

A collection of scientific results



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Impregum™

Polyether Impression Material



**3M** ESPE

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# Impregum™

## Polyether Impression Material

### Introduction

Dear Dental Professional,

As the worldwide leader in impression materials, 3M ESPE strives to be the partner of choice for precision impressions with innovative products of the highest quality as demonstrated by the evolution of the Impregum polyether impression material line.

Introduced in the mid-1960's, polyether materials have become well respected for their high level of precision and dimensional stability. Through a continuous innovation process, polyether materials have become significantly easier to handle. The Impregum™ Penta™ Soft Polyether product line introduced in 2000 achieved major improvements with respect to removal and taste.

With the launch of Impregum™ Penta™ Soft Quick Step Polyether in 2004, 3M ESPE answered the market demand for a fast-setting polyether impression material especially suited for one and two cases.

Now, in 2009, we supplement our portfolio with Impregum™ Soft Polyether Tray Material, conveniently delivered by hand dispenser. As with the Pentamix™ Automatic Mixing Unit delivery option, the hand dispenser offers the same unique chemistry of our other polyether soft materials—best initial hydrophilicity, excellent flow properties, and unique snap-set behavior—for capturing fine detail even in moist conditions.



Dr. Al Viehbeck

Best Regards

**Dr. Al Viehbeck**

3M ESPE Global Technical Director

St. Paul, MN and Seefeld, Germany

January 2009

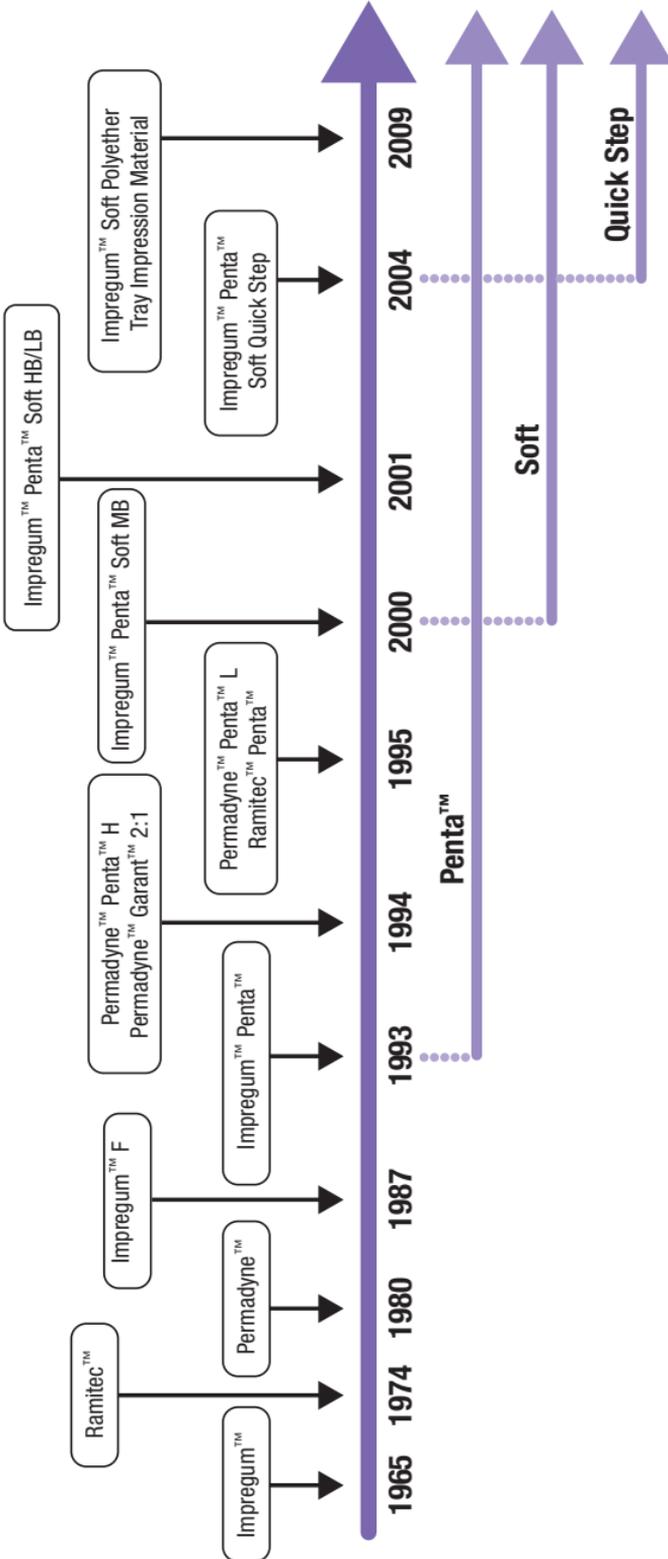
Impregum Soft polyether has proven itself in both the clinical and laboratory setting as demonstrated by this collection of internal and independent studies from around the globe. Based on the data contained in the referenced abstracts and articles, we have provided graphics, “Aim of Study” and “Results of the Study” to visualize and summarize the results. In the text and graphics branded products of various companies are mentioned. Trademarks owned by 3M Company or 3M ESPE AG are listed on the back page of this brochure. All other trademarks are owned by other parties.

This impressive collection of data demonstrates the performance of Impregum polyether impression material, but the best way to understand how this translates into clinical success is to try it yourself. I am confident that you will soon understand why we are proud to offer you the Impregum family of products.

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## Polyether Family Timeline



# Impregum™

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## Official Ratings

1



# Impregum™

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## 1. Official Ratings

1



**THE DENTAL ADVISOR**  
2007 and 2008 Preferred Product  
Vol. 22, No. 5, June 2005  
(Reprints available)

After evaluation by 33 dentists in 230 clinical applications, THE DENTAL ADVISOR awarded Impregum™ Penta™ Soft Quick Step the rating of 4½+.

All categories evaluated were ranked as very good to excellent overall. Among the most-liked features were the even consistency of the mixed material, adequate working time, the color contrast of the heavy and light bodies, and the rigidity of the final impressions. The improved taste compared to other polyethers and the fast setting time were appreciated by most consultants. Detail of final impressions is excellent and margins are easy to read.



**REALITY NOW**, Vol. 19, March 2005  
(Reprints available)

Impregum Penta Soft polyether impression material was evaluated and RATED 4-STARS for 2005 by **REALITY**.

Evaluators remarked on the great flow and that it fills the shark fin test easily, and the increased flexibility makes it significantly easier to remove from the mouth.

### CRA Newsletter, June 2005

Evaluators of an independent research institute specifically remarked on the improved taste of the mint flavored polyether impression material as well as the short intraoral set time.

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## Clinical Features

2



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## 2. Clinical Features

### Indications:

Impregum™ Penta™ Soft and Impregum™ Penta™ Soft Quick Step are well suited for precision impressions, in particular for the following applications:

2

Indications	Impregum™ Penta™ Soft	Impregum™ Penta™/Garant™ Soft H/L	Impregum™ Penta™ Soft Quick Step	Impregum™ Penta™ Soft H/L Quick Step
Impressions of inlay, onlay, crown and bridge preparations	●	●	✱	✱
Functional impressions	●	●		
Implant impressions	●	●	✱	✱
Fixation impressions	●	●	✱	✱

✱ particularly well suited for impressions of 1 or 2 preparations/units

### Features and Benefits:

#### Features

#### Benefits

#### Features of the “Quick” Line

- Maximum working time of 1 minute
- Intraoral setting time of 3 minutes
- Saves your practice time and money
- Faster chair time for patient and dentist

#### Generation “Soft” Features

- Less rigid polyether
- Fresh mint flavor
- Easier to remove for dentist and lab
- Maintains proper rigidity for a wide range of applications
- More pleasant for patient

#### General Polyether Features

- Initially hydrophilic
- Excellent flow properties
- Snap-set behavior
- Provides precise impressions in moist conditions
- Captures fine detail for precise impressions
- Provides restorations which fit precisely without distortions
- Reduces the need for costly adjustments, remakes and retakes
- Produces finely detailed impressions for a better-fitting prosthesis
- Helps get an accurate impression on the first take

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## 2. Clinical Features — Hydrophilicity

2

When an impression material is hydrophilic, it has a strong affinity for water which contributes significantly to the precision and reproduction of detail. It is especially clinically relevant when the material flows to the teeth and gum tissue (i.e. tray insertion), during the intraoral working time and before the material is set.

### Hydrophilicity of *Unset* Impression Materials:

A video measurement of the contact angles was taken at 25 data points per second, and compared. The photos below show a water droplet after placement on each impression material.

#### Impregum™ Soft Quick Step LB



- Polyether is intrinsically hydrophilic
- Polyether surface is initially hydrophilic, so there is immediate contact with moist teeth and tissue. This provides exact detail on moist surfaces

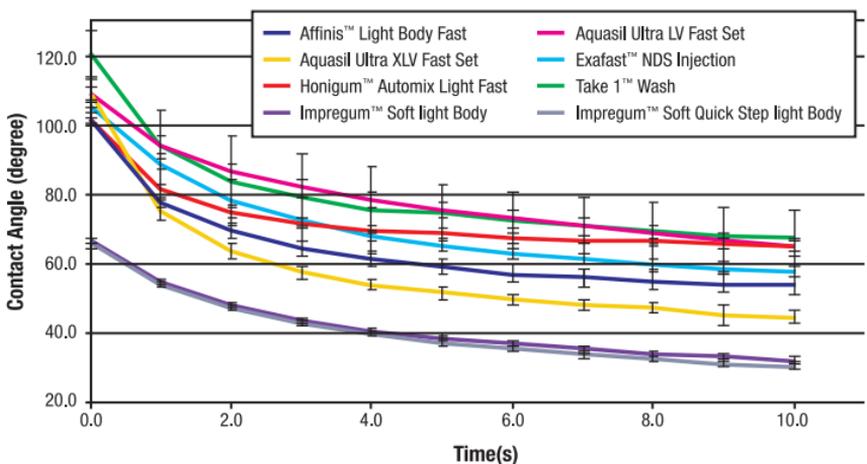
#### Aquasil Ultra LV Fast Set



- VPS materials are intrinsically hydrophobic, surfactants are responsible for spreading the water drop
- Newly built surface of VPS materials is initially hydrophobic, surfactants migrate to the moisture on the surface and then the water drop spreads

### Contact Angles of *Unset* Light Body Impression Materials:

Impregum™ is more hydrophilic than VPS materials.



