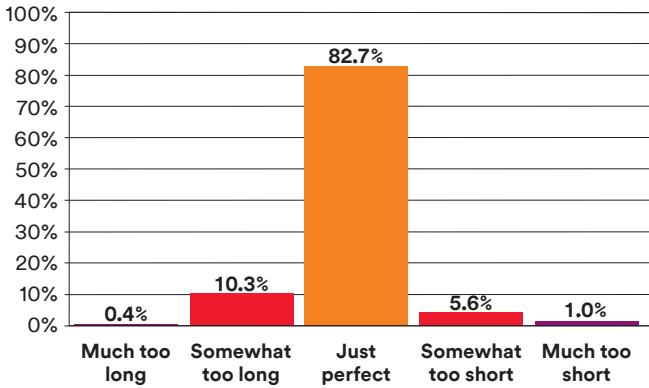


Fig. 14: Dentists' ratings for working time of 3M™ Imprint™ 4 Tray and Wash Materials. Source: Field evaluation in Europe and the U.S. conducted by 3M and Key Group Research.

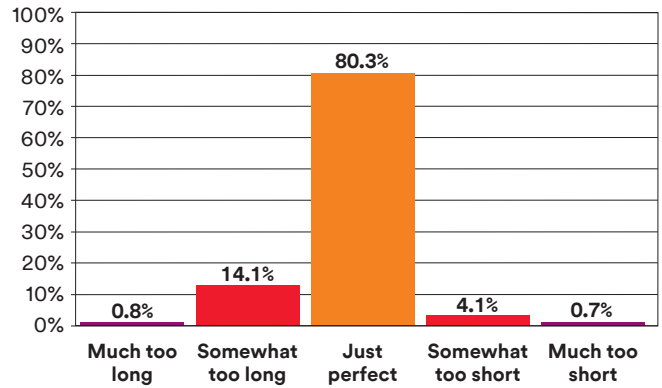


Fig. 15: Dentists' ratings for intra-oral setting time of 3M™ Imprint™ 4 Tray and Wash Materials. Source: Field evaluation in Europe and the U.S. conducted by 3M and Key Group Research.

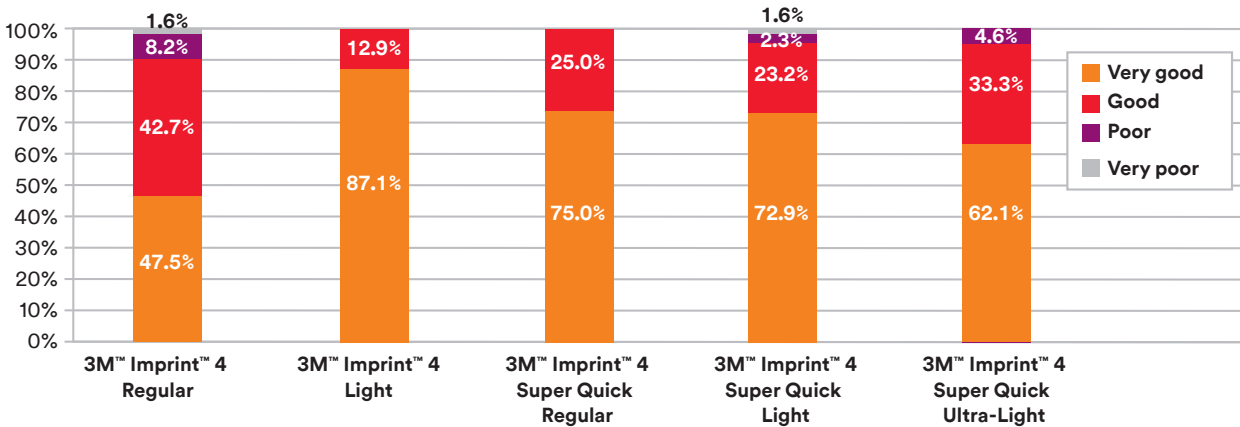


Fig. 16: Detail reproduction of 3M™ Imprint™ 4 Wash Materials. Source: Field evaluation in Europe and the U.S. conducted by 3M and Key Group Research

