

# Protemp™ 4

## Temporization Material



## Technical Data Sheet

### Indications

- Crowns
- Bridges
- Inlays and onlays
- Veneers
- Long-term temporaries

### 3M ESPE – The innovation leader in temporization.

Temporary restorations are an indispensable part of the complete crown and bridge restorative procedure, and the roles which a temporary restoration must fulfil have become more demanding over time. In the past, the functional aspects of temporary restoration predominated. However, with recent advancements in restorative dentistry, there is an ever increasing demand placed on aesthetics as well as structural strength.

3M ESPE, with more than 40 years of experience in temporization, meets this demand with the introduction of Protemp™ 4 Temporization Material. This unique bis-acrylic composite material with a new generation of sophisticated fillers – a result of advances by 3M ESPE in nanotechnology – sets new industry standards with the following key features:

- **Higher fracture resistance and therefore even stronger and longer lasting** than the well proven Protemp™ 3 Garant™ Temporization Material.
- **Highly aesthetic** through natural gloss and fluorescence.
- **Easier handling and faster procedure** with no polishing or glazing<sup>1</sup>.

Protemp 4 temporization material joins a family of high quality, reliable temporization materials designed to meet the evolving needs of the dental professional.

<sup>1</sup> In case excess material has to be removed or adaptations have to be made the resulting surface needs to be finished and polished as usual.

# With a string of unparalleled features, Protemp™ 4 Temporization Material is unique in the market

Protemp™ 4 Temporization Material is the latest development of bis-acrylic composite material for multiple-unit restorations in the 10:1 Garant™ Cartridge from 3M ESPE.

In vitro tests show that Protemp 4 material ranks highest in important mechanical characteristics such as:

- **Fracture toughness** and
- **Flexural and compressive strength**

Results from mastication testing which comes closest to the in vivo situation corroborate these findings.

The high mechanical performance profile of Protemp 4 temporization material translates not only into enhanced clinical safety, but also into more convenience for patients and dentists.

Additionally, Protemp 4 temporization material with its top-of-the-class fracture resistance and remarkable aesthetics is well equipped to be the first choice for the most demanding discipline in temporization, i. e. as a long-term temporary.

## Product benefits at a glance

### Record-breaking toughness

- Highest fracture resistance
- Better abrasion stability through new sophisticated filler technology
- Also indicated for long-term temporization

### Outstanding aesthetics

- Brilliant, natural gloss without polishing
- 5 fluorescent shades (Bleach, A1, A2, A3, B3) matched with Filtek™ Supreme XT Flowable Restorative
- Excellent colour stability, virtually no colour change

### Easy and fast handling

- Tangibly less inhibition layer than other bis-acrylic materials
- No polishing required – just cleaning with ethanol will get the surface immediately shiny
- No glaze necessary

### Gingival health

- Plaque can be easily removed
- Pleasant wearing comfort for patients

## Record-breaking toughness and durability

Protemp 4 temporization material is the best-in-class material in a test that indicates its durability under in vivo stress.

### Material toughness

Material toughness can be measured as “fracture work” which shows the energy that a material can absorb until fracture. The higher this value the more likely the material will resist to fracture under stress. Compared with other leading temporization materials (see below), Protemp 4 temporization material has the best material toughness values, i. e. shows the greatest resistance to fracture.

