A Collection of Scientific Results
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Introduction

Dear Dental Professional,

The evolution of the Impregum polyether impression material line over the years perfectly demonstrates our commitment at 3M ESPE for delivering innovative dental products of the highest quality.

Since the introduction of Impregum polyether impression material in 1965, many innovations have been made to the material and to its delivery system, the Pentamix™ automatic mixing unit, to meet the changing needs of dental practitioners. To date, more than 100,000 customers world-wide use Impregum materials for most of their impressioning indications. In fact, more than 400,000,000 impressions have been taken with 3M ESPE polyether material since its introduction.

We are truly exited about our newest member of the Impregum family, the Impregum™ Penta™ Soft Quick Step material — which is the first fast-setting polyether impression material. In addition to its quick setting time, it offers the same unique chemistry of our polyether products — best initial hydrophilicity, superior flow properties and unique snap-set behavior — for excellent detail reproduction in a wet environment and precise-fitting restorations.

The impressive array of internal and independent data in this booklet demonstrates the performance of Impregum polyether impression material, but the best way to understand how this translates into clinical reliability and success is to try it for yourself. I am very confident that you will soon understand why we are proud to offer you the Impregum family of products.

Best Regards

Dr. Oswald Gasser

3M ESPE Global Technical Director

St. Paul, MN and Seefeld, Germany
April 2006
Impregum™

Polyether Family Timeline
Impregum™

Official Ratings
1. Official Ratings

THE DENTAL ADVISOR
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 4-1/2+. 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.
2. Clinical Features

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

<table>
<thead>
<tr>
<th>Indications</th>
<th>Impregum Penta Soft</th>
<th>Impregum Penta H / Garant L DuoSoft</th>
<th>Impregum Penta Soft Quick</th>
<th>Impregum Penta H / L DuoSoft Quick</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impressions of inlay, onlay, crown and bridge preparations</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
</tr>
<tr>
<td>Functional impressions</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
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<tr>
<td>Implant impressions</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
</tr>
<tr>
<td>Fixation impressions</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
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</tbody>
</table>

Features and Benefits:

<table>
<thead>
<tr>
<th>Features</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Features of the “Quick” Line</td>
<td></td>
</tr>
<tr>
<td>• Maximum working time of 1 minute</td>
<td>• Saves your practice time and money</td>
</tr>
<tr>
<td>• Intraoral setting time of 3 minutes</td>
<td>• Faster chair time for patient and dentist</td>
</tr>
<tr>
<td>Generation “Soft” Features</td>
<td></td>
</tr>
<tr>
<td>• Less rigid polyether</td>
<td>• Easier to remove for dentist and lab</td>
</tr>
<tr>
<td>• Fresh mint flavor</td>
<td>• Maintains proper rigidity for a wide range of applications</td>
</tr>
<tr>
<td>• Initial hydrophilic</td>
<td>• More pleasant for patient</td>
</tr>
<tr>
<td>General Polyether Features</td>
<td></td>
</tr>
<tr>
<td>• Excellent flow properties</td>
<td>• Provides precise impressions in moist conditions</td>
</tr>
<tr>
<td>• Snap-set behavior</td>
<td>• Captures fine detail for precise impressions</td>
</tr>
<tr>
<td>• Provides restorations which fit precisely without distortions</td>
<td>• Provides restorations which fit precisely without distortions</td>
</tr>
<tr>
<td>• Reduces the need for costly adjustments, remakes and retakes</td>
<td>• Produces finely detailed impressions for a better-fitting prosthesis</td>
</tr>
<tr>
<td>• Helps get an accurate impression on the first take</td>
<td></td>
</tr>
</tbody>
</table>
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™ L DuoSoft Quick
- 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 Light Body Impression Materials:**
Impregum is more hydrophilic than VPS materials.
2. Clinical Features — Flow Properties

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
2. Clinical Features — Flow Properties

The Shark Fin Test Proves It

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

During the whole working time, polyether impression materials show a significantly superior flow behavior as compared to VPS.
2. Clinical Features — Snap-Set Behavior

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

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

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.
Clinical Effectiveness of a Fast Setting Polyether Impression Material

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.

“Evaluations Reveal VPS Users an Excellent Market for New Impression Material”

*3M ESPE Connection* (October 2004), Volume 9, Number 10, 1-2.

