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## Product dossier

**CAVIT® LC**



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## 1. Preface

The CAVIT product line has been on the market ever since the ESPE company was established. Now it is being extended to include a light-cured version – CAVIT LC. With this innovative product, ESPE now offers the Dentist an economical and user-friendly alternative to the familiar temporary restorative materials. Important features of CAVIT LC are its pleasant, heavy-bodied consistency before and after curing, and also fluoride release.

CAVIT LC combines the advantages of conventional temporary restorative materials with the benefits of composites. Its excellent material characteristics combined with easy and economical application permit efficient and aesthetic temporary restorations.

Scientific studies have confirmed the low level of polymerisation shrinkage and minimal solubility of CAVIT LC. These criteria, together with excellent mechanical properties for a temporary restorative material, mean that CAVIT LC is predestined for temporary treatment of inlay and onlay preparations, sealing of implant screwholes, temporary restorations and linings for pre-fabricated temporary crowns and bridges.

## 2. Introduction

Temporary restorative materials are used frequently in the dental surgery. Even in the 19th century, materials such as zinc phosphate cement and zinc eugenol cement or Fletcher's Artificial Dentine were favoured for temporary filling of cavities.

Temporary restorative materials are a suitable means of provisionally sealing prepared cavities and for sealing in medicinal inserts. They serve as dressings for the dentine surface, so protecting the periodontium and pulp against harmful influences. In the case of root canal treatment, they also prevent infection of the periapical tissue caused by saliva.

### 2.1 History

Ever since ESPE was established in 1947, CAVIT has been supplied and successfully used worldwide. Over the years, the packaging has been repeatedly modified, but the composition of the material itself is largely the same as in the original formulation.

CAVIT-W and CAVIT-G are modified versions which were added to the product family for special applications.

Owing to its extremely hard surface, the classic CAVIT is suitable for sealing cavities which are subject to strong occlusal forces and for securing temporary post crown attachments.

CAVIT-W, with its increased adhesion to the hard tooth substance and reduced final hardness, is specially designed for use in endodontic treatment.

CAVIT-G is ideal for inlay preparations, since it is easily and cleanly removed without using rotary instruments.

### 2.2 Background

Temporary restorative materials are frequently used in the dental practice and little has changed in their method of use over the years. They are an efficient means of temporarily sealing prepared cavities, serving as a dressing for the dentine surface and protecting the periodontium against harmful influences.

Temporary restorative materials can be divided into six groups according to their chemical composition:

1. Zinc phosphate cements
2. Silicate cements
3. Zinc oxide eugenol cements
4. Gutta-percha
5. Pre-formed ductile preparations
6. Temporary composites

Owing to their easy handling and high strength, zinc phosphate and silicate cements are also frequently used for longer-term temporary work in the dental surgery.

Zinc oxide eugenol cements are commonly used on account of the therapeutic effect of eugenol. A disadvantage is the polymerisation-inhibiting properties of the eugenol. For this reason, these cements should not be used where final restoration of the cavity with composites and dentine adhesives is planned.

Pre-formed ductile preparations – which include CAVIT – are extremely easy to use. The materials are inserted into the cavity in a mouldable state. Setting is initiated by the reaction between water in the saliva and calcium sulphate and zinc oxide-zinc sulphate.

## 2.3 Motivation

The continuously increasing popularity of light-cured materials for final restoration of cavities, and the polymerisation instruments required, brought about the development of light-cured temporary restorative materials.

These products are comparable to composites in their quick and easy use for anterior teeth, molars and premolars.

Owing to the composite basis, these temporary restorative materials offer significantly better mechanical characteristics than many other temporary sealing compounds.

## 2.4 Indications

CAVIT LC is a light-cured temporary sealing compound for temporary restoration of cavities. In addition to treatment of inlay and onlay preparations, CAVIT LC is useful for sealing implant screwholes and as a lining for pre-formed temporary crowns and bridges.

The packable consistency of CAVIT LC gives it good modelling properties. It can be ideally placed, e.g. with a Heidemann spatula, and compacted with a round condenser.