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## 2. Clinical Features — Flow Properties

**2**

Excellent flow behavior of the impression material is needed during working time — especially at the end of syringing when the tray is placed. With a 1-step technique, excellent flow of light body material is necessary because the pressure to force the material into place is low for the following reasons:

- Tray may not be customized
- Dual arch trays
- Clinical situation (e.g. diastema)

### Shark Fin Test:

The Shark Fin Test is a test method to measure flow characteristics of impression materials. This test method accurately mimics the clinical behavior. Measurements were done at two different times, both at room temperature: the first after 25 seconds, and the second at the end of the working time recommended by the manufacturer.

#### Step 1



#### Step 2



#### Step 3



#### Step 4



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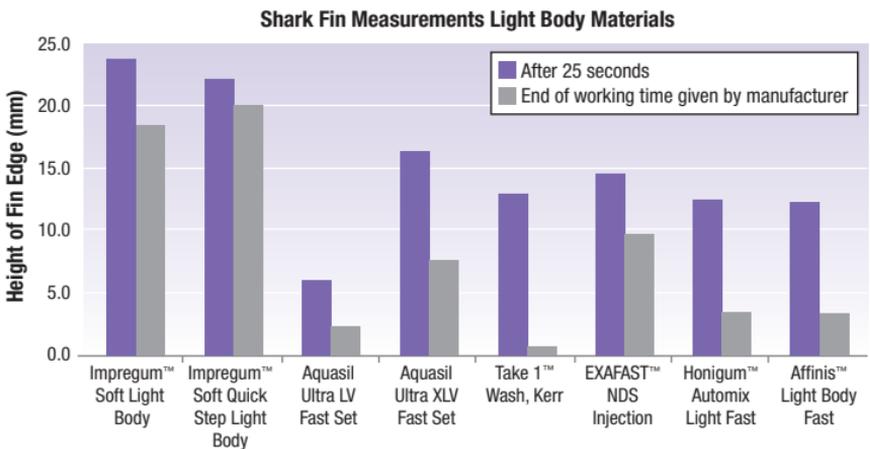
## 2. Clinical Features — Flow Properties

### The Shark Fin Test Proves It



2

Impregum™ Penta™ Soft polyether flows better into the toughest spots — yet does not slump — capturing more detail than any VPS for more precise impressions.



Richter B., Kuppermann B., Führer C., Klettke T. "Flow Properties of Light Bodied Impression Materials During Working Time". *CED/NOF/IADR 2004 #142*.

**During the whole working time, polyether impression materials show a significantly superior flow behavior as compared to VPS.**

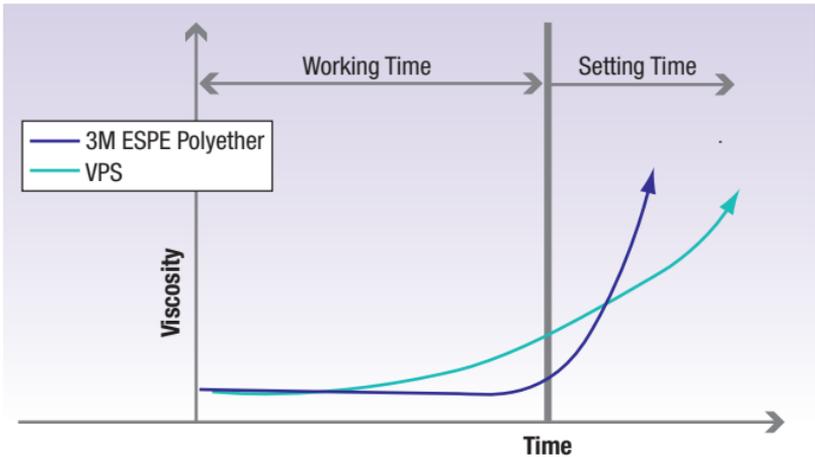
**2. Clinical Features — Snap-Set Behavior**

2

In the context of impression materials the term “snap-set” refers to the rapid transition from the unset to the set state, as shown below. In terms of rheology, snap-set can best be described as the sudden transition from an extended preservation of plasticity to the manifestation of elasticity.

This snap-set behavior — which is typical for polyether impression materials — ensures the material will not start setting before the working time ends, and when it does set, it does so immediately, resulting in precise-fitting restorations without distortion.

**Snap Set**



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## In Vivo Research

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## 3. In Vivo Research — Precision

### Precision of Fast-Set Impressions — Randomized Controlled Clinical Trial

**Authors:** H. Rudolph, S. Quaas and R.G. Luthardt, Medizinische Fakultät der Universität Ulm, Germany; M. Koch, J. Preißler, R. Koch, Technische Universität Dresden, Medizinische Fakultät Carl-Gustav-Carus, Germany.

**Reference:** IADR/CED/ID #16 (2007).

#### **Aim of the Study:**

When fast-set impression materials are used for a one-stage impression technique, the clinical relevance of an exact timing for mixing, applying and syringing both material components is gaining importance. Aim of this clinical trial (RCT) was to determine the influence of a non-optimal timing on the precision of fast-set impressions. Primary objective was the precision of the three-dimensional (3D) tooth surface reproduction as well as the reproduction of the subgingival tooth surface.

#### **Results:**

Compared to the tested VPS (Aquasil Ultra) the machine-mixed polyether material showed a significantly higher precision in the distal lower jaw, where the influence of saliva, swallowing and deformation due to impression removal is increasing.

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## 3. In Vivo Research — Precision

### Performance of a Fast Setting Polyether Impression Material

Authors: S. Langdon, T. Klettke and B. Coalwell

Reference: *Expertise™ Scientific Facts 2006*. IADR #669 (2006).

3

#### Aim of the Study:

To compare the clinical performance of a fast setting polyether impression material with calibrated experienced polyether (PE) users and vinyl polysiloxane (VPS) users.

#### Results:

Dentists that currently use VPS were very favorable toward Impregum™ Penta™ Soft Quick Step fast setting polyether impression material: they indicated that precision and accuracy of fit of the restorations were excellent and better compared to their current material. Additionally, VPS users indicated that the detail reproduction of Impregum Penta Soft Quick Step impressions in the presence of blood/saliva was better compared to their current material.



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## Clinical Surveys — Results

4



**4. Clinical Surveys — Europe (2005)**

**Clinical Effectiveness of the Impression Material  
Impregum™ Penta™ Soft Quick Monophase**

Source: 3M ESPE Internal Data.

**4** **Aim of  
the Study:**

Evaluation of clinical effectiveness of the new polyether impression material Impregum Penta Soft Quick (3M ESPE).

The dentists were asked to compare precision and accuracy of fit of the restorations, precision and accuracy of restorations when taking impressions in the presence of blood/saliva, and the overall performance with the material they currently use.

**Results:**

Current Impregum Penta Soft users rated the overall performance, precision and accuracy of restorations when taking impressions in the presence of blood/saliva of the new fast-setting polyether Impregum Penta Soft Quick significantly higher; and precision and accuracy similar, compared to regular setting Impregum.

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## 4. Clinical Surveys — Europe (2005)

### Clinical Effectiveness of the Impression Material Impregum™ Penta™ Soft Quick Heavy Body/Light Body

Source: 3M ESPE Internal Data.

#### Aim of the Study:

Evaluation in 12 countries of clinical effectiveness of the new polyether impression material Impregum™ Penta™ DuoSoft™ Quick (3M ESPE).

Doctors were asked to compare precision and accuracy of fit of the restorations, precision and accuracy of restorations when taking impressions in the presence of blood/saliva, and the overall performance with the material they currently use.

#### Results:

Overall performance, as well as precision and accuracy in cases when blood/saliva was present of Impregum Penta DuoSoft Quick was rated higher compared to regular setting Impregum by current polyether users.

VPS (competitive) users stated better precision and accuracy in general and in cases when blood/saliva was present, as well as better overall performance compared to their currently used VPS impression material.

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## 4. Clinical Surveys — North America (2006)

### Six Sigma and You — Towards Fewer Crown Errors

**Authors:** S. Thorne, Pacific Dental Services, Inc. and S. Diogo, Editor in Chief, DPR.

**Reference:** *Dental Practice Report*. Volume 14. Number 2 (February 2006): 60–63.

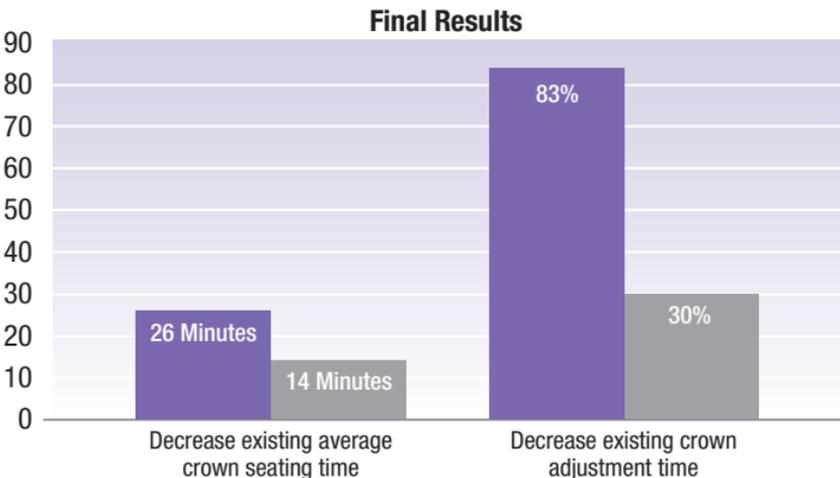
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**Aim of the Study:**

Six Sigma methodology was applied on the crown procedure and how it was being delivered in one particular practice, which consisted of three offices. One of the most critical inputs of the process was changed: the impression material used in the procedures. All existing impression materials were removed from the three PDS offices. In their place, 3M ESPE supplied the offices with Impregum™ Penta™ Soft Quick Step Impression Material and Pentamix™ 2 Mixing Units.

**Results:**

The change in impression material and the other process changes that were implemented resulted in a drop from 83% to 30% for crowns that needed adjustment. This 42% decrease in crown seating time because of their better fitting translates into an estimated potential \$48,000 increase in production each month.



# Impregum™ Polyether Impression Material

## 4. Clinical Surveys — North America (2005)

### Applying Six Sigma Process at HealthPartners Dental Group

Source: 3M ESPE Internal Data.

