

TOTAL C-RAM

AUTOMIX / DUAL-CURE

WHITE PAPER



Product description

Total C-Ram is a dual-cured, radiopaque permanent adhesive methacrylate-based resin cement formulated for all substrates. Total C-Ram is optimized for all types of ceramics including zirconia. Its overall properties enable it to achieve good results with metal as well.

KEY FUNCTIONS	INGREDIENTS
Resin matrix	TEGDMA, Bis-GMA, UDMA
Acidic adhesive monomers	4-META, Methacrylated phosphoric acid esters
Coupling agent Promotes the ability of TOTAL C-RAM to form durable bond with ceramic surfaces	Silane
Fillers Provides the material with good mechanical strength and durability	Nanosilica concentrate

Total C-Ram has been formulated with acidic monomers to ensure a tenacious bond to both dentin and enamel, acting like coupling agent. These monomers have an affinity for tooth structure, for ceramic and for metal as well. The addition of methacrylate monomers that contain phosphoric acid esters simultaneously demineralize and infiltrate both the smear layer and the underlying dentin, providing both micromechanical and chemical bonding [2].

2 in 1 action:

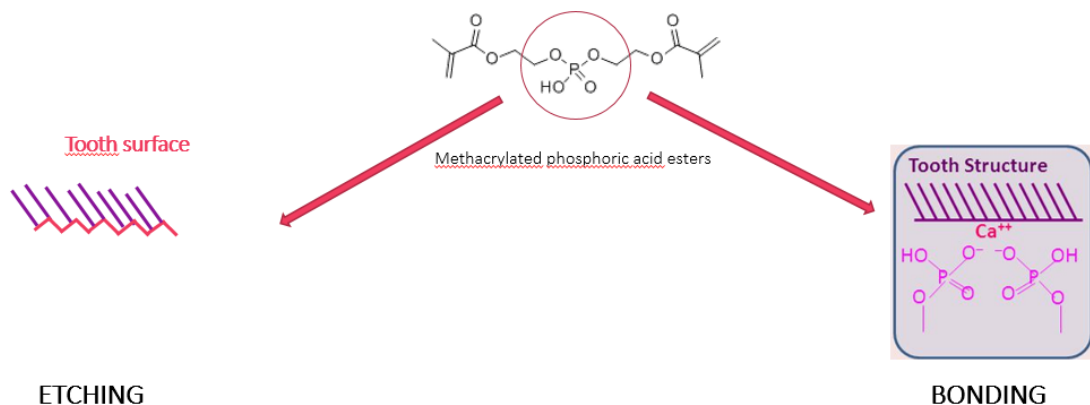


Figure 1 - Methacrylated phosphoric acid esters double action

The presence of silane coupling agent promotes the ability of Total C-Ram to form a durable bonding to ceramics.

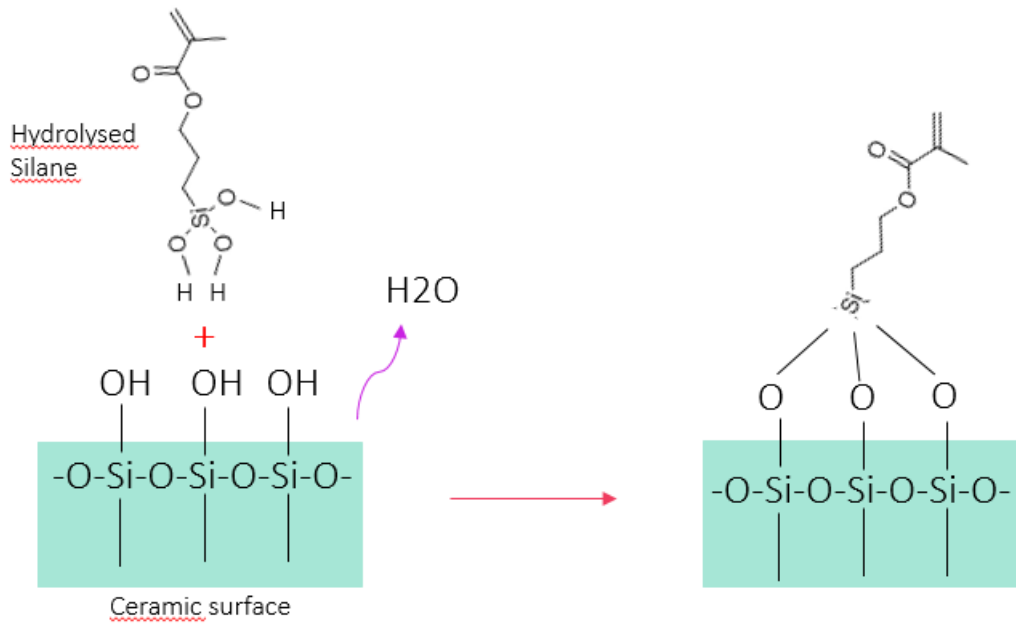


Figure 2 - Chemical reaction between ceramic surface and silane

Main advantages:

- Radiopaque
- Hydrophilic
- Dual-cured
- No taste or odor
- Forms an outstanding bond with ceramics

Indications

Permanent cementation of all substrates and especially optimized for all types of ceramics including zirconia:

- Crown
- Bridges
- Inlays
- Onlays
- Veneers

Shades

The 3 shades of Total C-Ram developed by ITENA make it possible to adapt the final color to each restorative case.

Opaque dentin	Similar to the tooth color with an aesthetic appearance. The choice of color is according to the practitioner's requirements
Translucent	
White	Has opaque properties and is designed for veneers. Also indicated to cover a gray shade of a metallic part, i.e, under the crown

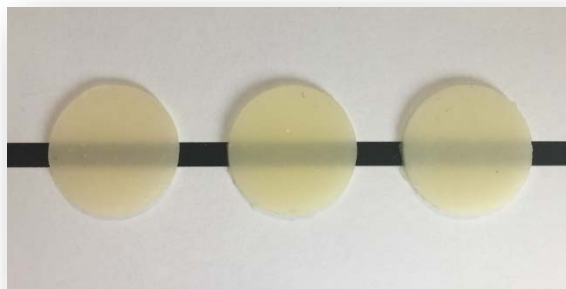


Figure 3 – TotalC-Ram's shades: Opaque dentin, translucent, white

Technical properties

Solubility:

Total C-Ram offers a high tightness due to its low water sorption and low water solubility properties.

Water sorption	8 µg/mm ³
Water solubility	1 µg/mm ³

Table 1 – Total C-Ram properties with water [1] _ based on ISO 4049:2009 [3]

Other properties:

Property	Value
Radiopacity	250 %AI (ISO 4049:2009)
Film thickness	10 µm (ISO 4049:2000)
Working time (in ambient light and temperature)	1.5-3.5 min
Setting time (in oral temperature)	2.5-4.5 min

Table 2 – Total C-Ram properties [1]

Product performances / MARKET

Color stability¹ [1]:

Color stability of a cement is an important parameter for the durability of the aesthetic aspect over time.

Different storage conditions have been tested:

Figure	Test conditions
Figure 4	24 hours of storage in dark + in water + under Xenon lamp irradiation
Figure 5	7 days of storage in dark + in water

Table 3 - Test conditions

$\Delta E \leq 3.00$	Excellent match
$3.00 < \Delta E < 5.00$	Acceptable value
$\Delta E > 5$	Unacceptable value

Table 4 - ΔE value represents the distance in color space that a sample falls from the standard

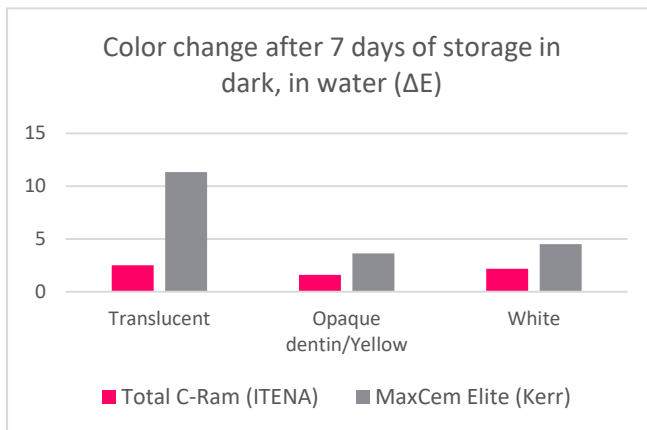


Figure 5 - Total C-Ram color change after 7 days of storage in dark and in water at 37°C compared with other product on the market¹

¹ Comparison with the same material that was analyzed immediately after polymerization