### 3. Chemical background

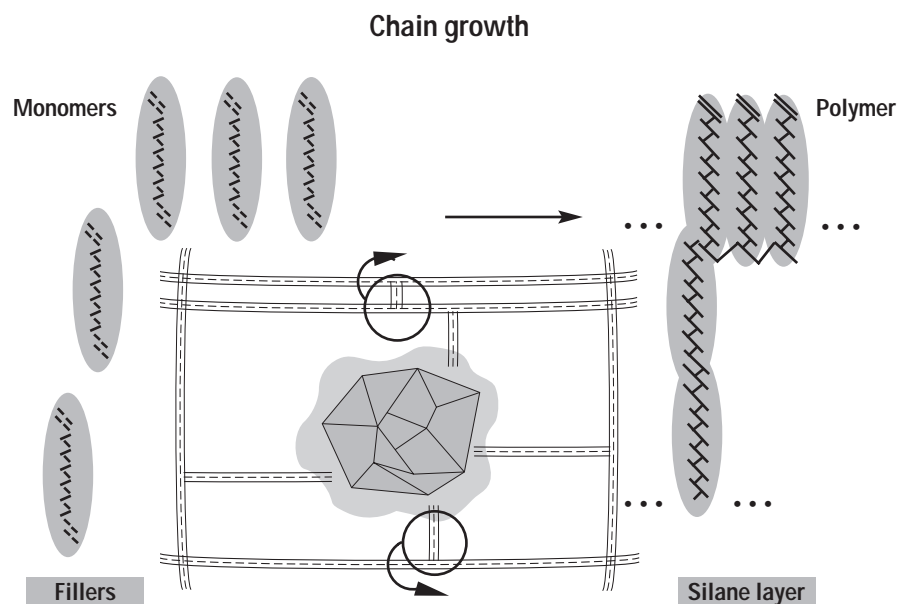
#### 3.1 General overview

The general meaning of the term composites is materials made up of various chemical substances. The material characteristics so produced are superior to those of the individual components, and in some cases significantly so. The best-known materials in this category are the fibre-glass reinforced plastics and carbon-fibre materials.

The basic technology of dental composites is essentially the same as for high-performance materials which are used in the aerospace industry, and also in household products.

#### 3.2 Hardening reaction

The organic phase of CAVIT LC contains comonomers which are bonded by radical polymerisation. The initiator is a camphor-quinone system which generates radicals through activation with visible light.



Polymerisation is based on opening the double bond of a methacrylate group by means of radicals – the so-called starting reaction – and subsequent interlinking of methacrylate units in the growth reaction. In this way long, cross-linked strands of recurrent building blocks are created. When two different monomers are made to polymerise, a copolymer is produced with a statistical sequence of the individual monomer units in the chain. The monomers used in CAVIT LC each have two functional groups (methacrylate units) accessible to a polymerisation reaction. This leads to cross-linking of the individual polymer chains, thereby providing additional stabilisation.

The inorganic fillers are embedded into this three-dimensional network, and a composite material is formed.

Integration of the fillers into the plastic matrix is performed via the so-called silanisation layer. The silanised glass is integrated into the resin matrix via the unsaturated methacrylate groups of the silane during polymerisation. In this way a permanent, chemically stable bond is created between fillers and organic matrix.

### 3.3 Material properties

On the basis on the above-mentioned indications, the following requirements for temporary restorative materials would seem particularly important:

- High mechanical strength
- Chemical stability in the oral environment
- Reliable marginal integrity
- Easy handling
- Easy removal
- Aesthetics
- Economy

To protect the cavity and preserve articulation, adequate mechanical characteristics and chemical stability in the oral environment are necessary for the duration of the indicated treatment period.

High marginal integrity prevents ingress of micro-organisms into the cavity.

Apart from the material properties, economic considerations and best possible aesthetics are also becoming increasingly important requirements for temporary restorative materials.

Numerous studies described in the literature indicate that at the present time there is no filling material for temporary restorations which can fully meet all the requirements stated above. Above all, the material characteristics, "high degree of hardness" and "good marginal behaviour" may be in conflict with each other.

Thanks to its mechanical properties and the very low level of colorant penetration, CAVIT, which has been on sale for 50 years now, represents the clinically acceptable compromise between the requirements stated above.