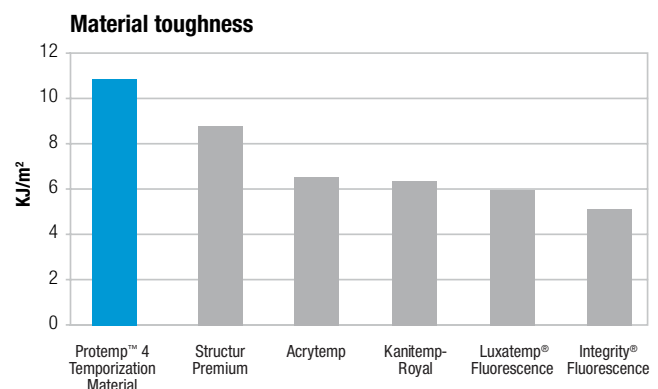
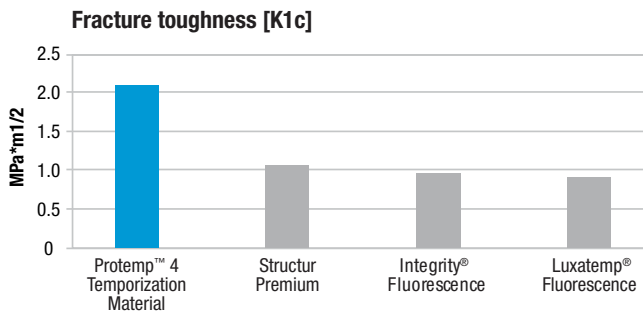


Fig. 1: In a test measuring material toughness, Protemp™ 4 Temporization Material showed greater resistance to fracture than other tested temporization materials.

Source: V. Babacic, R. Perry and G. Kugel, Tufts University, Boston, MA, U.S.A., AADR 2008, #0371

## Fracture toughness (determined as K1c value)

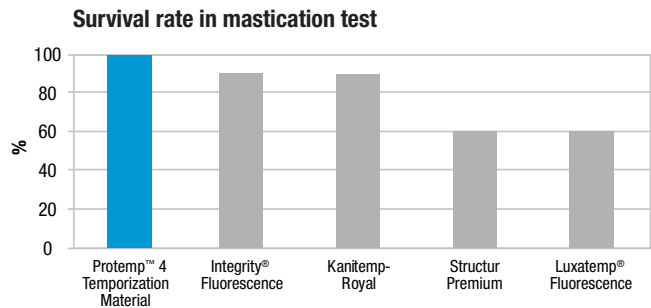
Fracture toughness is a quantitative way of expressing a material's resistance to crack propagation when a crack is present. The higher value the higher the resistance of the material to fracture. Protemp 4 material shows considerably higher fracture toughness values than all other competitive temporization materials tested.



**Fig. 2: Fracture toughness.**  
Source: Dr. Rosentritt, University of Regensburg, Germany – K1c value [MPa\* $m^{1/2}$ ] test

# Toughness

In a mastication simulation of 3 unit-bridges, the restorations made with Protemp 4 temporization material clearly showed the highest survival rate.



**Fig. 4: Survival of 3-unit bridges in mastication tests: 10 samples of each product tested with 450,000 loading cycles (100N) and 3,000 thermocycles (5-55°C).**  
Source: 3M ESPE internal data

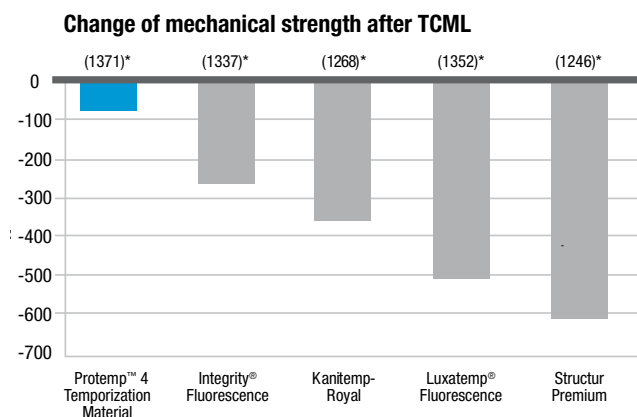
## Mechanical strength under stress

The various toughness measurements indicate a higher chance of survival in real life for temporaries made with Protemp 4 temporization material. To simulate this as close as possible to the in vivo situation, Protemp 4 material and other leading temporization materials were subjected to mastication simulations. The higher the values – shown by the shortest bars – the more resilient and stronger the material. Among all materials tested, Protemp 4 temporization material again showed best mechanical strength and maintained this mechanical strength even after prolonged stress.