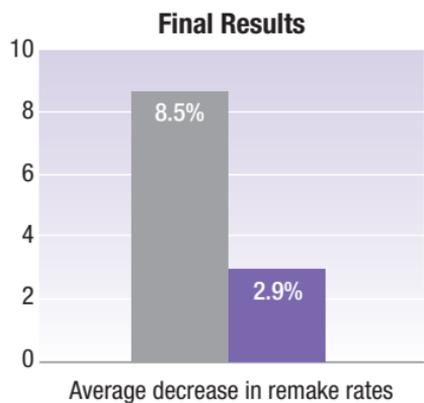
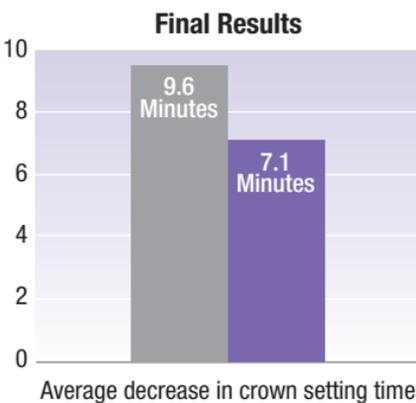
**Aim of the Study:**

Six Sigma methodology was applied on the crown procedure with a main objective to improve patients' crown and bridge experience. The study focused on 4 dental clinics involving 11 dentists. A total of 218 single-unit crown impressions were analyzed, first using existing impression materials and then using Impregum Penta Soft Quick Step Impression Material and Pentamix 2 Mixing Units.

4

**Results:**

Since utilizing Impregum Penta Soft Quick Step impression material and Pentamix 2 mixing units in the impression procedures, the average crown seating time decreased from 9.6 to 7.1 minutes. The average remake rate decreased from 8.5% to 2.9%.



# Impregum™

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## 4. Clinical Surveys — North America (2004)

### Clinical Effectiveness of a Fast Setting Polyether Impression Material

Source: 3M ESPE Internal Data.

- 4 Aim of the Study:** Compare the clinical effectiveness of a fast setting polyether impression material with current polyether users and competitive vinyl polysiloxane users.
- The clinical effectiveness of the polyether material was measured by rating: the precision and accuracy of fit of the final restoration as excellent, precision and accuracy of fit of final restorations as better than current material, and detail reproduction of final impression in presence of blood/saliva as better than current material.
- Results:** VPS users (competitive) were very favorable toward Impregum™ Penta™ Soft Quick Step fast setting polyether impression material. Vinyl polysiloxane users indicated that precision and accuracy of fit of the restorations were excellent and better than their current material. Additionally, VPS users (competitive) indicated that the detail reproduction of Impregum Penta Soft Quick Step impressions in the presence of blood/saliva was better than their current material.

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### Evaluations Reveal VPS Users an Excellent Market for New Impression Material

Source: 3M ESPE Internal Data.

- Aim of the Study:** 3M ESPE initiated a field test with over 1,000 dentists with Impregum™ Penta™ Soft Quick Step medium body and Impregum Penta Soft Quick Step heavy body/light body.
- Results:** The respondents stated (combined agree/strongly agree response) tear strength values were excellent (84%), detail reproduction was excellent (82%), precision and accuracy of fit of the final restorations were excellent (84%). 68% of VPS users indicated it is “somewhat” or “much” better than what they use now.

# Impregum™

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## Testimonials

5



## 5. Testimonials — Europe

“Fast-setting, neutral taste, good removal from mouth, high precision. Very good improvement of Polyether impression materials; good, easy handling; very good and precisely fitting impressions.”

– Dr. Robert Williams

5

“Excellent impression material for small to medium restorations with acceptable taste. From now on I will use this material for small to medium restorations, because its properties convinced me.”

– Dr. Frank Scholz

“Highly precise, optimal processing in Pentamix™, better taste. Highly precise material for manufacturing of very good prosthetic works, much appreciated by the lab, very good results.”

– Dr. Ingolf Scholz

“Highly precise impression with exact dosing and shorter time in mouth. The best impression material I have been using so far.”

– Dr. Uwe Rumpff

# Impregum™

Polyether Impression Material

## 5. Testimonials — North America

“When it comes to selecting an impression material for outstanding clinical results, Impregum™ Penta™ Soft Quick Step Impression Material from 3M ESPE is, by far, my product of choice. The accuracy and hydrophilicity of this fast-setting, user friendly impression material essentially eliminates the need to re-do impressions, greatly benefiting both doctor and lab technician. This product ensures clinical success.”

– Dr. Christopher A. Hooper  
Virginia Beach, VA

5

“3M ESPE has successfully addressed my major concerns — rigidity, taste, and set time — with the new Impregum Penta Soft Quick Step Impression Material for one- and two-unit cases. I used this product in a pinch when I couldn't get a good impression with other materials, and haven't gone back since. The accuracy and predictability are simply unsurpassed, and my impressions are developed faster and more efficiently than ever before. Creating an outstanding impression the first time, every time, has never been easier.”

– Dr. Brian Kinsey  
Atlanta, GA

“Success in clinical dentistry is not simply a question of luck or talent; it is a question of knowledge. With the new Impregum Penta Soft Quick Step Impression Material from 3M ESPE, I know that my impressions will be efficient, expedient and predictable. The true hydrophilic nature of this polyether impression material has simplified impression-taking to produce exquisite detail of my preparations — even in moist conditions — with the first and only impression”

– Dr. James Downs  
Denver, CO

## 5. Testimonials — North America

5

“Using Impregum™ Penta™ Soft Quick Step Impression Material from 3M ESPE, I have finally escaped the inconsistencies, retakes, and costly remakes experienced with other materials. This product enables me to capture detailed impressions on the first try and produce superior-fitting restorations with fewer adjustments. The finished cases not only look better, but are less stressful to produce for the doctor. Therefore, I can say this product is more than a good buy; it’s a bargain. I wouldn’t use anything else.”

– Dr. Joseph Schachner  
Bronx, NY

“Impregum Penta Soft Quick Step Impression Material from 3M ESPE performs very well in wet conditions, producing precise reproduction of detail. The faster setting time is a benefit to both the patient and the doctor, while labs enjoy the ability to pour multiple impressions without fear of distortion. Most importantly, the unsurpassed accuracy of this material allows me to provide my patients with well-fitting restorations that require fewer adjustments at the time of cementation.”

– Dr. John P. Goodman  
Kansas City, MO

“I’ve been a dentist for 33 years and am very particular about the impressions I take. I switched to 3M ESPE Impregum Penta Soft Quick Step Impression Material for my practice because of its outstanding flow properties, which enable me to create detailed impressions even in moist conditions. This leads to more accurate impressions and highly satisfied patients. Impregum Penta Soft Quick Step impression material is extremely accurate and easy to use; I’ve reduced my retakes by a substantial amount.”

– Dr. Steven Shwedel  
Taylor, MI

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Polyether Impression Material

## 5. Testimonials — North America

“Impregum™ Penta™ Soft Quick Step Impression Material from 3M ESPE offers unsurpassed detail and accuracy. The hydrophilic properties ensure that my impressions have outstanding marginal accuracy and integrity, despite the presence of bleeding and saliva. Superb handling also makes this material very easy and efficient to work with. I’ve saved a great deal of time in my practice by eliminating remakes, which makes Impregum Penta Soft Quick Step impression material my product of choice.”

– Dr. David DeGrave  
Green Bay, WI

5

“When I discovered 3M ESPE Impregum Penta Soft Quick Step Impression Material, I wasn’t looking for a new impression material but knew what I had been using wasn’t great. After trying Impregum Penta Soft Quick Step impression material for the first time, I was amazed. Now, after making the switch, I can get an accurate impression on the first take, eliminating the need for costly adjustments to the crowns I place. This fast-setting material is impressive and has cut time in my practice immensely.”

– Dr. Paul Nelson  
Fullerton, CA

“Partnering with 3M ESPE on clinical quality improvement has been a great opportunity for HealthPartners Dental Group. With access to new products and knowledge, our dental teams have increased satisfaction with clinical processes and deliver even better care to our patients.”

– Chas Salmen, DDS  
HealthPartners Dental Group

**5. Testimonials — North America**

“I use this impression material (Impregum™ Penta™) as the ‘work horse’ material in the office.”

– Dr. Izchak Barzilay  
Toronto, ON  
“Impression Materials in the  
Prosthodontic Practice”  
Oral Health (November 1999)

**5**

“I find Impregum very forgiving. It will work in many situations.”

– Dr. Izchak Barzilay  
Toronto, ON  
“Niagara-On-The-Lake, ON”  
Impression Trouble Shooting  
Lecture (2005)

# Impregum™

Polyether Impression Material

## In Vitro Research

6



## 6. In Vitro Research — Hydrophilicity

### Investigation of a New approach to Measuring Contact Angles for Hydrophilic Impression Materials

Authors: G. Kugel, T. Klettke, J.A. Goldberg, J. Benchimol, R.D. Perry and S. Sharma

Reference: *Journal of Prosthodontics*. 16 (2007): 84–92.

#### Aim of the Study:

6

To examine the initial water contact angles of seven unset impression materials using available equipment, in an effort to determine whether polyether impression materials (Impregum™) have lower contact angles and are, therefore, more hydrophilic than VPS impression materials.

#### Results:

Comparing the investigated impression materials revealed the initial contact angles to range from  $66.2 \pm 1.5^\circ$  to  $127.5 \pm 4.4^\circ$ , of which the Impregum™ Impression Material was lowest after 45 seconds ( $66.2 \pm 1.5^\circ$ ), 120 seconds ( $70.3 \pm 2.8^\circ$ ), and 24 hours ( $80.3 \pm 1.0^\circ$ ) after start of mix.

The polyether materials tested exhibited lower contact angles and, thus, significantly higher initial hydrophilicity than all measured VPS materials. Additionally, Impregum impression materials are more hydrophilic in the unset stage than in the set stage.

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## 6. In Vitro Research — Hydrophilicity

### Pre- and Post-set Hydrophilicity of Elastomeric Impression Materials

**Authors:** K.X. Michalakis, A. Bakopoulou, H. Hirayama, D.P. Garefis and P.D. Garefis

**Reference:** *Journal of Prosthodontics*. 16 (2007): 238–248.

**Aim of the Study:** To evaluate the hydrophilicity of one Polyether (Impregum), four poly (vinyl siloxanes), and one condensation silicone before and after setting under simulated clinical conditions, and to correlate the findings to the contact angles of these materials.

**Results:** Polyether (Impregum) was the most hydrophilic of all materials tested.

6

### Initial Water and Saliva Wettability of Elastomeric Impression Materials

**Authors:** F. Rupp, A.M. Martin, I. Stephan, D. Axmann and J. Geis-Gerstorfer

**Reference:** *Expertise™ Scientific Facts 2007*. IADR #1621 (2007).

**Aim of the Study:** One very important feature for impression materials is their hydrophilicity. From a clinical perspective, this is of major importance during intraoral application within the working time. Previously reported contact angle measurements (IADR 2004 #1385, IADR 2005 #3084) used water as the fluid and showed that Impregum impression materials have the highest wettability in the unset stage. This study compared contact angles measured using water with those measured using artificial saliva.

**Results:** Water contact angle data are comparable to those of saliva. The study confirms the superior hydrophilicity of Impregum impression materials under clinically relevant conditions.

