Telio®

Everything (for) provisionals

Scientific Documentation

Telio CS C&B

ivoclar vivadent
passion vision innovation

Table of Contents

1. Introduction

1.1 The temporary restoration

In indirect restorative procedures, provisional restoration of the prepared teeth is an indispensable treatment step. A provisional restoration offers effective protection of the exposed dentin, which is compatible with the pulp. Additionally, it immobilizes the prepared teeth in their position. The temporary provides patients with interim masticatory function, phonetics and aesthetics, while the dentist may use it as a diagnostic tool and as a means to evaluate the planned permanent restoration. As is the case with other materials, an increasing level of importance is placed on the accuracy of fit and biocompatibility of temporary materials today.

1.2 Provisional restoration with temporary crown and bridge materials

Temporary crown and bridge materials mainly consist of tooth-coloured composites or polymers. The task of provisional restorations is to fully assume the function of a crown, partial crown, an inlay, onlay or a bridge until the permanent restoration is placed. As a result, temporary restoratives have to fulfil many different requirements:

- Protection of the pulp
- Provision of masticatory function
- Prevention of tooth migration
- Aesthetics
- Prevention of caries and periodontal diseases
- Biocompatibility
- Compatibility with impression materials and temporary cements
- Practical handling properties
- Low generation of heat during polymerization
- Low polymerization shrinkage
- Colour stability
- Polishability

This list is not complete, of course.

1.3 Telio CS C&B

Telio CS C&B is a self-curing composite material for the fabrication of temporary crowns and bridges of high quality. A choice of five shades enables the creation of temporaries that look natural and aesthetic.

The material is dispensed from a cartridge with a static mixing device. Thus homogeneously mixed material is ensured, down to the last drop.

2. Technical Data

Standard Composition:	**(in wt%)**
Base	
Dimethacrylates	51.1
Barium glass filler, highly dispersed silicon dioxide	48.7
Initiators, stabilizers and pigments	0.2
Catalyst	
Triglyceride	35.9
Glass filler	57.0
Initiators and stabilizers	7.1

Physical Properties

Flexural strength	85 - 95	MPa
Working time (at 23 ºC)	65 - 80	s
Setting time (at 37 ºC)	65 - 80	s

3. *In vitro* Investigations of Telio CS C&B

Various physical and mechanical properties of Telio CS C&B have been evaluated in the Research and Development Department of Ivoclar Vivadent. As there are no defined standards for temporary materials, the values obtained were compared to the values of other temporary crown and bridge materials currently on the market (see Table 1).

Abbreviation	Temporary C&B material	Manufacturer
C&B+	Telio CS C&B	Ivoclar Vivadent AG
FILL	Fill-in Unidose	Kerr
LUX	Luxatemp Automix Plus	DMG
PRO	Protemp 3 Garant	3M ESPE
PT2	Perfec Temp II	Discus Dental
2SC	Structur 2 Sc	VOCO

Table 1: List of investigated temporary C&B materials

3.1 Exothermy

All the C&B materials that were investigated are methacrylate-based composite resins. The curing process is based on the radical polymerization of monomers. This is an exothermic reaction, which means that energy is released in the form of heat. If too much heat is generated, the tissue which is in direct contact with the material may be damaged. Moreover, the pulp, which is only protected by the dentin that remains following preparation, is endangered.

According to ISO 4049, the composite material is mixed at a constant temperature. The curing process is initiated at a starting temperature of 37°C.