# Strength

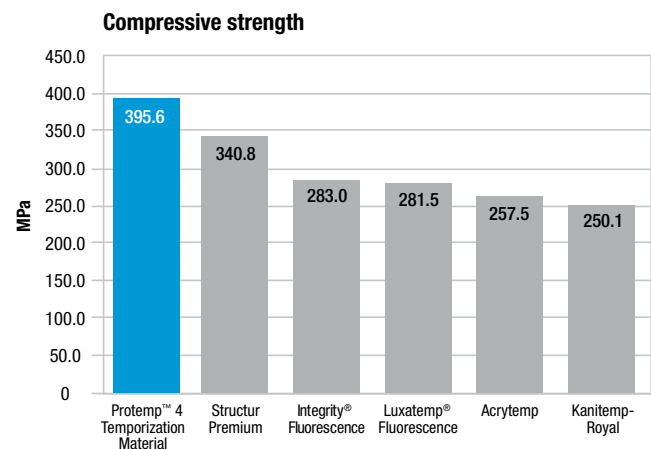
## Outstanding compressive strength

Mechanical study results comparing the compressive strength of Protemp 4 temporization material to leading competitive materials further confirm the excellent mechanical properties of Protemp 4 temporization material.



**Fig. 3: Change of mechanical strength after thermocycling (5-55°C, 3,000 thermocycles) and mechanical loading (480,000 loading cycles; 100N).**  
3M ESPE internal TCML study results corresponding to 2 years mastication simulation with 3 unit-bridges.

Source: Mechanical strength of control group without TCML.



**Fig. 5: Compressive strength (resistance to compression).**  
Source: V. Babacic, R. Perry and G. Kugel, Tufts University, Boston, MA, USA, AADR 2008, #0371

# Outstanding aesthetics

## Fluorescence close to nature

The fluorescence pigments of Protemp™ 4 Temporization Material match very well with the fluorescence of natural teeth. As shown below, Protemp 4 material allows the fabrication of temporaries that look naturally beautiful in various lighting conditions, also in challenging ultraviolet light.



Human tooth



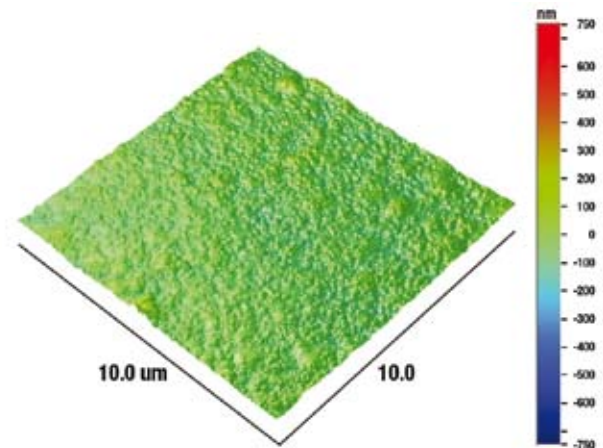
Protemp™ 4 Temporization Material

Fig. 8: Temporary single crowns fluorescence compared to human teeth - Protemp™ 4 Temporization Material looks almost the same as nature.

## Gloss without polishing or glazing – a benchmark in surface quality

Due to its new sophisticated generation of fillers, 3M ESPE sets new industry standards. Right from the beginning, the unique surface quality of Protemp 4 Temporization Material is obvious. Compared to competitive materials, the surface of Protemp 4 material is significantly smoother, as below AFM topography pictures show. Just wiping off with ethanol will get the surface glossy and shiny immediately, making the whole procedure faster as the polishing and glaze working step is no longer required.

