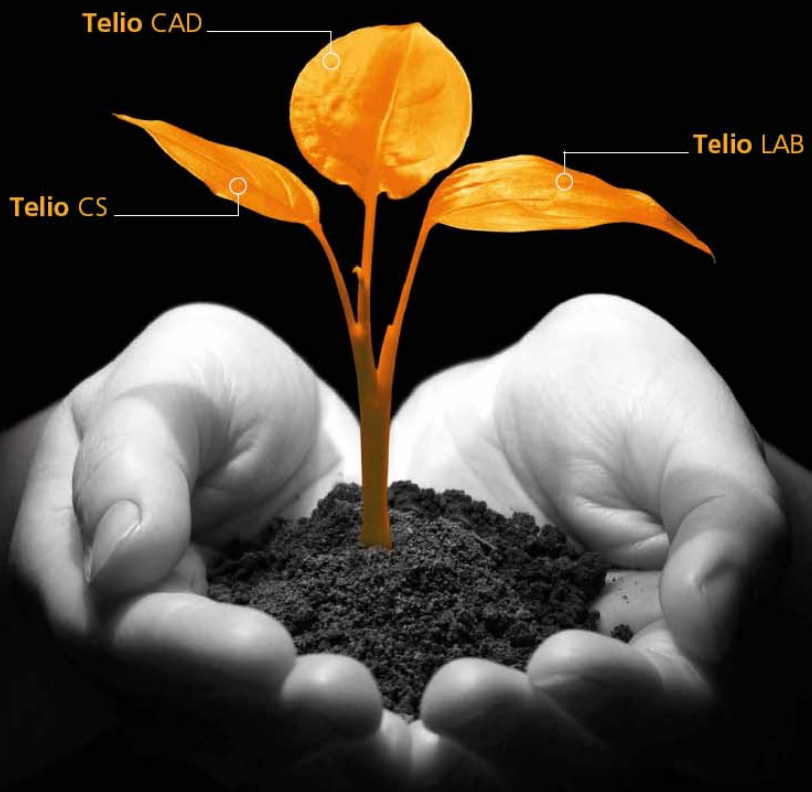
Telio®

Everything (for) provisionals



Scientific Documentation

Telio CAD

ivoclar vivadent
passion vision innovation

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1. Introduction

1.1 The temporary restoration

The temporization of teeth is considered to be an important intermediate step in the provision of permanent tooth replacement [1; 2].

Due to the continued growth of the implant market, the demand for temporary crown- and bridge materials for implant cases has been constantly rising [3]. This applies mainly to materials suitable for the fabrication of long-term temporaries. What is more, modern CAD/CAM technology cannot only be employed for the fabrication of permanent restorations, but also allows temporary restorations to be milled from industrially produced blocks [4]. As a consequence, temporary materials are offered in the form of blocks ever more frequently and can thus be used to quickly and easily mill temporary restorations either in the dental practice or the lab [4]. In contrast to conventional temporary materials, the industrially produced blocks offer the advantage of a consistently high quality, as fluctuations due to the mixing of components cannot occur [5]. In addition, these blocks also eliminate the problem of polymerization shrinkage. In conjunction with conventional, methacrylate-based temporary crown & bridge materials, the fit of the restoration may be detrimentally affected by polymerization shrinkage [6].

Today, even temporary restorations have to meet high demands in regard to accuracy of fit, function and esthetics. These aspects become even more important the longer a temporary restoration is intended to remain in the mouth. Long-term temporaries in particular are increasingly viewed from this perspective.

Depending on the composition of the blocks, they achieved different results in the *in-vitro* investigations conducted. The blocks made of polymethyl methacrylate (PMMA) have been shown to perform well, which makes them a suitable material for use in long-term temporization cases [5; 7].

1.2 Telio CAD

Telio CAD is a block made of polymethyl methacrylate (PMMA) and is used to mill both full-contour single-tooth and multiple-unit temporary restorations using CAD/CAM technology.
This block enables restorations to be milled both in the laboratory (labside) and the dental practice (chairside). Additional layering materials and stains can be used to enhance the esthetic appearance of the milled restorations.