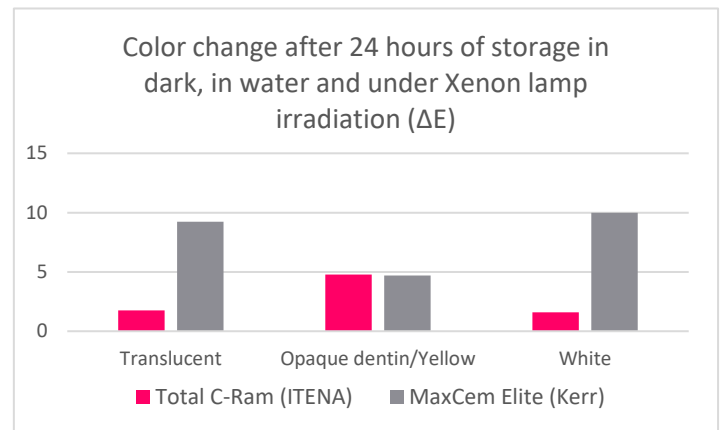


Figure 4 - Total C-Ram color change after 24 hours of storage in dark, in water and under Xenon lamp irradiation compared with other product on the market²

² Comparison with samples stored in dark and dry conditions at 37°C during 7 days

Total C-Ram has a much higher color stability than MaxCem Elite™ for the different evaluated storage conditions. Hence, the aesthetic aspect of the restoration is maintained over longer time.

¹ Based on ISO 7491 "Determination of color stability" [4]

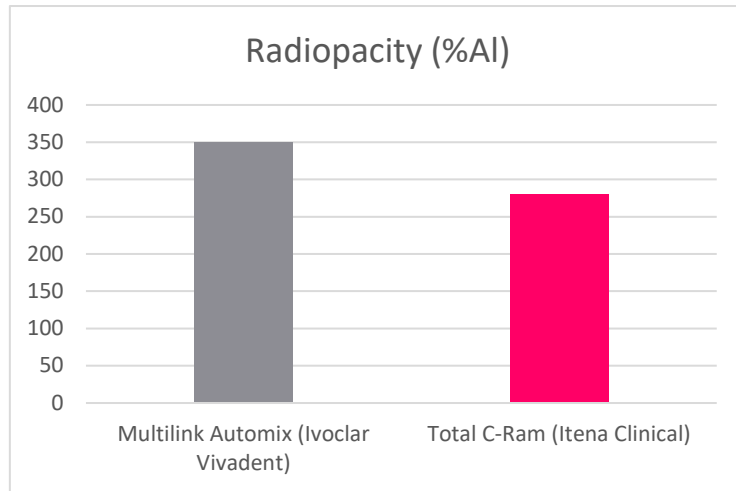


Figure 6 - Total C-Ram radiopacity compared with another product on the market [1] based on ISO 4049:2009 [3]

Total C-Ram possesses a good radiopacity value, making it easier to visualize on x-rays and facilitating practitioner's procedures.

Curing:

Appropriate polymerization is a crucial factor in obtaining optimal physical properties and a satisfying clinical performance. [5]

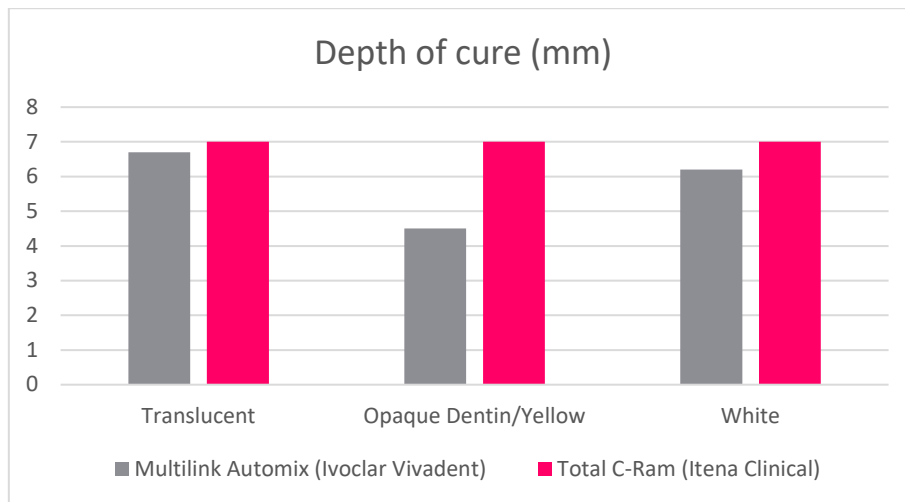


Figure 7 - Total C-Ram depth of cure compared with another product on the market [1] based on ISO 4049:2009 [3]

Total C-Ram has higher depth of cure than Multilink Automix for the different available shades.