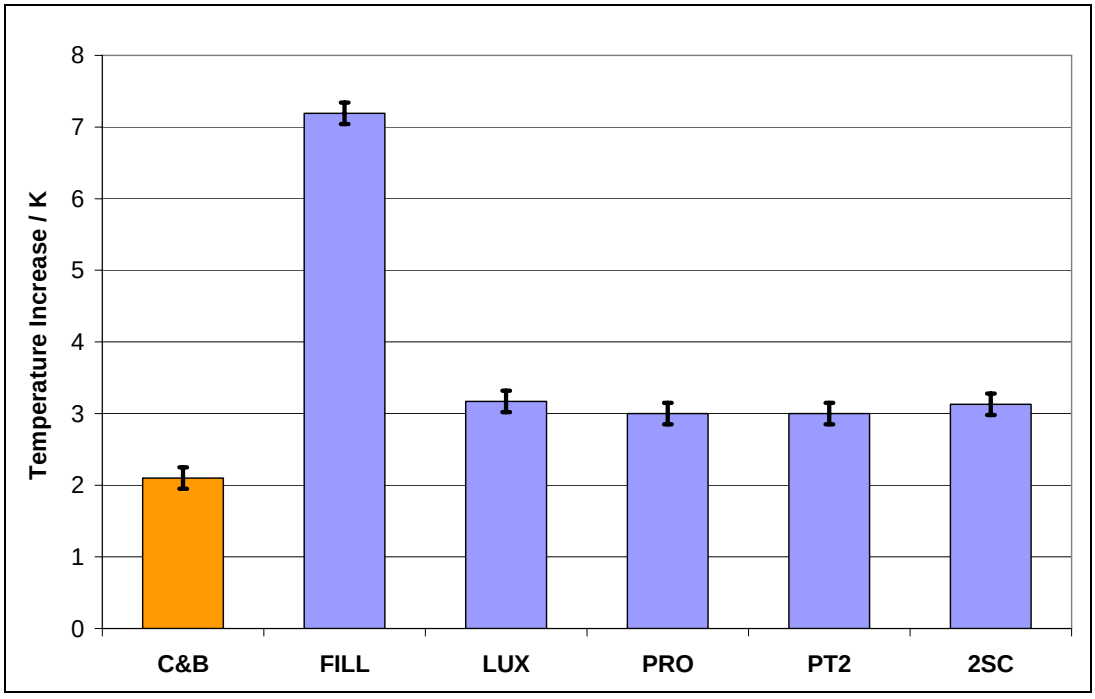

Fig. 1: Exothermy measured during the curing process

The measured temperature increases of around 3°C are tolerable and do not increase the risk of tissue or pulp damage. Only in the case of Fill-in Unidose was the temperature increase twice as high.

3.2 Volumetric shrinkage

Because of the shrinkage these materials undergo during the curing process, cured polymers usually occupy less space than the monomers. The extent of volume loss is dependent on the monomers employed, the filler content and monomer conversion.

High volumetric shrinkage leads to shrinkage-induced stresses, which result in a weakening of the C&B material. Additionally, the accuracy of fit may be compromised.

Volumetric shrinkage is determined by means of density measurements. In this case, the values of the uncured composites were compared to those of cured composites. Prior to performing the measurement, the cured test specimens were stored in water for 24 hours at 37 °C.