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## 6. In Vitro Research — Hydrophilicity

### Applicable Research in Practice: Understanding the Hydrophilic and Flow Property Measurements of Impression Materials

Authors: R.D. Perry J.A. Goldberg, J. Benchimol and J. Orfanidis

Reference: *Compendium*. 27 (2006): 582–586.

**Aim of the Study:** The study investigates the hydrophilic and flow behavior of impression materials.

**6 Results:** Impregum™ is most hydrophilic and most flowable compared to the VPS materials investigated. An extensive clinical case with 8 single-unit Lava™ Crowns illustrates the high clinical relevance of Impregum's excellent flow properties and hydrophilicity. The precision impression with Impregum™ Penta™ Soft Quick Polyether Impression Material has earned the appreciation of the dental technician for its detailed accuracy.

---

### Quantifying Wetting Characteristics of Hydrophilized VPS and Polyethers During the Application Phase

Authors: F. Rupp, H.R. Lee, M. Groten and J. Geis-Gerstorfer, University of Tübingen, Germany

Reference: *Deutsche Zahnärztliche Zeitschrift* (2005): 60, 587–992.

**Aim of the Study:** To characterize the wetting ability of VPS and polyether impression materials during the application phase.

**Results:** In contrast to VPS impression materials 3M ESPE polyether impression materials showed the highest and most constant hydrophilicity during the whole working time.

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## 6. In Vitro Research — Hydrophilicity

### Hydrophilicity of Elastomeric Non-Aqueous Impression Materials During Setting

Authors: F. Rupp, D. Axmann, A. Jacobi, M. Groten and J. Geis-Gerstorfer

Reference: *Dental Materials*. (2005): 21, 94–102.

**Aim of the Study:** To develop an experimental set-up and analysis strategy for wettability measurements of impression materials during their working time.

**Results:** In contrast to VPS impression materials 3M ESPE's polyether impression materials show pronounced and constant initial hydrophilicity throughout prescribed working time.

6

### Comparison of Hydrophilic Measurements of Impression Material During Working Time

Authors: J. Goldberg, J. Benchimol, R. Perry and G. Kugel, Tufts University School of Dental Medicine, Boston, MA, USA

Reference: *Expertise™ Scientific Facts 2005*. IADR #3084 (2005).

**Aim of the Study:** One important feature for impression materials is their hydrophilicity. From the clinical point of view this is of major importance concerning the working time. Therefore this study conducted initial contact angle measurements at an early stage of working time and at the end of working time as stated by the manufacturer. In this study regular set light-bodied impression materials were compared.

**Results:** This study emphasizes the superior hydrophilicity of the polyether materials. Impregum™ Garant™ Soft light body showed significantly lower contact angles than all other tested materials independent of the time of measurement.

## 6. In Vitro Research — Hydrophilicity

### “Flow” of Impression Materials with 2mm Slit at End-Working-Time

**Authors:** J. Benchimol, R. Perry, G. Kugel and S. Ferreira, Tufts University School of Dental Medicine, Boston, MA, USA

**Reference:** *Expertise™ Scientific Facts 2005*. IADR #3048 (2005).

#### Aim of the Study:

Good flow properties of light-bodied impression materials may facilitate impression making especially in deep sulcular areas. This study used the 2mm shark-fin method to determine the flow characteristics of different light-and ultralight-bodied impression materials at the end of working time, when it is clinically most relevant as the tray is inserted and the syringing material is pushed into the sulcus.

#### Results:

The results of this study validate statistically superior flow properties of the new quick setting Impregum Soft Quick Step light body polyether material in comparison to seven VPS impression materials.

# Impregum™

Polyether Impression Material

## 6. In Vitro Research — Hydrophilicity

### Hydrophilicity of Fast Setting Impression Materials During Working Time

**Authors:** R. Guggenberger, T. Klettke, C. Führer, B. Gangnus and D. Ranftl, 3M ESPE AG, Seefeld, Germany

**Reference:** *Expertise Scientific Facts 2005*. IADR #1822 (2005).

#### Aim of the Study:

Hydrophilicity is one key feature of impression materials. The methodology of examining the hydrophilicity using contact angle measurements on unset material is known, but parameters were not studied on a broad range yet. This study evaluated the hydrophilicity on fast setting impression materials as a function of the water droplet volume used in the video analysis test.

#### Results:

The water droplet volume size influenced the measured contact angle values. However, for all experiments the new quick setting polyether impression material Impregum™ Soft Quick Step light body material was more hydrophilic than the VPS material investigated.

**6. In Vitro Research — Hydrophilicity****Hydrophilic Changes Characterizing The Working Time of Different Elastomeric Impression Materials**

**Authors:** F. Rupp, A. Jacobi, M. Groten and J. Geis-Gerstorfer, Dental Clinic, University of Tübingen, Germany

**Reference:** *Expertise™ Scientific Facts 2005*. IADR #1204 (2005).

**Aim of the Study:**

Hydrophilicity of impression materials is required for good clinical performance under moist oral conditions. Contact measurements are mostly done at an early stage of working time. This study evaluated the contact angles as function of working time/polymerization degree.

**Results:**

While VPS materials significantly decrease in hydrophilicity with a higher polymerization degree, the polyether impression materials Permadyne™ Garant™ 2:1 and Impregum™ Garant™ L DuoSoft™ showed a consistent hydrophilicity during working time. This supports the clinical advantage of polyethers under moist oral conditions.

# Impregum™

Polyether Impression Material

## 6. In Vitro Research — Hydrophilicity

### Initial Hydrophilicity of Impression Materials Before, During And After Setting

**Authors:** T. Klettke, C. Führer, B. Richter and D. Ranftl, 3M ESPE AG, Seefeld, Germany

**Reference:** *Expertise™ Scientific Facts 2005*. IADR #169 (2005).

**Aim of the Study:**

One important feature for impression materials is their hydrophilicity. From the clinical point of view this is of major importance within the working time. Therefore this study conducted initial contact angle measurements not only after setting is usually done, but also before and during the setting reaction.

**Results:**

This study highlights the superior hydrophilicity of the polyether materials Impregum™ Soft Quick Step light body and Impregum™ Garant™ Soft light body within and after working time.

6

### Hydrophilicity of Precision Impression Materials During Working Time

**Authors:** T. Klettke, B. Kuppermann, C. Führer and B. Richter, 3M ESPE, Seefeld, Germany

**Reference:** *Expertise™ Scientific Facts 2005*. CED #141 (2004).

**Aim of the Study:**

To evaluate the hydrophilicity of Impregum™ Soft Quick Step light body and the regular setting Impregum™ Garant™ Soft light body in the clinical important unset stage compared to seven other precision impression materials.

**Results:**

The Impregum Soft Quick Step light body and the Impregum Garant Soft light body are superior regarding hydrophilicity in the unset stage. This enables working even under difficult moist oral conditions.

## 6. In Vitro Research — Hydrophilicity

### Initial Hydrophilicity of 15 Type 3 Impression Materials During Setting

**Authors:** J. Geis-Gerstorfer, H.R. Lee, D. Axmann and F. Rupp, University of Tübingen, Germany

**Reference:** *Expertise™ Scientific Facts 2004*. IADR #1385 (2004).

#### Aim of the Study:

Hydrophilic properties of impression materials are essential in terms of initial wettability, detail reproduction, quality of pouring etc. and therefore to clinically receive high qualitative impressions. Not only contact angles at different times, but also the changes in hydrophilicity during polymerization do influence the hydrophilic behavior. Comparing polyether and VPS materials in their behavior was the aim of this study.

#### Results:

The tested polyether impression materials showed lowest contact angles initially as well as at the end of the evaluation period. Both polyether materials and one group of silicone materials had only small changes in hydrophilicity during the working time while one group of VPS materials decreased significantly in hydrophilicity while contact angles increases within the first 180 seconds after mixing.

# Impregum™

Polyether Impression Material

## 6. In Vitro Research — Hydrophilicity

### Changes in Water Contact Angles During the First Phase of Setting of Dental Impression Materials

Authors: M. Mondon and C. Ziegler, University of Kaiserslautern, Germany

Reference: *Int J Prosthodont.* (2003): 16: 49–53.

**Aim of the Study:** Examination of the changes in wettability of dental impression materials during setting.

**Results:** Impregum™ Penta™ Soft showed a more hydrophilic behavior during the process of setting compared to Aquasil and can therefore be expected to exhibit better flow properties.

6

### Wettability, Imbibition, and Mass Change of Disinfected Low-Viscosity Impression Materials

Authors: X. Lepe, G.H. Johnson, J.C. Berg, T.C. Aw and G.S. Stroh

Reference: *J of Prosth Dent.* Volume 88. Number 3 (2002): 268–276.

**Aim of the Study:** The study compared wettability, imbibition, and mass change of various automixed low-viscosity VPS (Affinity™, Take 1™, Imprint II, Aquasil LV) and polyether materials (Permadyne™ Garant™ 2:1, Impregum™ Garant™ Soft light body).

**Results:** 3M ESPE polyether impression materials were the most wettable over all.

# Impregum™

Polyether Impression Material

## 6. In Vitro Research — Flow Properties

### “Flow” Under Pressure of Four Impression Materials Using Shark-Fin Device

Authors: M.S. Kim, E.H. Doherty and G. Kugel

Reference: *J Dent Res.* 80. AADR Abstracts #624 (2001).

**Aim of the Study:** To test the flow of different impression materials under pressure using the shark fin device (weight 422g).

**6 Results:** Impregum™ Penta™ and Impregum™ Penta™ Soft Impression Materials showed the greatest flow.

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### Flow of Impression Materials During Working Time

Authors: J.L. Durack, C. Hudson, B. Kuppermann and T. Klettke

Reference: *Expertise™ Scientific Facts 2008.* IADR #3191 (2008).

**Aim of the Study:** To compare the flow of Impregum™ Soft Polyether Tray Impression Material delivered from the hand dispenser and a commercial automixable Impregum with commercial VPS impression materials.

**Results:** Impregum impression materials exhibited higher flow than the VPS tested.

# Impregum™

Polyether Impression Material

## 6. In Vitro Research — Flow Properties

### Flow Characteristics of Polyvinylsiloxane (VPS, A-silicones) and Polyether in the Modified Shark Fin Test

Authors: M.V. Pastau, F. Rupp and J. Geis-Gerstorfer

Reference: *Deutsche Zahnärztliche Zeitschrift*. 62 (2007): 685–689.

**Aim of the Study:** To study the influence of temperature on the setting of the impression materials.

**Results:** The study confirmed the high influence of the temperature on the flow properties and the polymerization, respectively. Clinically relevant is the fact, that the working time (defined by limit values at 21°C) of the tested Polyvinylsiloxane (VPS, A-silicones) is below 120 seconds and of Impregum above 180 seconds.