2. Technical Data

Standard composition	(in wt.%)
Polymethyl methacrylate (PMMA)	99.5%
Pigments	< 1.0%

Physical properties

According to ISO 10477 - Polymer-based crown and bridge materials

Flexural strength	130 ± 10	MPa
Flexural modulus	3200 ± 300	MPa
Ball indentation hardness	180 ± 5	MPa
Vickers hardness	190 ± 5	
Water absorption	< 28	µg/mm³
Solubility in water	< 0.6	µg/mm³

3. *In-vitro* Investigations with Telio CAD

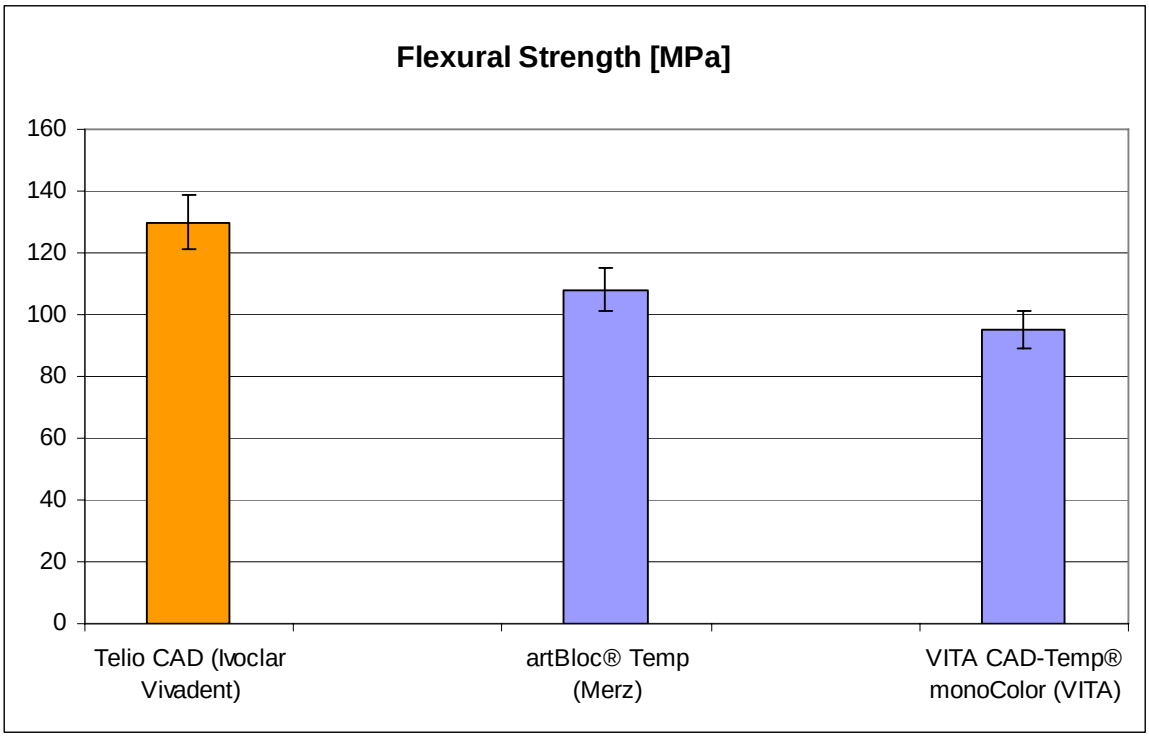
Various internal tests were conducted at the R&D Department of Ivoclar Vivadent to evaluate the physical and mechanical properties of Telio CAD blocks in sizes B40 L and B55. As there are no definitive standards for temporary materials, the results obtained were compared to those of other temporary CAD/CAM blocks currently on the market.

In addition, complementary external investigations have been initiated. These investigations are still in the process of being completed. In these tests, the following parameters are investigated:

- Fracture load of bridges after aging in artificial saliva
- Fracture load of bridges after chewing simulation and
- Wear resistance following various mastication cycles

3.1 Flexural strength

Temporary materials also need to provide sufficient mechanical strength in order to withstand the force exerted during chewing. A measure for this strength is the flexural strength of a material, which is expressed as the stress that is exerted on the bent test specimen on the instant of failure. The test specimens were fabricated and the measurements conducted according to ISO 10477 guidelines.