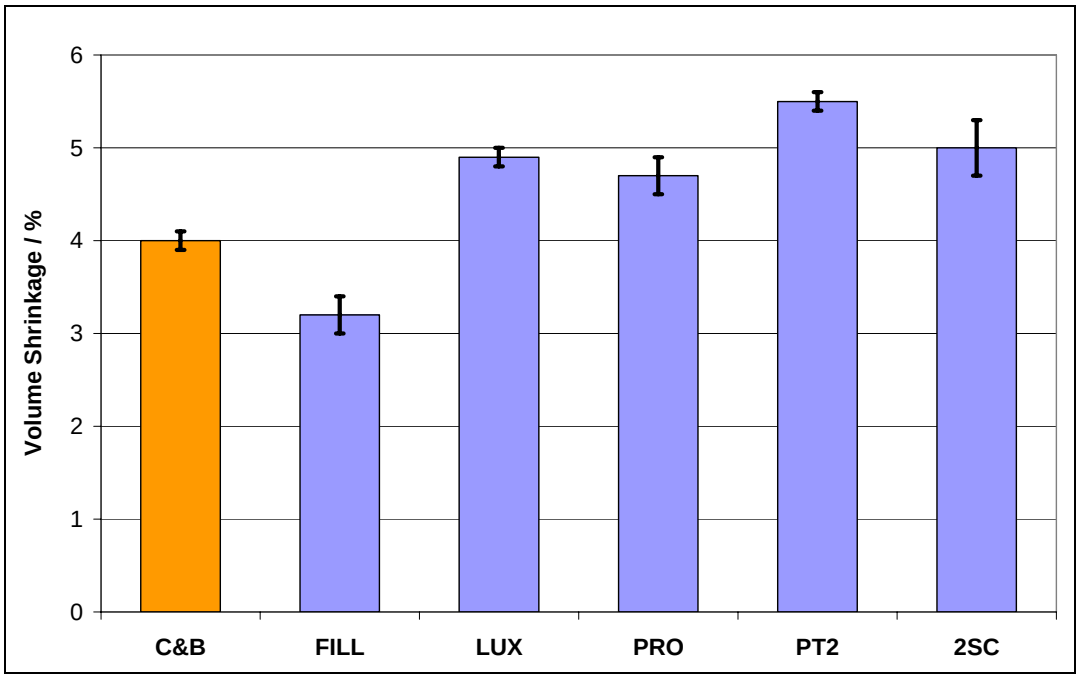

Fig. 2: Measurement of polymerization shrinkage

With a volumetric shrinkage of 4 %, Telio CS C&B is at the lower end of the value range.

3.3 Oxygen inhibition layer

Atmospheric oxygen is an agent that effectively inhibits radical polymerization. As contact with atmospheric oxygen cannot be excluded during the processing of dental materials in the surgery or laboratory, the surface layer of composites usually remains uncured due to oxygen inhibition. The thickness of this inhibition layer is dependent on the initiator system and the oxygen permeability of the composite material.

The following values pertaining to the inhibition layer were obtained by placing a quantity of 0.1 g of mixed C&B material on a glass plate. The material was immediately covered with a second glass plate and a weight of 120 g was applied. After 3 minutes, the upper glass plate was removed. Subsequently, a light microscope was used to measure the thickness of the layer of material still adhering to the upper glass plate.