6

### Flow of Fast and Regular Set Elastomeric Impression Materials

Authors: Hadley, N.C. Lawson, J.O. Burgess and L.C. Ramp

Reference: *Expertise™ Scientific Facts 2007*. IADR #1630 (2007).

**Aim of the Study:** The study used the shark fin method to measure the flow of regular and fast setting light bodied impression materials. Measurements were conducted at mouth temperature (37°C) in intervals of 30 seconds from 30 seconds to 210 seconds.

**Results:** This study validates the very high flow of Impregum over a prolonged period of time under clinically relevant conditions.

# Impregum™

Polyether Impression Material

## 6. In Vitro Research — Flow Properties

### Flowability of Impression Materials During Working Time

Authors: K. Ohkuma, R.A. Yapp and J.M. Powers

Reference: *Expertise™ Scientific Facts 2007*. IADR #1618 (2007).

#### Aim of the Study:

The monophasic and 1-step heavy/light-body impression techniques in particular require a light bodied impression material with high flow. This study used the shark fin tool to determine flow properties under dry vs. wet conditions. Affinity™ VPS Light Body HF and Impregum™ Garant™ L DuoSoft™ were compared.

#### Results:

Impregum showed very high flow throughout its entire working time in contrast to the VPS material. In the shark fin test, Impregum had higher flow in the wet environment after 30 seconds. High flow throughout the working time of an impression material, especially in a wet environment, is an indicator of predictable clinical results.

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### Measuring Flow of Regular Set Impression Materials Using Oscillating Rheometer

Authors: S. Stipho, C. Maiolo, W. Jones, R. Perry and G. Kugel

Reference: *Expertise™ Scientific Facts 2007*. PEF #564 (2006).

#### Aim of the Study:

To measure the ratio of plastic ( $G''$ ) and elastic ( $G'$ ) properties of eight regular set impression materials during the whole working time to determine the best flowable materials.

#### Results:

Impregum™ and Examix™ showed the best flow with highest  $d$  values. After 1 min. 15 sec. elapsed, only Impregum continued to retain the most plastic behavior while the other materials became more elastic. This shows that Impregum has the most flowability and would indicate high clinical reliability during working time.

# Impregum™

Polyether Impression Material

## 6. In Vitro Research — Flow Properties

### Flow of Fast and Regular Set Elastomeric Impression Materials

Authors: J.C. Broome, J.O. Burgess and N.C. Lawson

Reference: *Expertise™ Scientific Facts 2007*. PEF #324 (2006).

**Aim of the Study:**

This study used the shark fin tool as a measurement device. Tests were performed at 98.6°F to simulate mouth temperature. Measurements were carried out at 60, 90, 120, 180 and 240 seconds.

**Results:**

The results of this study validate the superior flow of Impregum over a prolonged period of time under clinically relevant conditions.

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### Comparison of Impression Materials Using Shark-Fin Test

Authors: E. Coccia, G. Rapelli, L. Scalise, L. Pallotto and A. Putignano

Reference: *Expertise™ Scientific Facts 2007*. PEF #323 (2006).

**Aim of the Study:**

To compare the flow properties of different impression materials using the shark-fin test.

**Results:**

The flow properties of light bodied materials were significantly higher than those of heavy bodied materials. In regard to different time elapsed since the start of mix, all materials (except for Permadyne™ Garant™ 2:1 and Impregum™ Garant™ L DuoSoft™) showed a significantly reduction of flow ability.

# Impregum™

Polyether Impression Material

## 6. In Vitro Research — Flow Properties

### Flow of Impression Materials Using REALITY-Method with 1.0mm Slit-Size

Authors: S. Stipho, C. Maiolo, S. Sharma, R. Perry and G. Kugel, Tufts University School of Dental Medicine, Boston, MA, USA

Reference: *Expertise™ Scientific Facts 2006*. AADR #413 (2006).

#### Aim of the Study:

6

Excellent flow properties of impression materials facilitate impression making especially in sulcular areas. Clinically relevant flow characteristics may depend on the chemical composition as well as on the curing mechanism employed. The study evaluated the flowability of seven regular setting light body/heavy body combinations which are indicated for 1-step impression technique using the shark-fin tool and REALITY-test method (slit size 1.0mm, mouth temperature). Three different types of materials were investigated: polyether cured via cationic ring-opening polymerization (Impregum™ Penta™ Soft light body/heavy body), polyether cured via condensation reaction (P2 Polyether light body/heavy body) and polysiloxanes cured via hydrosylation, VPS (Aquasil Ultra XLV/heavy, Affinis™ light/heavy body, Splash!™ extra light/heavy body, Examix™ NDS Injection Type/heavy body, Flexitime™ Correct Flow/heavy body, Virtual™ extra light/heavy body).

#### Results:

The polyether cured via cationic ring-opening polymerization showed superior flow properties indicating high clinical reliability of Impregum impression materials.

# Impregum™

Polyether Impression Material

## 6. In Vitro Research — Flow Properties

### Flow of Impression Materials Using Different Slit Sizes During Working-Time

**Authors:** S. Stipho, C. Maiolo, R. Perry and G. Kugel, Tufts University School of Dental Medicine, Boston, MA, USA

**Reference:** *Expertise™ Scientific Facts 2006*. AADR #412 (2006).

#### Aim of the Study:

1-step impression technique requires an injection impression material with very good flow properties. This study compares the flow characteristics of eight regular setting light- and ultralight-bodied impression materials. In order to determine the flowability into the gingival sulcus which is crucial for a detailed impression the shark-fin tool with different slit sizes (1.0mm, 1.6mm, 2.0mm) was used.

#### Results:

Impregum™ Garant™ Soft light body showed superior flow properties compared to the investigated chemically different impression materials. The result indicates the high clinical reliability of Impregum during working time.

## 6. In Vitro Research — Flow Properties

### Flow of Eight Impression Materials with 2mm Slit After 25 sec

**Authors:** J. Benchimol, R. Perry, G. Kugel and M. Hallas, Tufts University School of Dental Medicine, Boston, MA, USA

**Reference:** *Esperite™ Scientific Facts 2005*. IADR #3083 (2005).

#### Aim of the Study:

Especially the monophasic and the 1-step heavy body/light body technique require a light-bodied impression material showing nice flow properties. This study used the 2mm-shark-fin method to determine the flow characteristics of different light- and ultralight-bodied impression materials to determine how well the impression material flows into the gingival sulcus, which is crucial for a detailed impression.

#### Results:

The results of this study confirm statistically superior flow properties of the new fast setting polyether impression material Impregum™ Soft Quick Step light body in comparison to seven vinyl polysiloxane impression materials.

# Impregum™

Polyether Impression Material

## 6. In Vitro Research — Flow Properties

### Impression Materials Flow with 1 mm Slit at End-Working-Time

**Authors:** J. Benchimol, R. Perry, G. Kugel and J. Hoffman, Tufts University School of Dental Medicine, Boston, MA, USA

**Reference:** *Expertise™ Scientific Facts 2005*. IADR #3082 (2005).

**Aim of the Study:**

Especially the monophasic and the 1-step heavy body/light body technique require a light-bodied impression material showing nice flow properties. Flow properties are not only clinically relevant when the material is syringed but also when it is supported by the tray at the end of working time. This study used the 1mm-shark-fin method to determine the flow characteristics of different light-and ultralight-bodied impression materials.

**Results:**

The results of this study underline the superior flow properties of the new fast setting polyether impression material Impregum™ Soft Quick Step light body.

### Gingival Sulcus Simulation Model for Evaluating the Penetration Characteristics of Elastomeric Impression Materials

**Authors:** P. Aimjirakul, T. Masuda, H. Takahashi and H. Miura

**Reference:** *Int J of Prosth.* Volume 16. Number 4 (2003): 385–389.

**Aim of the Study:**

This study evaluated the ability of elastomeric impression materials to penetrate the gingival sulcus beyond the preparation margin using a model of brass and agar gel to simulate human sulci and clinical gingival conditions.

**Results:**

The penetration ability of 3M ESPE polyether showed greater extension than the other materials, regardless of sulcular width.

**6. In Vitro Research — Snap-Set Behavior****Temperature Effect on the Setting of Dental Impression Materials**

Authors: T. Klettke, B. Kuppermann, D. Ranftl and R. Hampe

Reference: *Expertise™ Scientific Facts 2006*. IADR #914 (2007).

**Aim of the Study:** To compare setting of two groups of impression materials, 3M ESPE Polyether and common VPS, as a function of temperature.

**6**

**Results:** Within the limitations of this study, polyethers 3M™ ESPE™ Impregum™ Penta™ and 3M™ ESPE™ Impregum Penta™ Soft demonstrated a significantly less temperature sensitive setting than the VPS Aquasil Ultra DECA 380 Monophase (Dentsply) and Affinis 360 MonoBody (Coltene), supporting the high clinical reliability of 3M ESPE polyether impression materials.

**Flow of Fast-Setting Light Bodied Impression Materials During Working Time**

Authors: S. Hader, B. Kuppermann, D. Ranftl and T. Klettke, 3M ESPE, Seefeld, Germany

Reference: *Expertise™ Scientific Facts 2006*. CED #607 (2005).

**Aim of the Study:** To compare flow properties of fast-setting light-bodied impression materials during the working time given by the manufacturer. The alterability in flow for each of the materials was determined using an ISO method (ISO 4823:2000, Consistency Measurement).

**Results:** In contrast to the VPS materials the polyether Impregum™ Soft Quick Step showed no reduction in flow throughout the working time whereas Take 1™ showed highest flow reduction. The snap-set property of Impregum Soft Quick Step ensures ideal setting behavior resulting in constant flow properties throughout the entire working time, supporting the high clinical reliability of 3M ESPE polyether materials.

# Impregum™

Polyether Impression Material

## 6. In Vitro Research — Snap-Set Behavior

### Effective Working Times of Fast-Setting Light Bodied Impression Materials

Authors: T. Klettke, S. Hader, D. Ranftl and B. Kuppermann, 3M ESPE, Seefeld, Germany

Reference: *Expertise™ Scientific Facts 2006*. CED #606 (2005).

#### Aim of the Study:

Limited information is available about the effective working times of wash materials at mouth temperature. Goal of the present study was to compare working times available for the dental practitioner of fast-setting light-bodied precision impression materials. Working times were determined according to ISO 4823:2000 at 23°C and 35°C using McCabe-Rheometer.

#### Results:

In contrast to the investigated VPS materials the snap-set behavior of Impregum™ Soft Quick Step ensures ample effective working time, especially at the mouth temperature, supporting the high clinical reliability of 3M ESPE polyether materials.