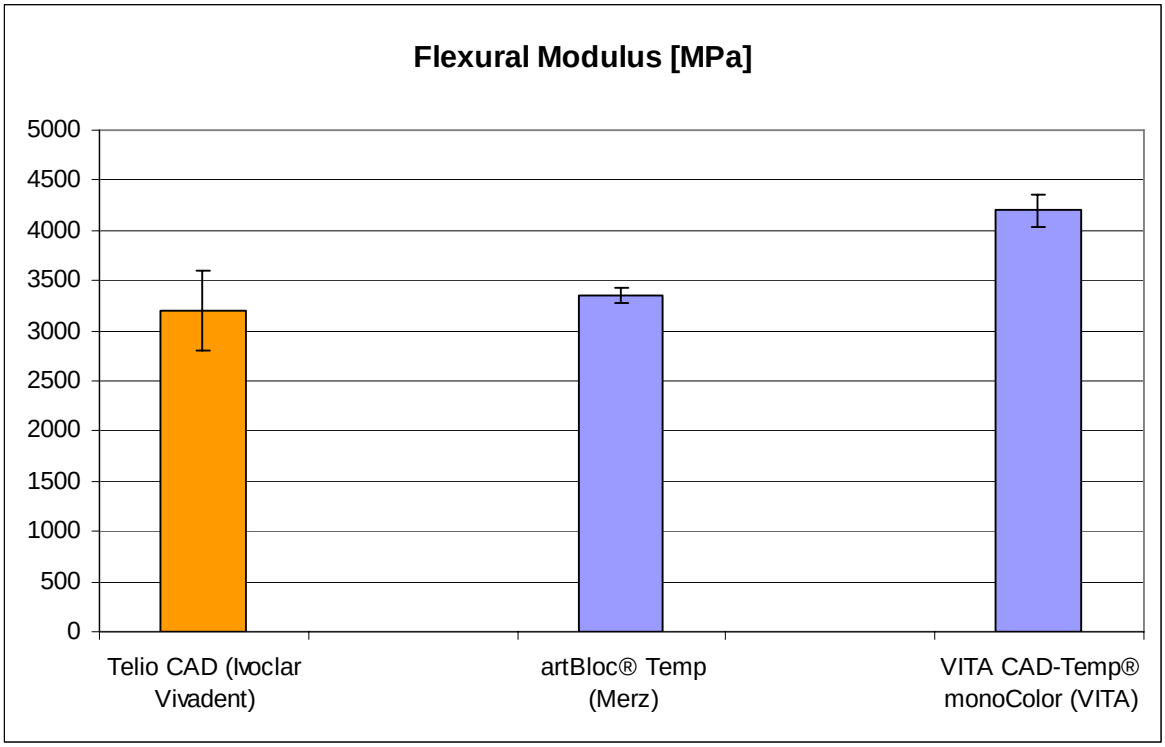


Source: R&D Ivoclar Vivadent, Liechtenstein (2009)

The flexural strength measured for Telio CAD shows that the material provides appropriate stability.

3.2 Flexural modulus

The flexural modulus which is often also referred to as modulus of elasticity is determined by means of the same trials as those indicated in section 3.1. The flexural modulus is defined as the gradient of the linear section of the stress-strain curve. Thus it describes the relationship between stress and strain in the elastic deformation of a solid body and thus refers to the stiffness of a material.