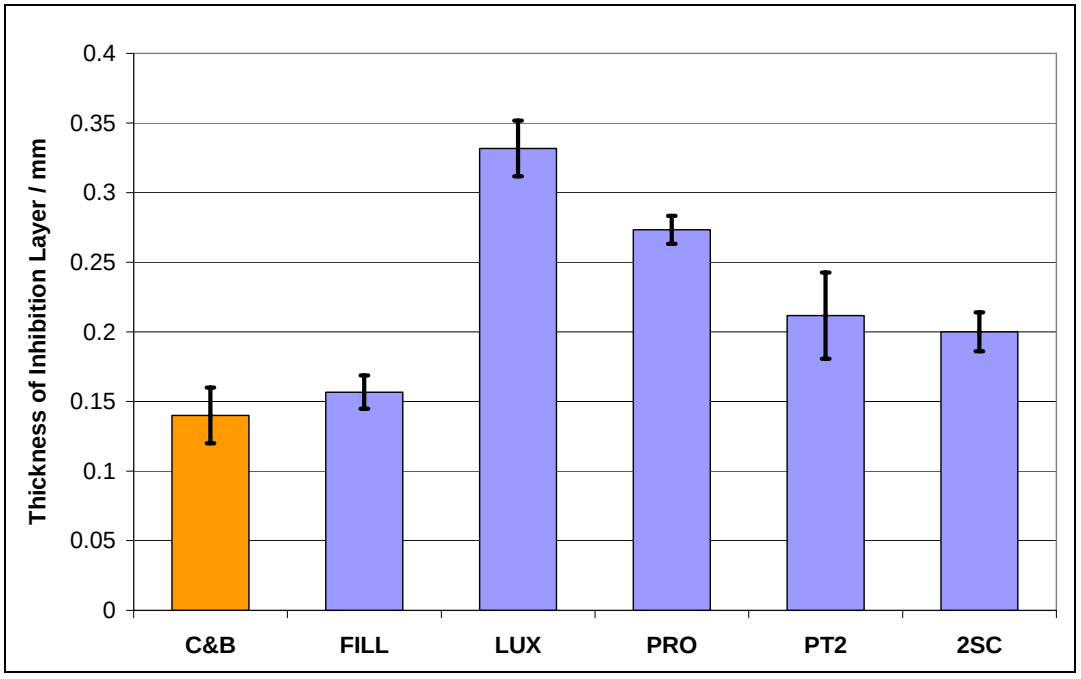

Fig. 3: Determination of the thickness of the oxygen inhibition layer

Inhibition layers of very low thickness were measured for Telio CS C&B under the indicated conditions.

3.4 Flexural strength

Temporary restoratives should demonstrate sufficient mechanical strength to resist the masticatory forces. Flexural strength is a measure for this type of strength. It indicates the force required to break a specimen by bending it. The specimens used in this test were manufactured and measured according to ISO 4049.

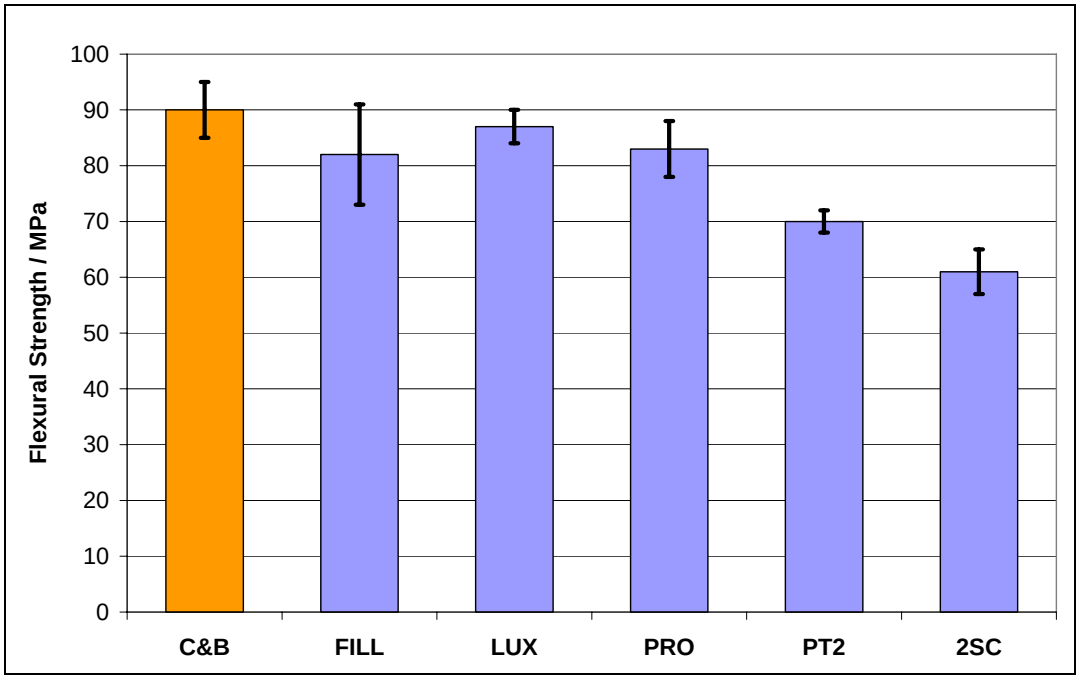

Fig. 4: Determination of flexural strength

Telio CS C&B was shown to provide convincing stability in bending strength tests.

3.5 Flexural modulus

The same type of tests as those described in paragraph 3.4 are used to measure the flexural modulus, also referred to as the modulus of elasticity.