# Impregum™

Polyether Impression Material

## 6. In Vitro Research — Snap-Set Behavior

### Flow Properties of Light Bodied Impression Materials During Working Time

**Authors:** B. Richter, B. Kuppermann, C. Führer and T. Klettke, 3M ESPE, Seefeld, Germany

**Reference:** *Expertise™ Scientific Facts 2005*. IADR #0142 (2005).

**Aim of the Study:**

This study evaluates the flow properties of the new Impregum™ Soft Quick Step™ light body and the well established Impregum™ Garant™ Soft light body materials during the whole working time in comparison to 6 other light-bodied impression materials.

**Results:**

The Impregum Soft Quick Step light body and the Impregum Garant Soft light body materials showed better flow properties than the other tested impression materials.

The flow properties as an important clinical aspect are superior during the whole working time, not only at the beginning.

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### Temperature Effects on the Rheological Properties of Current Polyether and Polysiloxane Impression Materials During Setting

**Authors:** J.C. Berg, G.H. Johnson, X. Lepe and S. Adan-Plaza, University of Washington, Seattle, WA, USA

**Reference:** *J of Prosth Dent*. 90. 2 (2003): 150–161.

**Aim of the Study:**

Rheological tests of VPS (Aquasil Deca and Aquasil LV, Dentsply) and 3M ESPE Polyether elastomeric impression materials during setting at intraoral temperature.

**Results:**

Permadyne™ Garant™ 2:1 and Impregum™ Garant™ Soft LB showed the highest flowability of all investigated materials.

The ultimate rigidity was highest for Impregum™ Penta™ and Impregum Penta Soft heavy body.

# Impregum™

Polyether Impression Material

## 6. In Vitro Research — Accuracy

### Sulcus Reproduction with Elastomeric Impression Materials: A New In Vitro Testing Method

Authors: J.W. Finger, R. Kurokawa, H. Takahashi and M. Kamotsu

Reference: *Dental Materials*. 24. 12 (2008) 1655–1660.

#### Aim of the Study:

To investigate the depth reproduction of differently wide sulci with elastomeric impression materials by single- and double-mix techniques using a tooth and sulcus model, simulating clinical conditions.

#### Results:

All tested materials and techniques reproduced 200µm wide sulci to almost nominal depth, irrespective of the impression technique used. Impregum™, a polyether cured by cationic ring-opening polymerization, showed the best penetration ability in 50 and 100µm sulci compared to P2, Fusion and Flexitime.

6

### Tear Strength and Dimensional Accuracy of Elastomeric Impression Materials

Authors: Y. Whiteman and D. Nathanson

Reference: *Expertise™ Scientific Facts 2007*. IADR #184 (2007).

#### Aim of the Study:

This study evaluates new impression materials, including an Impregum impression material, for tear strength and effect of time and storage temperature on dimensional accuracy.

#### Results:

Tear strength varied significantly among the materials tested. Storage (2 weeks) at 21°C, -12°C and 37°C generated some dimensional changes. All changes were small and within ADA specifications and accepted clinical parameters.

**6. In Vitro Research — Accuracy****Moisture Effect on Polyether and Vinylpolysiloxane Accuracy and Detail Reproduction**

**Authors:** M.P. Walker, C.S. Petrie, R. Haj-Ali, P. Spencer, C. Dumas and K. Williams, University of Missouri-Kansas City, Kansas City, MO, USA

**Reference:** *J Prosth.* 14. 3 (2005): 158–163.

**Aim of the Study:**

This investigation evaluated and compared the dimensional accuracy and surface detail reproduction of two VPS (Aquasil Monophase, Dentsply and Genie™ Ultra Hydrophilic, Sultan Chemists Inc.) and two 3M ESPE polyether impression materials (Impregum™ Penta™ Soft and Permadyne™ Garant™ 2:1).

**Results:**

Although moisture may not adversely affect the dimensional accuracy of either polyether or hydrophilic VPS material, the evidence suggests that polyether material is more likely to produce impressions with superior detail reproduction in the presence of moisture.

**Precision of Duplicate Dies Made With Different Impression Taking Procedures**

**Authors:** H. Rudolph, S. Quaas, R. Loos and R.G. Luthardt, Dresden University of Technology, Germany

**Reference:** *Expertise™ Scientific Facts 2005.* IADR #1897 (2005).

**Aim of the Study:**

This in vitro study evaluated the precision of fit of the duplicate die made with a monophase and a heavy body/light body polyether impression material combination.

**Results:**

Both impressions using Impregum™ Penta™ Soft Quick and Impregum™ Penta™ H DuoSoft™ Quick/ Impregum L DuoSoft Quick resulted in highly accurate duplicates. No difference was found between the two materials and techniques used.

# Impregum™

Polyether Impression Material

## 6. In Vitro Research — Accuracy

### Accuracy of Newly Formulated Fast-Setting Elastomeric Impression Materials with Disinfection

**Authors:** C.P.K. Wadhvani, G.H. Johnson, X. Lepe and A. Raigrodski, University of Washington, Seattle, WA, USA

**Reference:** *Expertise™ Scientific Facts 2005*. IADR #1634 (2005).

**Aim of the Study:** To examine the accuracy of one regular setting and two fast setting impression materials including possible effects of disinfection.

**Results:** All tested materials showed high accuracy and were unaffected by disinfection. The new quick setting material Impregum™ Penta™ Soft Quick Step performed in a similar way as the regular setting control Impregum Penta impression materials.

6

### Moisture Effect on Polyether and Vinylpolysiloxane Accuracy and Detail Reproduction

**Authors:** M.P. Walker, C. Petrie, R. Haj-Ali, P. Spencer, C. Dumas and K. Williams, University of Missouri-Kansas City, Kansas City, MO, USA

**Reference:** *Expertise™ Scientific Facts 2004*. IADR #0431 (2004).

**Aim of the Study:** Polyether and VPS impression materials were compared regarding their reliability in dimensional accuracy and surface detail reproduction under dry and moist conditions.

**Results:** All materials worked satisfactorily under dry conditions. All Permadyne and Impregum impression materials met also surface detail criteria under moist conditions while only 29% of the Aquasil impressions delivered satisfactory results under these clinically relevant conditions.

**6. In Vitro Research — Accuracy After Disinfection**

**Accuracy of Newly Formulated Fast-Setting Elastomeric Impression Materials**

**Authors:** Ch.P.K. Wadhvani, G.H. Johnson, X. Lepe and A.J. Raigrodski  
**Reference:** *J of Prosth Dent.* 93 (2005): 530–539.

**Aim of the Study:** The accuracy of Impregum Penta Soft Quick Step impression material was tested, particularly with respect to disinfection.

**6**

**Results:** Impregum Penta Soft Quick Step impression material was unaffected by immersion disinfection. The working casts were similar for Impregum Penta and Impregum Penta Soft Quick Step impression materials.

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**Effect of Disinfection on the Accuracy of Elastomeric Impression Materials**

**Authors:** J.N. Calvo, N.C. Olaya, L. Salazar and E. Gutierrez, National University of Colombia, Bogotá D.E, Colombia  
**Reference:** *Expertise™ Scientific Facts 2005.* IADR #1891 (2005).

**Aim of the Study:** This study evaluated the effect of impressing disinfectants on their detail reproduction ability.

**Results:** All materials, including the Impregum™ Soft Polyether Impression Material, passed the ISO 4823 criteria for dimensional stability and could reproduce 5 and 20 microns indentations. The NaOCl 1% disinfectant showed lowest impact on the dimensional changes of the impression materials.

# Impregum™

Polyether Impression Material

## 6. In Vitro Research — Accuracy After Disinfection

### Accuracy of Impregum™ Penta™ and Impregum™ Penta™ Soft with Disinfection

Authors: K. Phillips, X. Lepe, T.C. Aw and G.H. Johnson

Reference: *Dent Res.* IADR Abstracts #3875 (2000).

#### Aim of the Study:

The accuracy of Impregum™ F Impression Materials is well established in the literature. The accuracy of Impregum™ Penta™ and Impregum™ Penta™ Soft Impression Materials was evaluated.

#### Results:

With disinfection the 3M ESPE polyether impression materials showed higher accuracy than the VPS tested for comparison.

**6. In Vitro Research — Detail in Wet Environment****Sulcus Reproduction with Elastomeric Impression Materials: A New In Vitro Testing Method**

Authors: W.J. Finger, R. Kurokawa, H. Takahashi and M. Komatsu

Reference: *Dental Materials*. 24. 12 (2008): 1655–1660.

**6****Aim of the Study:**

To investigate the depth reproduction of differently wide sulci with elastomeric impression materials by single- and double-mix techniques using a tooth and sulcus model, simulating clinical conditions.

**Results:**

The sulcus model is considered useful for screening evaluation of elastomeric impression materials ability to reproduce narrow sulci. All tested materials and techniques reproduced 200µm wide sulci to almost nominal depth. Irrespective of the impression technique used, Impregum™ showed the best penetration ability in 50 and 100µm sulci.

**Surface Detail Reproduction of Elastomeric Impression Materials Related to Rheological Properties**

Authors: M.J. German, T.E. Carrick and J.F. McCabe

Reference: *Dental Materials*. 2. 4 (2008): 951–956.

**Aim of the Study:**

To discern, for elastomeric impression materials, the important rheological properties and importance of hydrophilicity for detail reproduction.

**Results:**

Tan delta was found to be the parameter most indicative of the accuracy of the impression and the flow of the material. Impregum samples, a polyether material, exhibited the highest initial tan delta, the largest shark fins at the time periods investigated, and the most accurate impressions.

# Impregum™

Polyether Impression Material

## 6. In Vitro Research — Detail in Wet Environment

### Surface Detail Reproduction with New Elastomeric Dental Impression Materials

Authors: M. Kanehira, W.J. Finger and M. Komatsu

Reference: *Quintessenz International*. 38 (2007): 479–488.

**Aim of the Study:** To compare the surface detail reproduction of 2 polyethers (P2, Impregum), 1 polyether-polysiloxane hybrid (Senn), and 1 polyvinylsiloxane impression material (Flexitime™) when impressions of prepared dentin are made, and to determine the wettability of the nonset and set impression materials.

**Results:** P2 does not cure on dry or wet dentin. Impregum, Senn, Flexitime reproduced prepared dentin accurately. Contact angles for Impregum were the lowest and showed hydrophilicity of the material. Contact angles for P2, Senn, Flexitime were greater than 90 degrees.

6

### Detail Reproduction of Impression Materials on a Wet Surface

Authors: R. Perry, G. Kugel, E. Appelin and B. Green

Reference: *Expertise™ Scientific Facts 2006*. IADR #1626 (2007).