**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.
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.
4. 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

“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
“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

“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
“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
4. 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

“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
4. 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)

“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)
5. In-Vitro Research — Hydrophilicity

“Wettability, Imbibition, and Mass Change of Disinfected Low-Viscosity Impression Materials”
*J of Prosth Dent* (2002); Volume 88, Number 3, 268-276.
Xavier Lepe, Glen H. Johnson, John C. Berg, Tar C. Aw and G. Scott Stroh

**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.

“Hydrophilicity of Fast Setting Impression Materials During Working Time”
R. Guggenberger, T. Klettke, C. Führer, B. Gangnus, and D. Ranftl, 3M ESPE AG, Seefeld, Germany

**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.
“Hydrophilicity of Elastomeric Non-Aqueous Impression Materials During Setting”
Frank Rupp, Deflef Axmann, Anne Jacobi, Martin Groten and Jürgen Geis-Gerstorfer

**Aim of the Study:** The purpose of the study was 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.

“Hydrophilicity of Precision Impression Materials During Working Time”
T. Klettke, B. Kuppermann, C. Führer, and B. Richter, 3M ESPE, Seefeld, Germany

**Aim of the Study:** The purpose of this study was 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.
5. In-Vitro Research — Hydrophilicity

“Initial Hydrophilicity of Impression Materials Before, During And After Setting”
T. Klettke, C. Führer, B. Richter and D. Ranftl,
3M ESPE AG, Seefeld, Germany

**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.

“Changes in Water Contact Angles During the First Phase of Setting of Dental Impression Materials”
Matthias Mondon and Christiane Ziegler, University of Kaiserslautern, Germany

**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.
5. In-Vitro Research — Hydrophilicity

“Comparison of Hydrophilic Measurements of Impression Material During Working Time”
J. Goldberg, J. Benchimol, R. Perry, and G. Kugel,
Tufts University School of Dental Medicine, Boston, MA, USA

**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.

“Quantifying Wetting Characteristics of Hydrophilized VPS and Polyethers During the Application Phase”
F. Rupp, H.-R. Lee, M. Groten, and J. Geis-Gerstorfer,
University of Tübingen, Germany

**Aim of the Study:**
The purpose of the study was 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.
5. In-Vitro Research — Hydrophilicity

“Hydrophilic Changes Characterizing The Working Time of Different Elastomeric Impression Materials”

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

**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 a 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.
5. In-Vitro Research — Hydrophilicity

“Initial Hydrophilicity of 15 Type 3 Impression Materials During Setting”

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

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.
“Flow Under Pressure of Four Impression Materials Using Shark-Fin Device”  
*J Dent Res* 80 (AADR Abstracts, 2001 #624).  
M.S. Kim, E.H. Doherty and G. Kugel

**Aim of the Study:**  
The purpose of this study was to test the flow of different impression materials under pressure using the shark fin device (weight 422g).

**Results:**  
Impregum™ Penta™ and Impregum™ Penta™ Soft impression materials showed the greatest flow.

“Flow of Impression Materials with 2mm Slit at End-Working-Time”  
J. Benchimol, R. Perry, G. Kugel, and S. Ferreira,  
Tufts University School of Dental Medicine, Boston, MA, USA

**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.
In-Vitro Research — Flow Properties

“Agingival Sulcus Simulation Model for Evaluating the Penetration Characteristics of Elastomeric Impression Materials”
P. Aimjirakul, T. Masuda, H. Takahashi, H. Miura

**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.

“Flow of Eight Impression Materials with 2mm Slit After 25 sec”
J. Benchimol, R. Perry, G. Kugel, and M. Hallas, Tufts University School of Dental Medicine, Boston, MA, USA

**Aim of the Study**: Especially the monophase 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.
Aim of the Study: Especially the monophase 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.
5. In-Vitro Research — Flow Properties

“Flow of Impression Materials Using Different Slit Sizes During Working-Time”
S. Stipho, C. Maiolo, R. Perry, and G. Kugel,
Tufts University School of Dental Medicine, Boston, MA, USA

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.
5. In-Vitro Research — Flow Properties

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

*Expertise Scientific Facts 2006* (AADR 2006 #413).
S. Stipho, C. Maiolo, S. Sharma, R. Perry, and G. Kugel,
Tufts University School of Dental Medicine, Boston, MA, USA

**Aim of the Study:**
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, Flextime™ 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.
5. In-Vitro Research — Flow Properties

“Measuring Flow of Regular Set Impression Materials Using Oscillating Rheometer”

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

Aim of the Study:
High flowability of light bodied impression materials is crucial for clinical success. Flowability may alter with time especially at elevated temperature. The study investigates the flowability of eight light-bodied regular setting impression materials at 37°C as a function of time using a common rheometer method. Three different types of materials were compared: a polyether cured via cationic ring-opening polymerization (Impregum™ Garant™ Soft light body), a polyether cured via condensation reaction (P2 Polyether light body) and polysiloxanes cured via hydrosylation, VPS (Aquisil Ultra XLV, Aquisil Ultra LV, Affinis™ light body, Splash!™ extra light body, Examix™ NDS Injection Type, Flexitime™ Correct Flow).

