

## CLINICAL EFFECTIVENESS OF CAD/CAM TEMPORARY RESIN CROWNS IN IMPLANT PROSTHODONTIC PROTOCOLS

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**Relevance.** Provisional fixed restorations are a critical component of the prosthetic phase in dental implantology. They serve multiple essential functions: ensuring controlled functional loading, guiding the biological shaping of peri-implant soft tissues (emergence profile), and allowing for the assessment and optimization of the final restoration's aesthetics. The integration of CAD/CAM technologies enables the fabrication of temporary crowns with superior precision, predictable occlusal morphology, and enhanced marginal integrity compared to traditional chairside methods.

**Aim of the Study.** To evaluate the clinical performance and structural stability of milled CAD/CAM resin temporary crowns supported by dental implants during the osseointegration period and soft tissue maturation phase.

**Materials and Methods:** The study included 16 patients with partial edentulism (9 females, 7 males; mean age  $42 \pm 2.1$  years). A total of 64 temporary crowns were fabricated, supported by both dental implants and natural teeth. The patients were divided into two groups based on the fabrication protocol:

- Group L/p (Control): 9 patients, 36 units fabricated using conventional laboratory thermopolymerization.
- Group Fr (Experimental): 7 patients, 28 units fabricated via CAD/CAM milling using Vita CAD-Temp blocks.

The observation period ranged from 2 to 6 months, with follow-up clinical examinations conducted at 3 and 9 months post-insertion. The evaluation focused on the following criteria:

1. *Mechanical Stability:* Resistance to fractures and chipping.
2. *Physical Properties:* Color stability and maintenance of occlusal contacts.

3. *Biological Response*: Evaluation of oral hygiene, biocompatibility, and microcirculation (via laser Doppler flowmetry or clinical assessment).
4. *Periodontal Status*: Assessment of peri-implant/periodontal health using the PMA (Papillary-Marginal-Attached) index and standardized Hygiene Indices.

**Results.** The comparative clinical analysis revealed a significant reduction in the overall complication rate for the digital protocol. The incidence of complications was 37.5% in the Laboratory Polymerization (L/p) group, compared to only 12.5% in the Milled CAD/CAM (Fr) group. This represents a 25% increase in clinical effectiveness when utilizing the CAD/CAM workflow.

The specific performance parameters favored the milled restorations across all evaluated categories:

- The rate of mechanical failures (fractures or chipping) decreased from 41.7% in the L/p group to 21.4% in the Fr group.
- Milled crowns exhibited a significantly lower negative impact on peri-implant and gingival tissues (17.9% vs. 58.3%), likely due to superior surface biocompatibility and reduced biofilm accumulation.
- Decementation rates were reduced from 33.3% to 10.7%, while the loss of occlusal contacts dropped from 30.6% to 7.1%.
- Stability of color and surface texture was significantly better in the CAD/CAM group (21.4% complication rate vs. 55.6% in the L/p group).
- The Hygiene Index was lower (indicating better hygiene) in the CAD/CAM group (25.8%) compared to the laboratory group (29.6%).

**Conclusions.** Milled CAD/CAM temporary resin crowns demonstrate significant clinical advantages over conventional laboratory-polymerized restorations, specifically:

- A significantly lower inflammatory response in peri-implant tissues and more stable oral hygiene parameters.
- Favorable microcirculation dynamics in the gingival margin, supporting faster and more predictable soft tissue maturation.
- High structural strength and superior biocompatibility, ensuring stability throughout the osseointegration phase.

### **Recommendation:**

1. CAD/CAM milled temporary crowns are highly recommended for complex prosthetic cases where the provisional phase is planned to exceed 3 months, especially in the “aesthetic zone” or during multi-stage implant protocols.

2. Laboratory-polymerized crowns remain a viable and cost-effective option only for short-term restoration (less than 3 months) where minimal soft tissue contouring is required.

**Keywords:** *Temporary crowns; CAD/CAM technology; milling; resin crowns; dental implants; osseointegration; Vita CAD-Temp; emergence profile.*