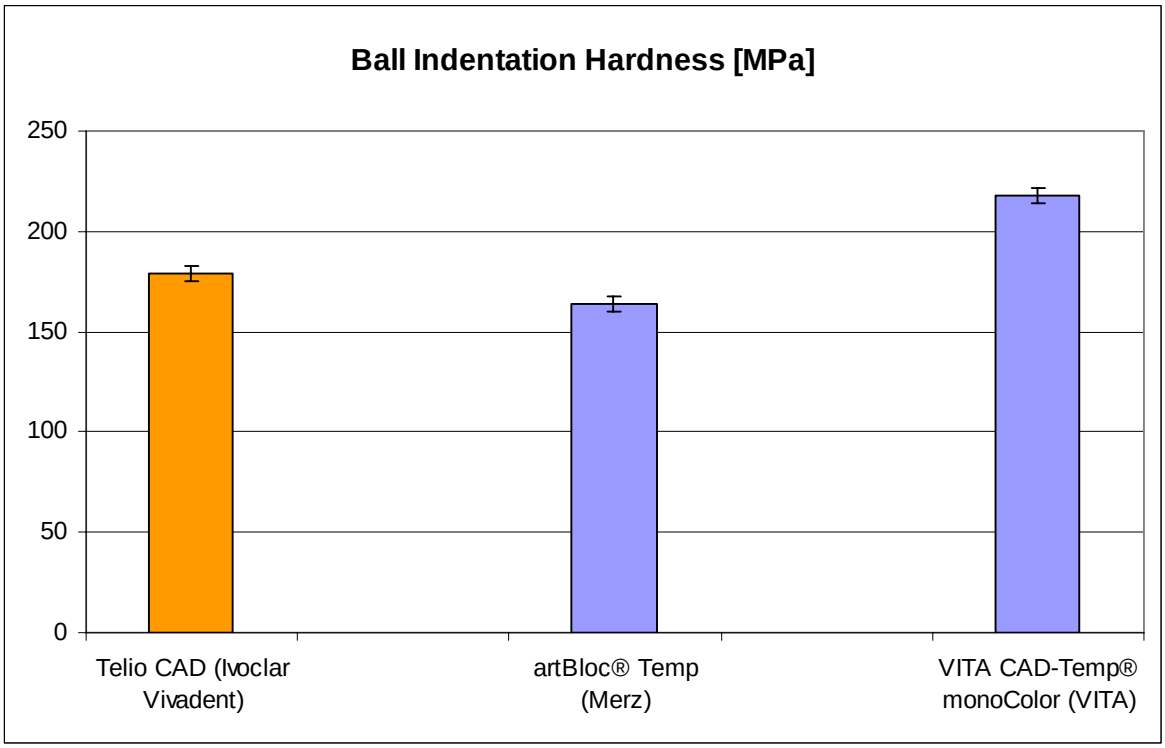
Source: R&D Ivoclar Vivadent, Liechtenstein (2009)

Telio CAD shows a flexural modulus similar to that of artBloc Temp. However, both materials show values that are significantly below those of VITA CAD-Temp.

3.3 Ball indentation hardness

When it comes to acrylics or composites, the determination of ball indentation hardness is a preferred method of describing their hardness. In this test, a ball is dropped on a composite surface measuring 50 x 50mm. The value determined is the quotient of the applied load and the surface area of the impression underneath the ball.

The hardness of a material is the resistance of a material to the penetration by another body. This parameter influences the resistance of a restorative material to wear by itself. Particularly when used for occlusal restorations, the material requires a certain degree of hardness. However, there is no clear correlation between hardness and wear resistance. As far as wear of the antagonist is concerned, the surface roughness is much more important than the degree of hardness.