Results:
Only the polyether cured via cationic ring-opening polymerization Impregum Garant Soft light body continued to retain most flowability on a very high level which indicates the high clinical reliability of Impregum impression materials during intraoral working time.
“Flow Properties of Light Bodied Impression Materials During Working Time”

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

**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.
“Temperature Effects on the Rheological Properties of Current Polyether and Polysiloxane Impression Materials During Setting”


John C. Berg, Glen H. Johnson, Xavier Lepe and Sergio Adan-Plaza, University of Washington, Seattle, WA, USA

**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.
**Aim of the Study:**
The purpose of this study was 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.
“Effective Working Times of Fast-Setting Light Bodied Impression Materials”


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

**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.
“Accuracy of Newly Formulated Fast-Setting Elastomeric Impression Materials with Disinfection”
C.P.K. Wadhwani, G.H. Johnson, X. Lepe, and A. Raigrodski, University of Washington, Seattle, WA, USA

**Aim of the Study:**
The purpose of this in-vitro study was 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.

“Moisture Effect on Polyether and Vinylpolysiloxane Accuracy and Detail Reproduction”
M.P. Walker, C. Petrie, R. Haj-Ali, P. Spencer, C. Dumas, and K. Williams, University of Missouri-Kansas City, Kansas City, MO, USA

**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.
5. In-Vitro Research — Accuracy

“Precision of Duplicate Dies Made With Different Impression Taking Procedures”
H. Rudolph, S. Quaas, R. Loos, and R.G. Luthardt,
Dresden University of Technology, Germany

**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.

“Moisture Effect on Polyether and Vinylpolysiloxane Accuracy and Detail Reproduction”
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,

**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.
“Accuracy of Impregum Penta and Impregum Penta Soft with Disinfection”
K. Phillips, X. Lepe, T.C. Aw and G.H. Johnson

**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.

“Accuracy of Newly Formulated Fast-Setting Elastomeric Impression Materials”
Ch.P.K. Wadhwani, G.H. Johnson, X. Lepe and A.J. Raigrodski

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

**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.
“Effect of Disinfection on the Accuracy of Elastomeric Impression Materials”
J.N. Calvo, N.C. Olaya, L. Salazar, and E. Gutierrez,
National University of Colombia, Bogotá D.E, Colombia

**Aim of the Study:** This study evaluated the effect of impressioning 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.
“The Effect of Surface Moisture on Detail Reproduction of Elastomeric Impressions”
G.H. Johnson, X. Lepe and T.C. Aw

**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.

“Wet Detail Reproduction and Dynamic Contact Angle of Impression Materials”
W. Jia and J.A. Sorensen

**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.
5. In-Vitro Research — Ease of Removal

“Investigations on the Force Required for Removal of Polyether Impressions”
J.T. Dunne and J. Zech

**Aim of the Study:** The purpose of this study was 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.

“Mechanical Properties of 3 Hydrophilic Addition Silicone and Polyether Elastomeric Impression Materials”
H.Lu, B. Nguyen and J.M. Powers

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

**Results:** Based on the strain in compression results, Impregum™ Penta™ Soft impression material is more flexible than previous 3M ESPE polyether materials.
“Comparison of Impression Materials for Direct Multi-Implant Impressions”


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

**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.

“Forces Required to Dislodge Implant Impression Copings in Impression Materials”


L. Kalogerogianni, I. J. Pesun, J. S. Hodges, and J. Homan

University of Minnesota, Minneapolis, Minnesota, USA

**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.
“Characterization of New Quick Setting Polyether Impression Materials”

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

**Aim of the Study:**

The aim of the study was 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.
5. In-Vitro Research — Automatic Mixing

“Ask Dr. Christensen”
_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.

“The Influence of the Mixing Technique on the Content of Voids in Two Polyether Impression Materials”
R. di Felice, R. Scotti and U.C. Belser

**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.
6. Journal Articles

Highlighting the Features and Benefits of Impregum™ Penta™ Soft Quick Step:

“Beyond First Impressions, The Recent Improvement in Impression Materials and Delivery Systems”
*Impressions — A Newsletter For Dental Professionals* (August 2004); Volume 11, 1–3.
Gerard Kugel

“Properties of Precision Impression Materials Crucial to Their Clinical Success”
*Quintessenz Zahntech* (November 2005), 31; 4; 414–430.
Thomas Klettke, Hans-Jürgen Dauelsberg and Christoph Zawta

“The First Impression Counts”
*Dentistry Today* (March 2005), 338–351.
George Freedman

“Impression Materials: A New Look at the Polyether System”
*Dentistry Today* (April 2001), 72–79.
Karl F. Leinfelder and André V. Ritter

“Applicable Research in Practice: Understanding the Hydrophilic and Flow Property Measurements of Impression Materials”
Ronald Perry

Highlighting Technique Tips:

“The State of Fixed Prothodontic Impression”
G.J. Christensen
For several commonly occurring impression problems potential solutions are given.

“The Virtues of Making a Good Impression”
R.D. Perry
A series of technique tips is given.