### Protemp™ 4 Temporization Material



# Aesthetics

## Five shades that match with Filtek™ Supreme XT Flowable Composite

Five fluorescent shades are available and designed to match with Filtek Supreme XT flowable restorative:

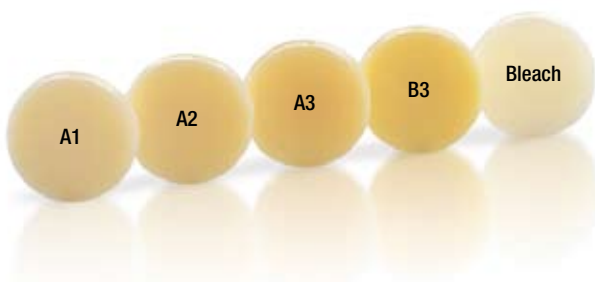
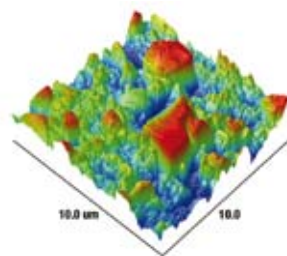
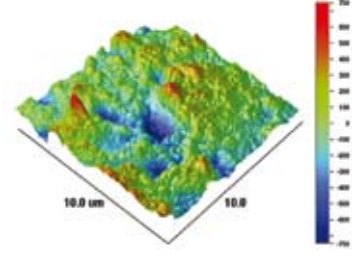


Fig. 9: Filtek™ Supreme XT Flowable Restorative shades.

### Luxatemp® Fluorescence



### Kanitemp-Royal



### Structur Premium

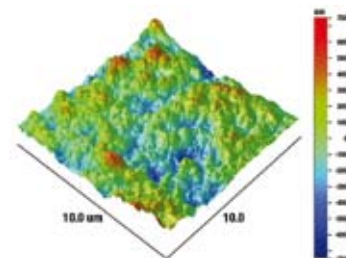


Fig. 10: Surface topology of Protemp™ 4 and other temporization materials after removing the inhibition layer with alcohol and no further polishing.

Source: 3M ESPE internal data – Atomic Force Microscopy (AFM) images by 3M Corporate Research Analytical Laboratory - CRAL

## Better colour stability

Thanks to its enhanced surface quality, Protemp™ 4 Temporization Material resists staining and holds colour better than all other leading materials tested. After 3 days immersed in coffee at 36 degree Celsius, the bridge made with Protemp 4 material shows the least colour change.

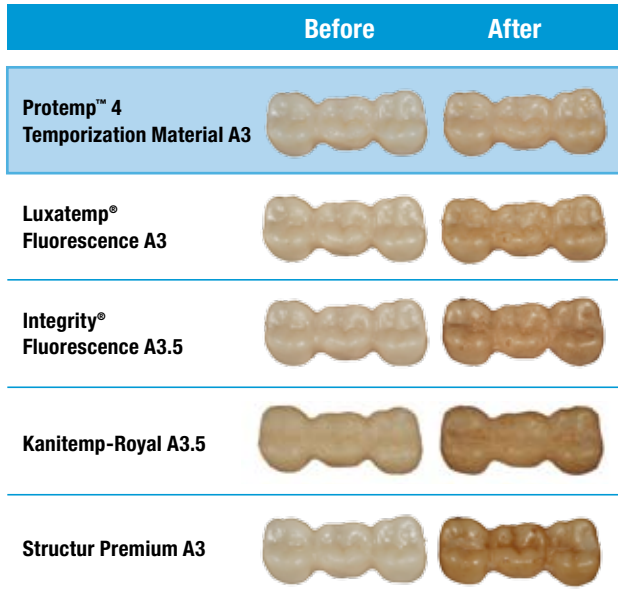


Fig. 11: Coffee test: 3 days immersed in coffee at 36°C.  
Source: 3M ESPE internal data

## Easier and faster handling and fabrication of temporaries

Tangibly less inhibition layer that is easier to remove

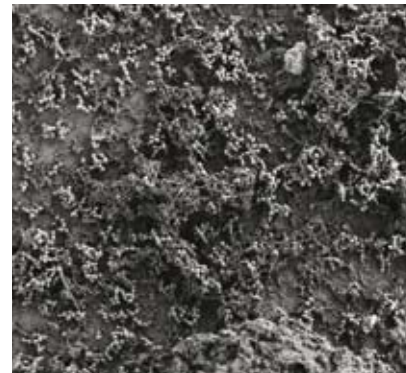
Compared to competitive bis-acrylic materials, Protemp 4 temporization material has tangibly less inhibition layer that can be easier removed. This leads to a simplified and faster finishing of the temporary restoration – without any messy or sticky procedures.