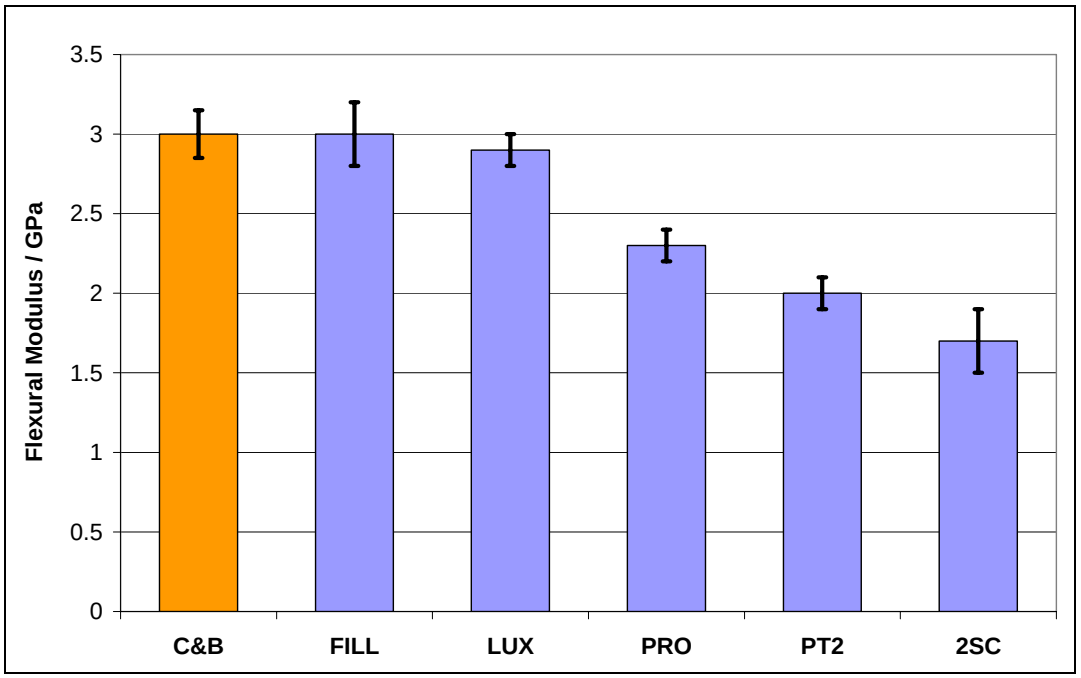

Fig. 5: Determination of the flexural modulus

Telio CS C&B exhibits a flexural modulus that is just as high as that of Fill-In Unidose.

3.6 Ball indentation hardness

The hardness of a dental composite is a measure for its resistance against wear. Particularly if the materials are also used for the reconstruction of the occlusal surface, they require a certain degree of hardness. One of the disadvantages associated with excessively high hardness of the restoration is wear of the opposing tooth.

Ball indentation hardness is the preferred method of measuring the hardness of composites or polymers. In this method, the indentation produced by a ball that falls on a composite layer of 50 x 50 mm in size is measured. The calculated value is the ratio of the force that acts upon the ball indentor and the surface of the indentation.