The degree of conversion reflects the percentage of methacrylate double bonds that are converted to single bonds during curing reaction. This property is linked to the polymerization mechanism.

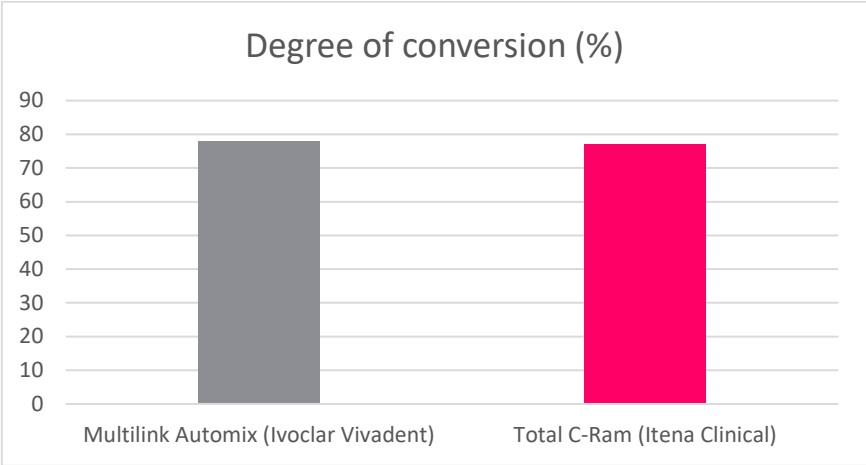


Figure 8 - Total C-Ram degree of conversion compared with another product on the market [1] based on ISO 4049:2009 [3]

Total C-Ram has a similar degree of conversion to Multilink product.

Mechanical properties

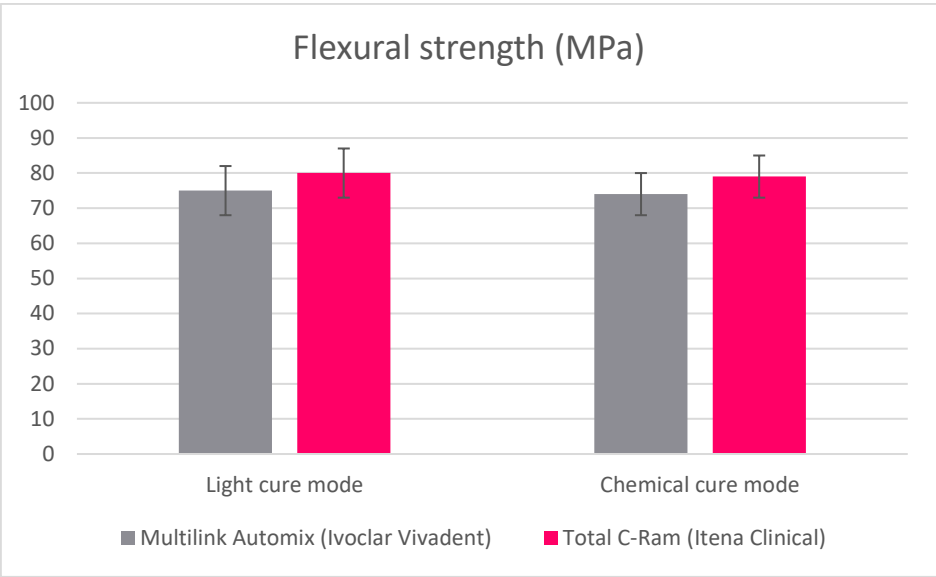


Figure 9 - Flexural strength of Total C-Ram compared with another product on the market [1] based on ISO 4049:2009 [3]

Total C-Ram flexural strength is slightly higher than the one of Multilink under light cure and chemical cure modes.

Adhesion

Adhesion properties have been evaluated on different parameters using shear bond strength method.