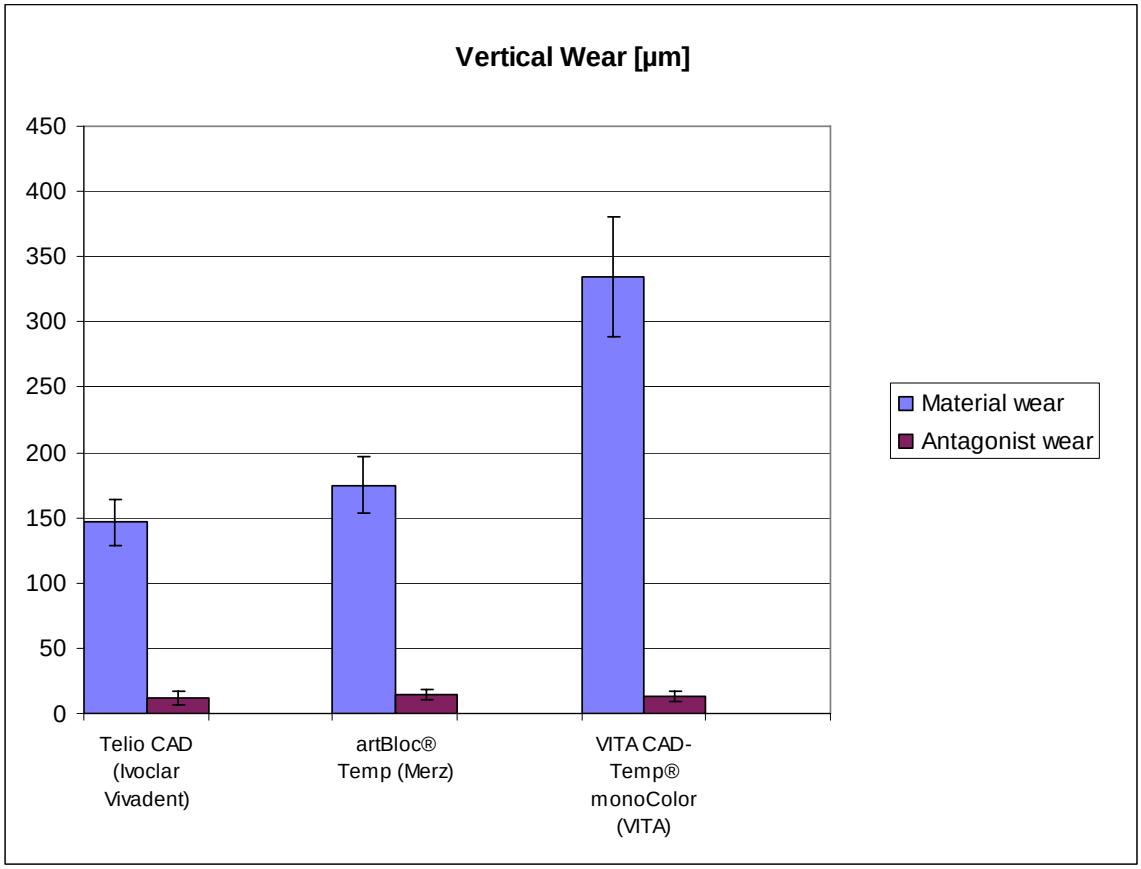
Source: R&D Ivoclar Vivadent, Liechtenstein (2009)

The ball indentation hardness of Telio CAD is more or less comparable to that of competitive products.

3.4 Wear

In order to assess the clinical behaviour of a dental material, chewing conditions are simulated in the laboratory.

At Ivoclar Vivadent, the Willytec chewing simulator is used for wear measurement. In order to obtain comparable results, a more or less standardized procedure is chosen. For this purpose, standardized ceramic antagonists are used and planar test specimens are subjected to 120,000 chewing cycles at a load of 50 N and a horizontal movement of 0.7mm. Vertical wear is measured by means of the 3D laser scanner. Vertical wear of less than 200µm is considered to be low wear, while wear in the region of 200 – 300µm is classified as medium wear.



Source: R&D Ivoclar Vivadent, Liechtenstein (2009)

No significant difference was found between the Telio CAD and artBloc Temp materials in regard to wear. However, there was a difference between these two materials and Vita CAD-Temp.