**Aim of the Study:** To evaluate the detail reproduction of Type 3 precision impression materials on a wet surface. Three different types of materials were investigated including: three polyethers (two cured via cationic ring-opening polymerization and one cured via condensation reaction) and eight hydrophilized polysiloxanes cured via hydrosylation.

**Results:** Impregum and Permadyne™, the polyethers cured via cationic ring-opening polymerization, have the highest detail reproduction when tested under clinically relevant moist conditions.

# Impregum™

Polyether Impression Material

## 6. In Vitro Research — Detail in Wet Environment

### Recording Surface Detail on Moist Surfaces with Elastomeric Impression Materials

Authors: J.F. McCabe and T.E. Carrick

Reference: *Eur. J. Prosthodont. Rest. Dent.* 14 (2006); 42–46.

**Aim of the Study:**

To assess the ability to accurately record detail on moist surfaces for three elastomeric impression materials derived from different polymers. One polyvinylsiloxane, one polyether and one hybrid material were used.

6

**Results:**

There was evidence that the polyether (Impregum™) and the hybrid materials were more accurate than the polyvinylsiloxane in recording true depths of deep grooves under moist conditions.

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### Impression Accuracy when Recording Impressions of Moist Surfaces

Authors: J.F. McCabe and T. Carrick

Reference: *Expertise™ Scientific Facts 2006*. IADR #2466 (2006).

**Aim of the Study:**

The detail reproduction of monophasic precision impression materials on moist surfaces was evaluated. Impregum™ Penta™ Soft and hydrophilized VPS were used in the study.

**Results:**

Impregum Penta Soft was more accurate and reliable than all tested VPS materials.

# Impregum™

Polyether Impression Material

## 6. In Vitro Research — Detail in Wet Environment

### The Effect of Surface Moisture on Detail Reproduction of Elastomeric Impressions

Authors: G.H. Johnson, X. Lepe and T.C. Aw

Reference: *J of Prosth Dent*. Volume 90. Number 4 (2003): 354–364.

**Aim of the Study:** Monophase and dual-viscosity impression techniques were tested with several single-viscosity and dual-viscosity systems in order to evaluate which might render better quality under wet and dry surface conditions.

**Results:** 3M ESPE polyether impression material reproduced the standard saw-tooth pattern better than addition silicones.

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### Wet Detail Reproduction and Dynamic Contact Angle of Impression Materials

Authors: W. Jia and J.A. Sorensen

Reference: *J of Dent Res*. AADR #1679 (2001).

**Aim of the Study:** The study tested wet detail reproduction.

**Results:** Impregum™ Penta™ Soft and Permadyne™ Impression Materials showed the best detail reproduction under the conditions of the study.

# Impregum™

Polyether Impression Material

## 6. In Vitro Research — Ease of Removal

### Mechanical Properties of 3 Hydrophilic Addition Silicone and Polyether Elastomeric Impression Materials

Authors: H. Lu, B. Nguyen and J.M. Powers

Reference: *Prosth Dent.* (2004): 92, 151-151.

**Aim of the Study:** Mechanical properties of impression materials with low and high consistency were compared.

**6 Results:** Based on the strain in compression results, Impregum™ Penta™ Soft impression material is more flexible than previous 3M ESPE polyether materials.

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### Investigations on the Force Required for Removal of Polyether Impressions

Authors: J.T. Dunne and J. Zech

Reference: *J Dent Res.* 70. IADR Abstracts #2436 (2000).

**Aim of the Study:** To determine the effect on reducing Shore A hardness on the force required to remove set polyether impressions from the simulated oral structures.

**Results:** Reduced Shore A hardness of polyether dental impression material significantly reduces the forces required to remove impressions from simulated mouth.

# Impregum™

Polyether Impression Material

## 6. In Vitro Research — Implants and Implant Impressions

### Implanting a Good Impression

**Authors:** J. Gulliermo and R. Paradies

**Reference:** *Dental Products Report*. (February 2008): 44.

**Aim of the Study:** In this clinical case report the use of Impregum Polyether impression material for open tray impression technique is shown.

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### Effects of Various Adhesive Materials on Implant Coping Torque Strength

**Authors:** R. Perry, G. Kugel, B. Green and E. Appelin

**Reference:** *Expertise™ Scientific Facts 2007*. IADR #1477 (2007).

**Aim of the Study:** This study compares the amount of torque required to rotate a cylindrical sandblasted implant coping in set impression materials. The higher the torque the lower the chance the coping will be dislodged. Three different types of materials were investigated.

**Results:** Impregum™ Penta™ Soft and Impregum™ Penta™ required the highest torque strength to rotate the implant coping. High torque decreases the chance of accidental implant displacement. The results show that because of their strong fixation ability, 3M ESPE polyether materials are a preferred material for making implant impressions.

# Impregum™

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## 6. In Vitro Research — Implants and Implant Impressions

### Properties of Precision Impression Material Crucial to Their Clinical Success

Authors: T. Klettke, H.-J. Dauelsberg and C. Zawta

Reference: *Quintessenz Zahntech.* 31 (2005): 414–430.

**Aim of the Study:** To evaluate clinically relevant features like hydrophilicity and flow properties using the shark fin test as well as mechanical properties.

6

**Results:** Impregum proved to be the most hydrophilic and flowable material. The mechanical properties are very suitable for implant impressions from the dentist's as well as from the a lab technician's stand point.

A clinical implant case guiding through the steps in the office and in the lab is shown.

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### Forces Required to Dislodge Implant Impression Copings in Impression Materials

Authors: L. Kalogerogianni, I.J. Pesun, J.S. Hodges and J. Holtan, University of Minnesota, Minneapolis, Minnesota, USA

Reference: *Expertise™ Scientific Facts 2005.* IADR #440 (2005).

**Aim of the Study:** The fit of implant prosthesis depends on the stability of the implant impression copings. This study compared VPS and polyether materials.

**Results:** The medium bodied 3M ESPE polyether impression material outperformed the VPS material for implant coping impressions.

# Impregum™

Polyether Impression Material

## 6. In Vitro Research — Implants and Implant Impressions

### A Modified Impression Technique for Accurate Registration of Peri-implant Soft Tissues

Authors: N. Attard and I. Barzilay

Reference: *J. Canad. Dent. Association.* 69 (2003): 80–83.

**Aim of the Study:** In the technique discussed, the impression coping was replaced by the interim crown itself. The technique described is superior because it accurately registers the soft tissue profile that has been created with the interim restoration.

**Results:** Using Impregum™ precision impression material, the soft tissue is very well replicated in the cast.

6

### Comparison of Impression Materials for Direct Multi-Implant Impressions

Authors: A.G. Wee, College of Dentistry, The Ohio State University, Columbus, Ohio, USA

Reference: *Journal of Prosthetic Dent.* (2000): 83, 323–331.

**Aim of the Study:** The in vitro study compared the amount of torque required to rotate a square impression coping in an impression and evaluated the accuracy of solid implant casts fabricated from different impression materials.

**Results:** Torque required to rotate an impression coping in the impression was significantly higher for medium bodied polyether than for heavy bodied addition silicone. 3M ESPE polyether impression material minimizes the chance of accidental displacement of direct implant copings.

# Impregum™

Polyether Impression Material

## 6. In Vitro Research — Automatic Mixing

### Ask Dr. Christensen

Reference: *Dental Economics*. (August 29, 2008).

#### Advantages:

- Consistency of impression material mixes
- Infection control is simple
- Minimal waste
- Minimal storage need
- Ease of training staff to mix impressions

“...In summary, the machine automixing concept is here to stay. Seldom do I find a practitioner who has changed to machine automixing who wants to go back to one of the other methods. The advantages are relatively obvious...”

6

### Pentamix™ 2 Versus Pentamix™ 3 Mixing Device: A Comparison

Authors: J. Stelzig<sup>1</sup>, M. Balkenhol<sup>1</sup>, C. Erbe<sup>2</sup> and B. Wöstmann<sup>1</sup>;  
Justus-Liebig University<sup>1</sup>, Giessen, Germany, Johannes-Gutenberg  
University<sup>2</sup>, Mainz, Germany

Reference: *Expertise™ Scientific Facts 2008*. IADR #3206 (2008).

#### Aim of the Study:

To compare the new Pentamix™ 3 Automatic Mixing Unit with its predecessor, Pentamix™ 2 Automatic Mixing Unit, regarding various material properties.

#### Results:

Within the limits of this study, it can be concluded that the Pentamix 3 device delivers a considerable higher amount of material per time. At the same time, it does not affect the Shore A hardness and features slightly longer working times for Express™ 2 Penta Heavy Body and Express™ 2 Penta Putty. The working time of Impregum™ Penta™ Soft, however, was not affected.

# Impregum™

Polyether Impression Material

## 6. In Vitro Research — Automatic Mixing

### Extrusion Speed and Performance of Automated Mixing Units

Authors: T. Klettke and J. Gramann

Reference: *Expertise™ Scientific Facts 2008*. AADR #1017 (2008).

#### Aim of the Study:

To compare the extrusion speed and the drive performance of common automated mixing units to determine if there is speed loss when dispensing high viscosity impression materials.

Five samples of a type 2 (3M™ ESPE™ Impregum™ Penta™ Soft Quick) and a type 0 impression material (3M™ ESPE™ Express™ 2 Penta™ Putty) were mixed with the 3M™ ESPE™ Pentamix™ 3 Automatic Mixing Unit, 3M™ ESPE™ Pentamix™ 2 Automatic Mixing Unit, Plug & Press Dispenser (Kettenbach), Dynamix (Heraeus Kulzer) and with MixStar (DMG) for exactly 30 seconds.

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#### Results:

Pentamix 3 mixing unit showed the highest extrusion speed and no significant difference when dispensing a type 0 and type 2 impression material.

### Mix Quality and Dispensing Rate for Two Automatic Mixing Units

Authors: J. Gramann, T. Klettke and S. Starr

Reference: *Expertise™ Scientific Facts 2008*. AADR #1016 (2008).

#### Aim of the Study:

To compare the mixing quality of Pentamix™ 2 Automatic Mixing Unit to that of the new Pentamix™ 3 Automatic Mixing Unit.

#### Results:

Pentamix 3 mixing unit enables a dispensing rate two times faster than that of Pentamix 2 mixing unit with the same high quality material mix.

# Impregum™

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## 6. In Vitro Research — Automatic Mixing

### Assessment of Preference of Mixing Techniques and Duration of Mixing and Tray Loading for Two Viscosities of Vinyl Polysiloxane Material

Authors: J. Nam, A.J. Raigrodski, J. Townsend, X. Lepe and L.A. Mancil

Reference: *J. Prosthodont. Rest. Dent.* AADR #14 (2006) 42–46.