Recently, various manufacturers have presented polymer-based temporary restorative materials. Simple handling and significantly better aesthetics mean that these tooth-coloured temporary restorative materials are increasingly preferred to conventional materials.

## 4. Product composition

### 4.1 Product components

CAVIT LC is a single-component, light-cured temporary restorative material whose high level of fluoride release distinguishes it from rival products in this material category. The blister pack, which is new for a heavy-bodied material, allows the Dentist to remove exactly the required quantity, whilst the unused material can be resealed in the blister foil, which is impermeable to light.

### 4.2 Constituents

The qualitative composition of CAVIT LC is listed in Table 1.

Oligomeric urethane dimethyl acrylate
Additional methacrylate
Plasticiser
Strontium glass
Pyrogenic silicic acid
Initiators
Stabilisers
Complex fluoride

**Table 1: Composition of CAVIT LC**

## 5. Test results

### 5.1 Physical technical data

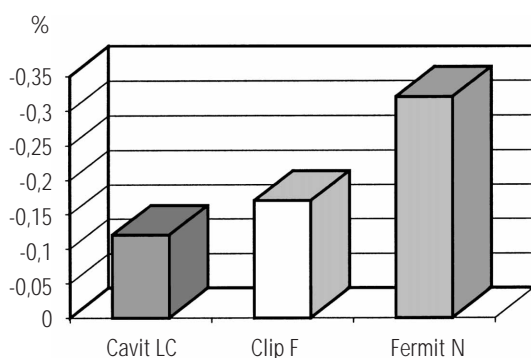
At the present time, there is no test standard specifically for composite-based temporary restorative materials, and the testing methods contained in the ISO 4049 standard (Plastics for Restorations) were not applicable to temporary restorative materials in all cases. For this reason, relevant tests from other standards were also used for characterising CAVIT LC (Table 2).

Compressive strength	51 MPa	ISO 9917
Diametrical tensile strength	8 MPa	ADA 27
Surface hardness	23 MPa	DIN 53456
Linear dimensional change after light activation	- 0,12 %	ISO 4823
Linear dimensional change after 24 h	- 0,17 %	ISO 4823
Water absorption	26 µg/mm <sup>3</sup>	ISO 4049
Solubility	1,3 µg/mm <sup>3</sup>	ISO 4049
Proportion of fillers	49 %	–

**Table 2: Mechanical characteristics of CAVIT LC**

### 5.2 Polymerisation shrinkage

Owing to its high proportion of fillers, CAVIT LC undergoes minimal polymerisation shrinkage. This material characteristic is the basic prerequisite for high marginal integrity. A comparison with competitive products also shows that CAVIT LC gives optimum results (Fig 1).



**Fig. 1: Polymerisation shrinkage of CAVIT LC after curing (in-house measurements)**

### 5.3 Solubility

The monomers used in CAVIT LC have a particularly pronounced hydrophobic (water-repellent) character. CAVIT LC, like the permanent composite restorative material PERTAC II, displays only minimal solubility. In comparison with rival products, it represents the optimum solution in terms of the current technical standard (Fig. 2).

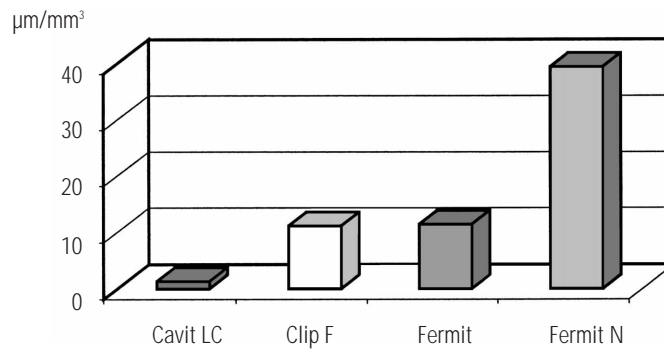


Fig. 2: Solubility of CAVIT LC (in-house measurements)

### 5.4 Fluoride release

CAVIT LC contains a patented complex alkali-metal fluoride, with the general notation MXF<sub>3</sub>, which makes fluoride ions available.