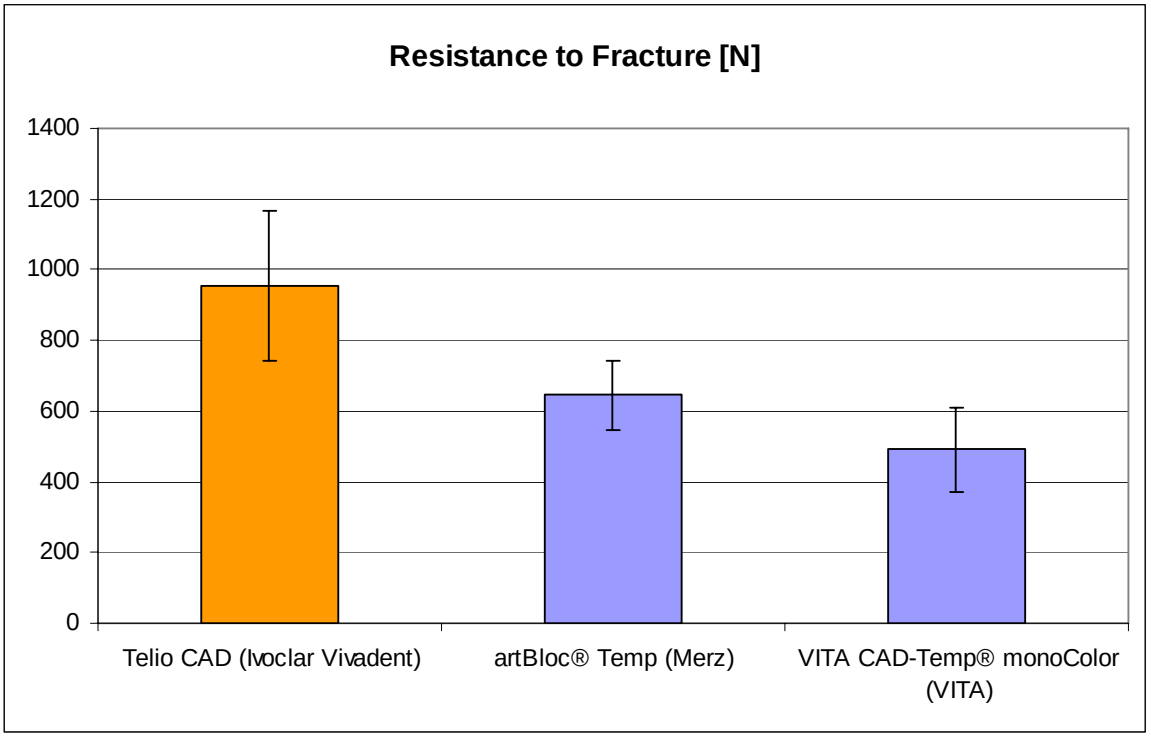
As far as antagonist wear is concerned, no difference was found between the three materials.

3.5 Strength measurement of bridges

The selected model (25-27) was scanned and constructed according to the instructions for use of the respective material. In general, a connector size of 12mm² between teeth 25-26 and 16mm² between teeth 26-27 was chosen. The circumferential minimum wall thickness was 0.8mm, while along the central fissure it was 1.5mm.

For this trial, a test set-up involving elastically mounted abutments was used. This set-up was chosen to simulate the mobility of the natural teeth.

The load was applied to the pontic using a rounded steel plunger (∅ 8mm). In order to avoid stress peaks in the contact areas, tin foil of 0.2mm thickness was placed between the plunger and the pontic. The bridges were loaded until fracture in the Zwick universal testing machine.



Source: R&D Ivoclar Vivadent, Liechtenstein (2009)

A comparison of the results obtained in conjunction with 3-unit bridges shows that there are significant differences in fracture strength between the materials tested.

4. Handling

The clinical experiences gathered with Telio CAD have been very positive and confirm the suitability of the material for the intended purpose. The handling properties impressed both dental technicians and dentists. The grindability and polishability of the restorations fabricated from Telio CAD received excellent ratings, as did the esthetic properties and the individualization options. In summary, it can be said that to date, the clinical performance of Telio CAD has been consistently positively rated.

However, to ensure clinical success and avoid pre-mature loss of retention, the following aspects have to be kept in mind:
An important pre-requisite to ensure reliable bonding of Telio CAD restorations to the tooth structure by means of a temporary cement such as Telio CS Link is a retentive preparation design and an accurately fitting restoration. The accuracy of fit is dependent on the precision provided by the CAD/CAM system. Furthermore, if long-term temporaries with a wear time of more than 4 weeks are incorporated, regular follow-up and recall examinations are required, so that the restoration can be re-cemented if required.

5. Biocompatibility

Test specimens made of Telio CAD were subjected to cytotoxicity and mutagenicity tests. In XTT assays conducted to assess the cytotoxicity of the material, no cytotoxic potential was found [8]. The AMES did not reveal a mutagenic effect [9]. The results of both tests show that Telio CAD is neither cytotoxic nor mutagenic and that its use does not pose a toxicological risk if used as indicated in the respective instructions for use.

6. Literature

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Edition: April 2010