<u>Substrate</u>	<u>Surface preparation</u>
Zirconia	Sandblasting after sintering
Lithium disilicate glass-ceramic	Etching + Ceramic primer
Hybrid ceramic (Lava Ultimate (3M))	No preparation
Dentin and enamel	Etching + Bonding

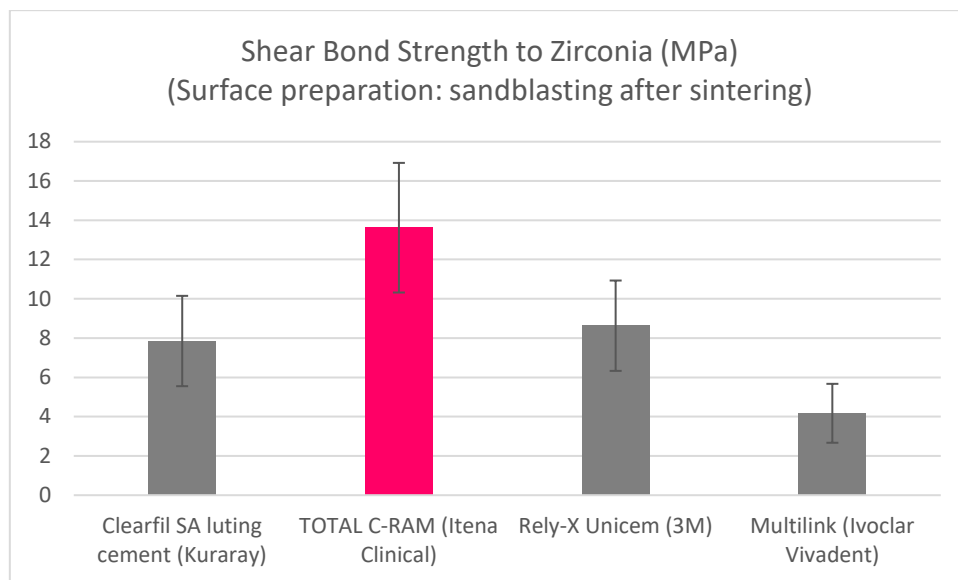


Figure 10 - Shear bond strength to Zirconia of Total C-Ram compared with other products on the market [7]

Total C-Ram shows higher shear bond strength to zirconia than other dual cured cements on the market.

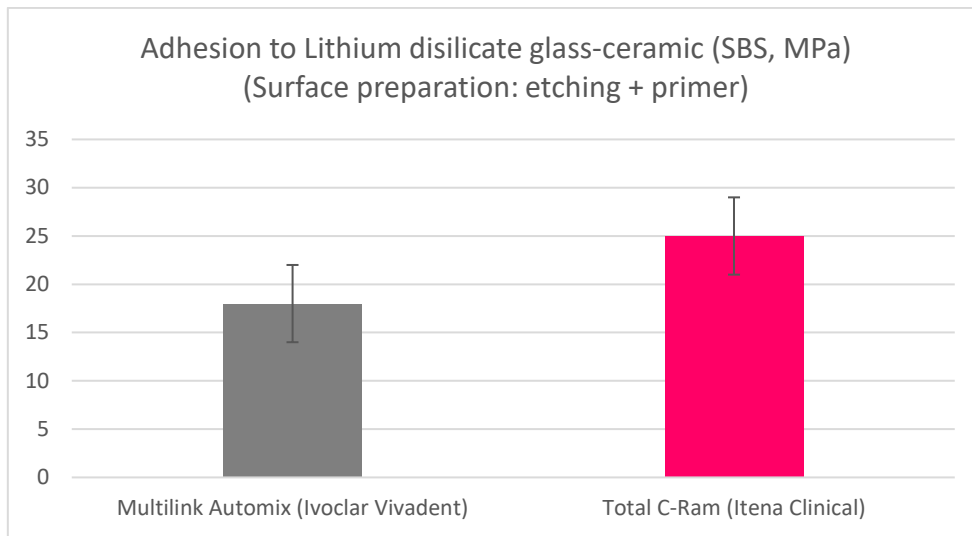


Figure 11 - Total C-Ram adhesion to lithium disilicate glass-ceramic compared with another product on the market [1] [8] [9]

Total C-Ram has the highest adhesion to etched lithium disilicate glass-ceramic prepared by ceramic primer application.