## Gingival health

### Easy to clean and high wearing comfort

Due to the smooth surface of Protemp™ 4 Temporization Material, plaque can be easily removed. Patients have a high wearing comfort with Protemp 4 temporaries (according to 3M ESPE field evaluation results). A 3M ESPE in vitro experiment showed that plaque can be easily removed from Protemp 4 temporization material due to its excellent surface quality properties. In this experiment Protemp 4 material was incubated for 48 hours in full human saliva for plaque growth and then cleaned with tooth paste (Aronal®) on an electrical tooth brush (Oral-B® Professional Care® 5000) for 5 seconds.

Before cleaning



Surface with plaque before cleaning.

After cleaning



Cleaned surface showing only residual tooth paste abrasive particles.

Fig. 12: SEM photos of Protemp™ 4 temporization material surface with plaque before and after cleaning: 500 fold magnification.  
Source: 3M ESPE internal data

# Easy handling



# Results from 3M ESPE field evaluation

## Overall satisfaction with Protemp™ 4 Temporization Material

As with all new 3M ESPE products, Protemp 4 temporization material was tested in dental practices before market introduction. The field test was carried out in 2008 and involved more than 200 dental practices in Germany, Italy, Switzerland, and the UK. During the 8 week test period approximately 4400 temporary restorations were fabricated and placed.

Many of Protemp 4 temporization materials' attributes were highly rated by evaluators leading to an overall satisfaction level of more than 90%.

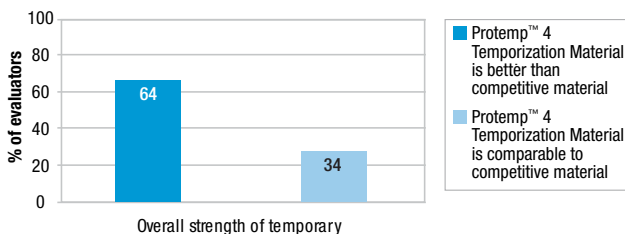
In addition, 95% of all participating dentists would recommend Protemp 4 temporization material to their colleagues.



**Fig. 13: Overall satisfaction with Protemp™ 4 Temporization Material.**  
(Top 2 box results on a 5 scale from "excellent" to "very poor" from the 3M ESPE Protemp™ 4 Temporization Material field evaluation 2008)  
Source: 3M ESPE Protemp™ 4 Temporization Material field evaluation 2008

## Reliable overall strength of Protemp 4 temporaries

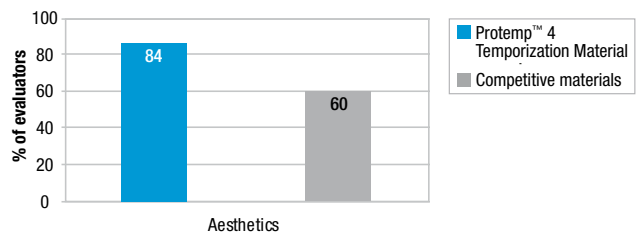
64% of the test participants rated the overall strength of Protemp 4 temporaries to be better than the strength of temporaries made with their currently used temporization material.



**Fig. 14: Rating of the overall absolute strength in comparison to currently used temporization materials.**  
(overall strength of Protemp™ 4 Material)  
Source: 3M ESPE field evaluation 2008

## Protemp 4 temporaries show outstanding aesthetic attributes

In comparison with competitive materials, 84% of the participating dentists gave "excellent" or "very good" ratings for the aesthetic attributes of Protemp 4 temporaries – thus agreeing with their patients who perceive Protemp 4 temporaries to be highly aesthetic and natural-looking.