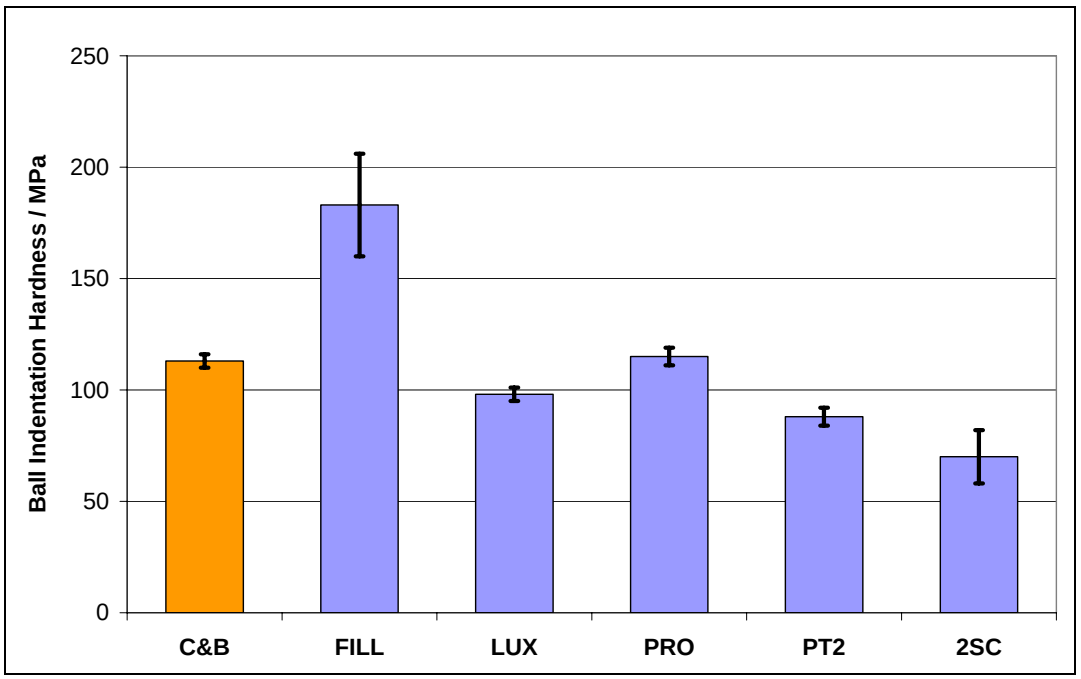

Fig. 6: Determination of ball indentation hardness

The ball indentation hardness of Telio CS C&B is in the range of that of most competitive products.

3.7 Clinical Use

The suitability of Telio CS C&B for clinical use was extensively investigated in the internal Clinic of Ivoclar Vivadent. The material was assessed according to the following criteria:

a. Extrudability
b. Adaptation to the tooth surface
c. Retention upon removal
d. Distortion during finishing
e. Finishing properties
f. Polishability
g. Accumulation of plaque
h. Mucous membrane reactions

Apart from using it for the fabrication of provisional crowns and bridges, Telio CS C&B was also applied as relining material for PMMA crowns. In addition, its repair capability was investigated in individual cases.

The clinical results obtained were very good. The dentists of the Clinic particularly appreciated the favourable handling properties. Furthermore, the restorations showed good polishing properties. No irritation of the mucous membranes occurred. A slight accumulation of plaque was observed in 18 % of the cases. Overall, Telio CS C&B showed good clinical performance.

Apart from these investigations, the material was used in various clinical studies as a provisional material in the fabrication of all-ceramic crowns and bridges.

4. Biocompatibility

Safety data sheets are available for all the ingredients used. A cytotoxicity test (XTT) and an Ames test were carried out with Telio CS C&B test specimens. In none of the tests was a cytotoxic potential of the material observed. Uncured material may cause a sensitizing reaction due to methacrylates. A corresponding warning for dentists and clinic staff has been included in the Instructions for Use.

5. Literature

D. G. Gratton, S. A. Aquilino; Dent. Clin. North Am. **48**, 487 (2004)
Interim restorations

R. Lange, M. Rosentritt, G. Handel; Quintessence **53**, 27 (2002)
Die provisorische Versorgung

G. J. Christensen; J. Am. Dent. Assoc. **134**, 637 (2003)
The fastest and best provisional restorations

R. W. Wassell, G. St George, R. P. Ingledew, J.G. Steele; Br. Dent. J. **192**, 619 (2002)
Crowns and other extra-coronal restorations: Provisional restorations

W. Bücking; Quintessence **53**, 483 (2002)
Die passgenaue provisorische Brücke

J. Wirz, R. Bangert, K. Jäger; Quintessence **43**, 1297 (1992)
Kronen- und Brückenprovisorien Teil I: Anforderungen

Ivoclar Vivadent AG
Research and Development
Scientific Services
Bendererstrasse 2
FL - 9494 Schaan
Liechtenstein

Contents: Dr. Thomas Völkel
Edition: January 2010