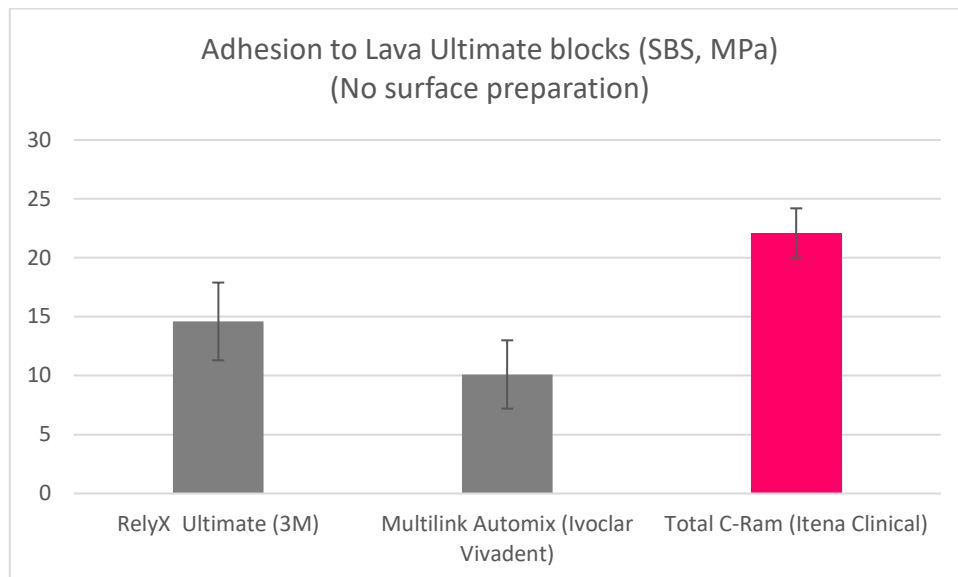


Figure 12 - Total C-Ram adhesion to Lava Ultimate blocks (3M) compared with other products on the market. Tests performed without surface treatment [1] [8]

Total C-Ram has the highest adhesion performance to Lava Ultimate blocks without any surface preparation.

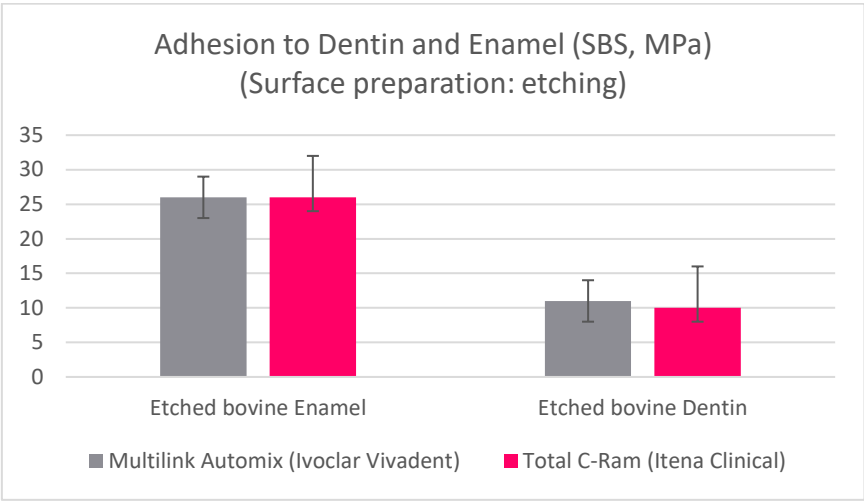


Figure 13 - Total C-Ram adhesion to etched bovine Dentin and Enamel compared with another product on the market [1] [8] [9]

Total C-Ram and Multilink products have a similar adhesion value to bovine dentin and enamel etched and covered by a bonding.

Scientific Literature data:

[1] Itena's R&D internal test report.

[2] Mackeler Ramos Polassi et al., Bonding ability of self-adhesive resin-cements after dentin biomodification with hyaluronic acid. 2017

[3] ISO 4049:2009 – Dentistry – Polymer-based restorative materials

[4] ISO 7491 – Determination of color stability

[5] Pinar Gultekin et al. Curing efficiency of dual-cure resin cement under zirconia with two different light curing units. 2015

[6] Saurabh K. Gupta, Payal Saxena, Vandana A. Pant, Aditya B. Pant. Release and toxicity of dental resin composite. 2012

[7] Ji-eun Moon, Sung-hun Kim, Jai-bong Lee, Seung-ryong Ha, Yu-sung Choi. The effect of preparation order on the crystal structure of yttria-stabilized tetragonal zirconia polycrystal and the shear bond strength of dental resin cements. 2011

[8] ISO/TS 11405 – Dentistry – Testing of adhesion to tooth structure

[9] ISO 29022:2013 – Dentistry – Adhesion – Notched-edge shear bond strength test