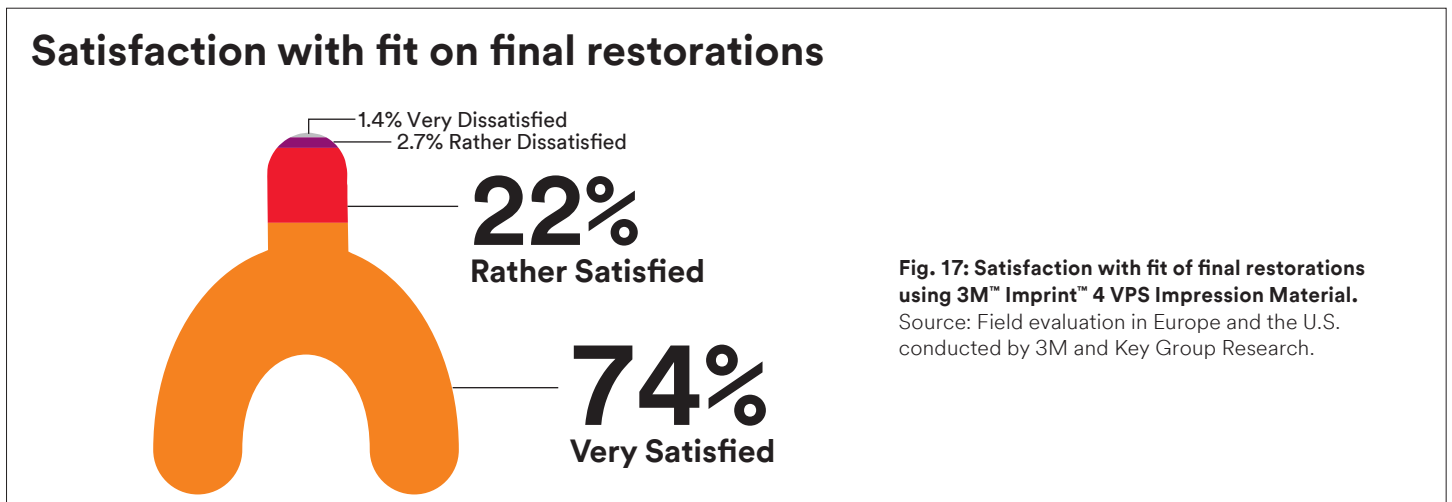


Fig. 17: Satisfaction with fit of final restorations using 3M™ Imprint™ 4 VPS Impression Material. Source: Field evaluation in Europe and the U.S. conducted by 3M and Key Group Research.

Clinical case

Replacement of an insufficient glass ceramic inlay

Dr. Gunnar Reich, Munich, Germany



1 Initial situation: glass ceramic inlay at tooth 46 needs to be replaced due to chipped disto-lingual ridge and insufficient margins.



2 3M™ Astrigent Retraction Paste is injected into the sulcus for hemostasis and gingiva displacement.



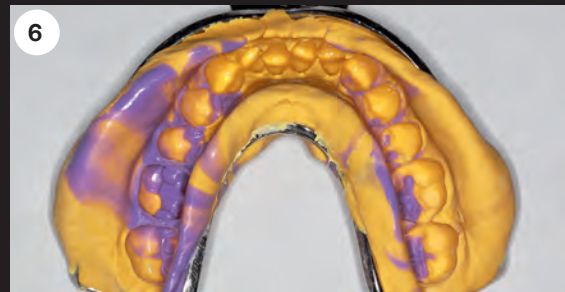
3 To achieve optimum results, 3M™ Astrigent Retraction Paste is left on for 2 minutes.



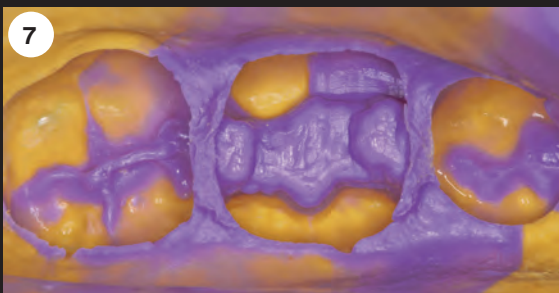
4 Situation ready for impression taking.



5 3M™ Imprint™ 4 Super Quick Light is syringed around the preparation using 3M™ Intra-oral Syringe Green.



6 Precision impression made in the 1-step heavy body/light body technique using 3M™ Imprint™ 4 Penta™ Super Quick Heavy (tray material) and 3M™ Imprint™ 4 Super Quick Light (wash material).



7 Impression detail of the preparation area.



8 Final 3M™ Lava™ Ultimate onlay restoration.

Warranty

3M warrants this product will be free from defects in material and manufacture at the time of purchase. 3M 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's sole obligation shall be repair or replacement of the 3M product.

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