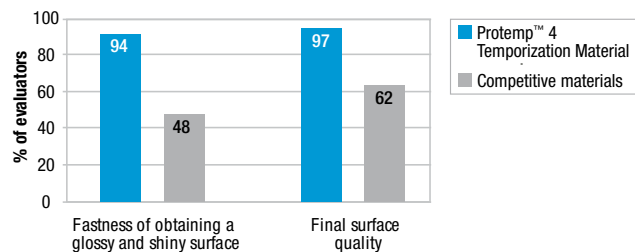


**Fig. 15: Ratings for aesthetic attributes of Protemp™ 4 Temporization Material and competitive temporary materials currently used by evaluators.**  
(Top 2 box results on a 5 scale from "excellent" to "very poor" from the 3M ESPE Protemp™ 4 Temporization Material field evaluation 2008)  
Source: 3M ESPE field evaluation 2008

# Test results

## Enhanced surface quality of Protemp 4 material

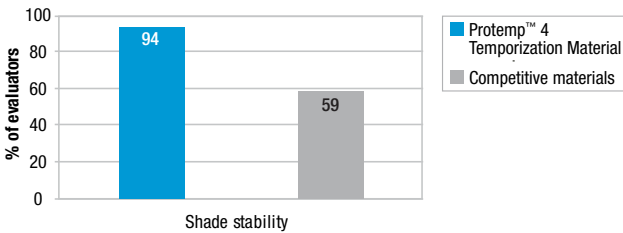
Asked for the fastness of achieving a glossy and shiny surface with Protemp 4 temporization material, 94% of the testers gave "excellent" or "very good" ratings. 97% found the final surface quality of Protemp 4 material to be "excellent" or "very good".



**Fig. 16: Fastness of obtaining a glossy and shiny surface, final surface quality testimonials.**  
(Top 2 box results on a 5 scale from "excellent" to "very poor" from the 3M ESPE Protemp™ 4 Temporization Material field evaluation 2008)  
Source: 3M ESPE field evaluation 2008

## Protemp™ 4 temporaries show higher colour stability

Compared with the evaluators' currently used competitive temporization materials, the shade stability of Protemp 4 material was assessed as considerably higher. 94% of the test dentists gave "excellent" or "very good" ratings.



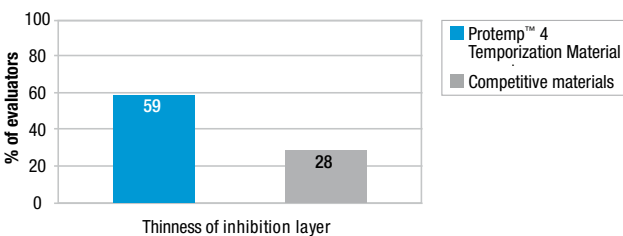
**Fig. 17: Ratings for shade stability of Protemp™ 4 Temporization Material and competitive temporary materials currently used by evaluators.**

(Top 2 box results on a 5 scale from "excellent" to "very poor" from the 3M ESPE Protemp™ 4 Temporization Material field evaluation 2008)

Source: 3M ESPE field evaluation 2008

## Less inhibition layer of Protemp 4 temporization material

Compared to competitive bis-acrylic materials that are currently being used, Protemp 4 temporization material shows tangibly less inhibition layer and therefore provides a faster and easier handling and procedure. This earned high credits from the participating dentists: 59% gave „excellent“ or „very good“ ratings.



**Fig. 18: Ratings for thinness of inhibition layer of Protemp™ 4 Temporization Material and competitive temporary materials currently used by evaluators.**

(Top 2 box results on a 5 scale from "excellent" to "very poor" from the 3M ESPE Protemp™ 4 Temporization Material field evaluation 2008)

Source: 3M ESPE field evaluation 2008

**Protemp™ 4  
Temporization Material**

# The Protemp™ Temporization Family – The top-of-the-class solution in temporaries.

With Protemp™ 4 Temporization Material and Protemp™ Crown Temporization Material – the world's first malleable and light-curable composite crown for single-unit temporaries – 3M ESPE now offers a complete line of temporization materials – providing first-rate performance, reliability and state-of-the-art quality for all temporary indications and needs.



**Protemp™ Crown  
Temporization Material**

## Temporization Solutions



You + 3M ESPE =

*Groundbreaking ideas for dentistry*

**3M ESPE**

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