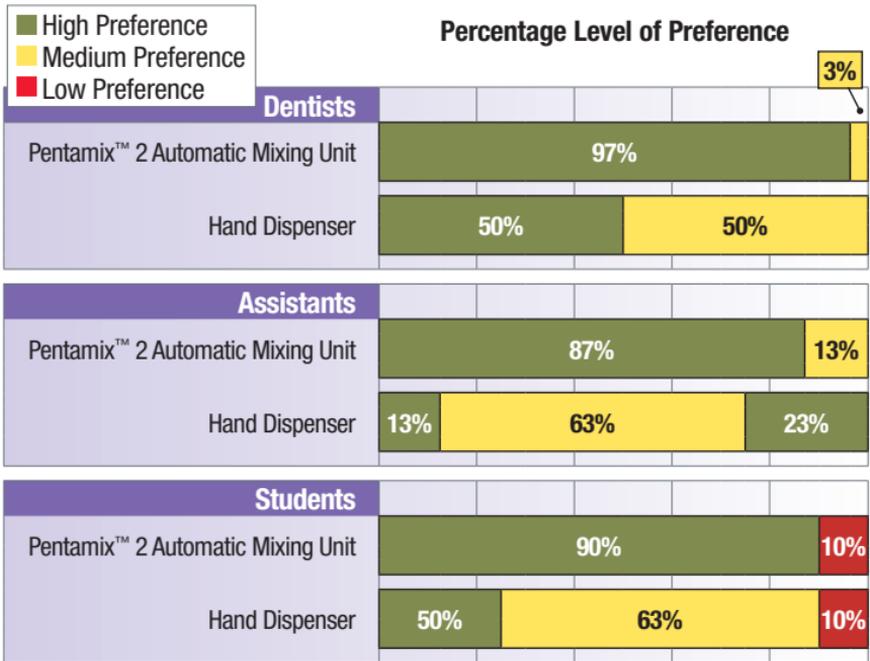
**Aim of the Study:**

To assess operators' (dental assistants, dentists, inexperienced students) preferences, and the duration of mixing and tray loading using different mixing techniques.

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**Results:**

All participant groups preferred electronic mixing to automixing or hand mixing.



Electronic Mixing (Pentamix™ 2 Automatic Mixing Unit) versus Automixing (Hand Dispenser). Percentage (frequency) of overall level of preference (low, medium, high) after 3 trials with heavy-body VPS.

# Impregum™

Polyether Impression Material

## 6. In Vitro Research — Automatic Mixing

### Ask Dr. Christensen

Reference: *Dental Economics*. (April 2002).

**Advantages:** The unsterile, self mixing syringes are eliminated. The impression material is always mixed thoroughly and quickly. Material waste can be reduced. The amount of material in self-mixing cartridges is small when compared to the large reservoir of impression material in the automated system. Therefore, time from filling one device to the next is reduced with automated systems.

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### The Influence of the Mixing Technique on the Content of Voids in Two Polyether Impression Materials

Authors: R. di Felice, R. Scotti and U.C. Belser

Reference: *Schweiz Monats Zahnmed.* Vol. 112 (1/2002): 12–16.

**Aim of the Study:** The influence of mixing technique of 3M ESPE polyether impression material has been determined by evaluating the surface area and the number of voids. Hand mixing was compared with Pentamix™ device as mechanical mixing.

**Results:** The Pentamix mechanical mixing unit generated the smallest number and total surface area of voids.

# Impregum™

Polyether Impression Material

## 6. In Vitro Research — Physical Properties

### Mechanical Properties of Monophase Impression Materials

Authors: R.A. Yapp and J.M. Powers

Reference: *Esperitise™ Scientific Facts 2008*. AADR #1106 (2008).

**Aim of the Study:** To compare mechanical properties of the type 2 consistency of several addition silicones, a new Impregum™ Polyether Tray Material delivered from the hand dispenser and a commercial automix (5:1) Impregum polyether as well as hybrid elastomeric impression materials.

**Results:** The new Impregum Soft Polyether Tray Material delivered from the hand dispenser and Impregum™ Penta™ Soft Quick Step had higher values in tear energy than the other six materials tested with the exception of Aquasil Ultra.

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### Comparison Study Between Two Different Mixing Ratios of Polyethers

Authors: K. Aurbach, R. Perry and G. Kugel

Reference: *Esperitise™ Scientific Facts 2008*. AADR #215 (2008).

**Aim of the Study:** To compare a new experimental Impregum™ Tray Impression Material; Impregum™ Soft, delivered from a hand dispenser versus the commercial automix (Impregum™ Penta™ Quick-Soft) 5:1 ratio material.

**Results:** The new experimental Impregum tray impression material delivered from a hand dispenser had higher tensile strength and Shore A hardness than the commercial automix (Impregum Penta Quick-Soft) 5:1 ratio material.

# Impregum™

Polyether Impression Material

## 6. In Vitro Research — Physical Properties

### Comparison of Different Types of Impression Materials

Authors: T. Klettke, D. Ranftl and B. Kuppermann

Reference: *Expertise Scientific Facts 2006*. IADR #2465 (2006).

#### Aim of the Study:

Impression taking is a crucial step for successful prosthetic restorations. Flowability and hydrophilicity are important properties of the unset and tear resistance of the set impression material.

Based on their curing mechanism, three different types of monophase impression materials were investigated:

- (1) polyether cured via cationic ring-opening polymerization Impregum™ Penta™ (3M ESPE)
- (2) polyether cured via condensation reaction P2 Polyether Magnum 360 (Heraeus-Kulzer)
- (3) hydrophilized polysiloxanes cured via hydrosylation Aquasil Ultra Monophase Deca (Dentsply), Flexitime™ 360 Monophase Deca (Heraeus-Kulzer), Affinis™ Monobody System 360 (Coltene), Senn Monophase Type (GC).

#### Results:

Only Impregum Penta showed highest performance in all investigated categories indicating the high clinical reliability of 3M ESPE polyether impression materials.

**6. In Vitro Research — Physical Properties**

**Characterization of New Quick Setting Polyether Impression Materials**

**Authors:** B. Gangnus, T. Klettke, C. Führer, B. Kuppermann and A. Rombach, 3M ESPE AG, Seefeld, Germany

**Reference:** *Expertise™ Scientific Facts 2005*. CED #0138 (2004).

**Aim of the Study:**

To evaluate the material characteristics and thus the clinical advantages of the new quick setting Impregum™ Penta™ Soft Quick Step materials in comparison to the well known normal-setting Impregum Penta Soft materials.

**Results:**

Clinical benefits of the new quick-setting Impregum Penta Soft Quick Step materials are the reduced total working time (especially attractive for one or two units) and a higher rigidity that make these materials very suitable for the dual-arch technique impressions.

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## 6. In Vitro Research — Polyether Retarder

### Effect of Polyether Retarder on the Flowability of Impregum™ Soft

Author: P. Aimjirakul

Reference: *Expertise™ Scientific Facts 2008*. AADR #1117 (2008).

**Aim of the Study:** To determine the effect of different lengths of Polyether retarder on the flowability of Polyether impression material.

**Results:** The longer the retarder, the longer the working time. Therefore, Polyether retarder can improve the flowability of Impregum Soft. In clinical application, it is suggested that Polyether retarder can be used for lengthening the working time and achieving better flow characteristics of Polyether.

### Prolongation of Working Time with Polyether Retarder

Authors: T. Klettke and R. Hampe

Reference: *Expertise™ Scientific Facts 2008*. CED #122 (2007).

**Aim of the Study:** To evaluate the effect of 3M ESPE Polyether Retarder on the working time of 3M ESPE Polyether impression materials as a function of the ratio retarder: impression material.

**Results:** The working time of 3M ESPE Polyethers can be prolonged using 3M ESPE Polyether Retarder. Longer working times may be a clinical advantage especially for cases involving multiple preparations or with time-consuming impression techniques such as functional impressions.

# Impregum™

Polyether Impression Material

## 6. In Vitro Research — Others

### Insertion Force of Tray Impression Materials

Authors: T. Klettke, R. Hampe and J.T. Madden

Reference: *Expertise™ Scientific Facts 2008*. IADR #3194 (2008).

#### Aim of the Study:

To compare the insertion force of an experimental polyether tray material and six commercially available VPS tray materials. All materials were dispensed using the handheld dispenser made by Mixpac Systems, AG.

6

#### Results:

There are differences in the insertion forces among the materials tested. Within the limitations of this study, the new polyether IP demonstrated an insertion force comparable to commercially available VPS tray materials. The data supports the suitability of IP for the monophasic and one-step tray/wash techniques.

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### Disinfection and Communication Practices: A Survey of U.S. Dental Laboratories

Authors: G. Kugel, R.D. Perry, M. Ferrary and P. Lalicata

Reference: *JADA*. 131 (2000): 786–792.

#### Survey Results:

The results of the survey indicate a significant and problematic lack of communication between dentists and laboratory directors. Only 44% of the labs knew if the impressions they received were disinfected. Laboratory directors stated that distortions as well as inaccurate or unclear margins are more observed with polyvinylsiloxanes than with polyethers. On the other hand the hardness/stiffness of polyethers is higher than that of polyvinylsiloxanes.

# Impregum™

Polyether Impression Material

## Highlighting Technique Tips

7



## 7. Highlighting Technique Tips

### **Impressioning Compendium—A Guideline for Excellent Impressions in Theory and Practice**

**Authors:** 3M ESPE in collaboration with Prof. Dr. med. dent. Bernd Wostmann and Prof. John M. Powers, Ph.D.

**Reference:** *3M™ ESPE™ Expertise™ Publication*. 3<sup>rd</sup> Edition (2008).

Comprehensive guide to the step-by-step impression procedures using a variety of techniques and materials.

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### **7 Good Impressions**

**Authors:** S. Rogeres and J. Gladman

**Reference:** *Dental Lab Products*. (October 2007).

Tips to avoid issues with impression making are given. The importance of good communication between labs and dentists is highlighted.

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### **The State of Fixed Prothodontic Impression**

**Author:** G.J. Christensen

**Reference:** *JADA*. Volume 136 (March 2005).

For several commonly occurring impression problems potential solutions are given.

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### **The Virtues of Making a Good Impression**

**Author:** R.D. Perry

**Reference:** *Dental Equipment & Materials*. (September/October 2004): 44–48.

A series of technique tips is given.

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### **Good Impressions — Gateway to Optimal Patient Care**

**Authors:** S. Rogeres and J. Gladman

**Reference:** *Dental Lab Products*. (October 2004).

Typical issues with impression are discussed from a laboratory perspective. Impregum is recommended.



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