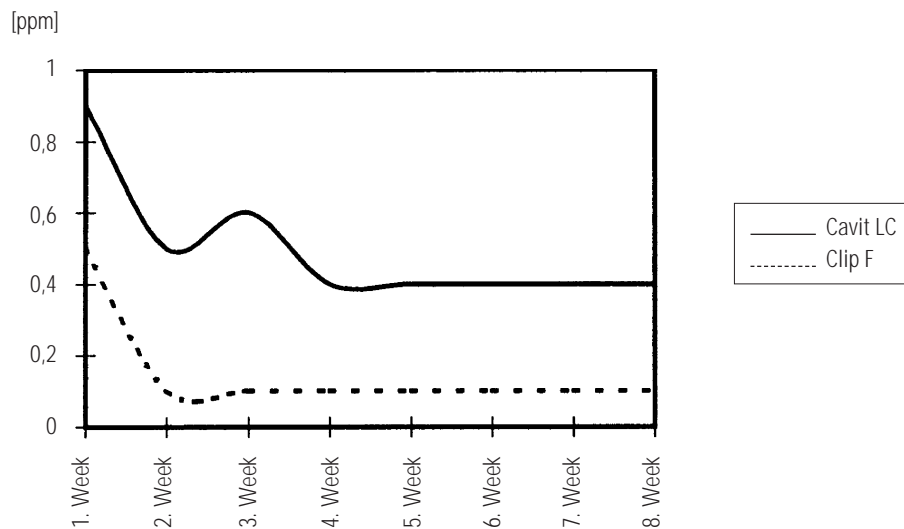


Fig. 3: Fluoride release of CAVIT LC (in-house measurements)

Figure 3 shows that CAVIT LC continuously releases fluoride ions over a period of two months. The comparison of these in-house measurements with Clip F shows that fluoride release from CAVIT LC is significantly higher than from the competitive product, especially during the first week, which is the typical duration of a temporary restoration.

## 6. Instructions for use

Carefully clean and dry the cavity to be restored before applying CAVIT LC. If cavity preparation is unfavourable, it is advisable to use a matrix.

Since CAVIT LC, as a product requiring polymerisation, may bond to lining materials which contain resin, the lining should first be isolated, e.g. with glycerine gel, before placing CAVIT LC.

Dispense the required quantity of CAVIT LC from the blister and reseal carefully to protect the remaining material.

Insert CAVIT LC into the cavity and model using, for example, a Heidemann or Nyström spatula or round condenser. Placement is made even easier if the instrument is moistened with water or bonding agent.

Light-cure, e.g. with ELIPAR TRILIGHT or ELIPAR HIGHLIGHT, for 20 seconds for layer thicknesses up to 5 mm and 40 seconds for layer thicknesses up to 7 mm.

Check occlusion and remove excess with a sharp instrument, or grind off. Then finish the restoration with a silicone polisher. To remove the temporary restoration from the cavity, use a robust pointed instrument.

## 7. Packaging

Article number	Pack description	Contents
044500	CAVIT LC standard pack	3 individual blisters (2,5 g each)

## 8. Summary

CAVIT LC is a hybrid composite for temporary restoration of cavities. It complements the CAVIT product family, which has been successfully used for many years. It offers the ideal combination of aesthetics, high mechanical strength and economy.

The resealable, pre-portioned blister pack is user-friendly, especially for a heavy-bodied material. This together with the ease of handling makes CAVIT LC pleasant to use on a daily basis in the dental surgery.

In spite of its high opacity, which makes the temporary restoration easy to recognise for the dentist, CAVIT LC also hardens to a great depth. This means that a layer of CAVIT LC can be applied in virtually any cavity. Layer thicknesses up to 5 mm need only be light-cured for 20 seconds, and up to 7 mm for 40 seconds.

CAVIT LC can be removed from the cavity in one piece thanks to its excellent mechanical characteristics. Especially for inlay preparations, the dentist does not require any rotary instruments.

CAVIT LC offers high fluoride release of approx. 1 ppm in the first week, which is significantly more than other fluoride-containing composites for temporary restorations.

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