

## Considerations Regarding Preparation for Porcelain-fused-to-metal Crowns

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**Abstract:** Full-coverage crowns are most frequently recommended prosthetic restorations in many clinical situations. Conventional porcelain-fused-to-metal crowns are most ordered full-coverage crowns to private dental laboratories. The aim of this study is to assess the quality of dental preparations for porcelain-fused-to-metal crowns made by dentists in private practice. The following aspects are considered: total occlusal convergence angle, incisal or occlusal reduction, axial reduction, presence of undercuts, aspect of cervical line, existence of sharp lines or angles and presence of supplementary retention. A detailed look at all aspects regarding tooth preparation can help to improve clinical results in everyday practice.

**Keywords:** porcelain-fused-to-metal crown, abutment preparation, working cast, error

**Abbreviation:** PFM (porcelain-fused-to-metal), TOC (total occlusal convergence)

### 1. INTRODUCTION

Full-coverage crowns are most frequently recommended prosthetic restorations in case of extensive coronary destruction, trauma, and treatment of partial edentulous span [1].

In order to achieve long-term success of prosthetic restorations is essential adequate preparation of supporting teeth. Goodacre *et al* [2] suggest respecting following principles in tooth preparation for coverage crown: 10-20 degree of total occlusal convergence (TOC) and 0.5-1 mm of axial reduction for metallic crowns and 1-2 mm of axial reduction for *porcelain-fused-to-metal* (PFM) and all-ceramic crowns.

Quality of tooth preparation is influenced by occlusal reduction, axial reduction, occlusal convergence, aspect of cervical preparation and axial walls. There are many studies that analyse the quality of tooth preparation for coverage crowns done by students [3-5], dentists [6], residents [5] or specialists [7]. Majority of these evaluates TOC, neglecting other aspects of preparation, which are most commonly errors denounced by dental laboratories [8].

*Conventional PFM crowns* are used form more than 30 years due to their advantages: strengths and aesthetics and are most ordered full-coverage crowns to private dental laboratories [9].

The aim of this study is to assess the quality of dental preparations for PFM crowns made by dentists in private practice. The following aspects are considered: TOC angle, incisal or occlusal reduction, axial reduction, presence of undercuts, aspect of cervical line, existence of sharp lines or angles and presence of supplementary retention.

### 2. MATERIALS AND METHODS

Assessment of tooth preparation can be done intraorally or by viewing the impression before sending to the laboratory or checking the stone or scanned model. The most accurate method is assessment of model because allow evaluation from all angles by direct visual inspection[10].

There were examined 120 working models and 201 preparations from three different dental clinics after cementation of crowns or bridges. 94 models with 137 preparations for PFM crowns were selected.

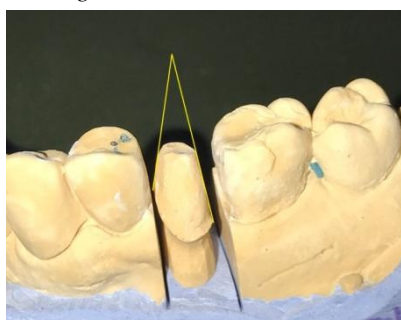
All models were examined with 2.5 magnification from occlusal (with and without antagonists), buccal and oral aspect (Figure 1-2) and photographed. Two lines (mesial and distal) were drawn from cervical margin parallel with prepared surface on each photographed preparation with the purpose to measure mesio-distal TOC angle (Figure 3).



**Figure1.** Assessment of tooth preparation - occlusal view, without antagonist



**Figure2.** Assessment of tooth preparation - occlusal view, with antagonist



**Figure3.** Assessment of tooth preparation - buccal view, mesio-distal TOC angle

The following parameters were evaluated:

- mesio-distal TOC angle,

**Table1.** Evaluation of TOC angle

Parameter	Incisors	Canines	Premolars	Molars	Mean value
Total occlusal convergence	25.67°	23.74°	28.05°	28.69°	26.54°

**Table2.** Different parameters evaluated as adequate (A) or inadequate (I)

Parameter	Incisors		Canines		Premolars		Molars		Total (percentage)	
	A	I	A	I	A	I	A	I	A	I
Incisal or occlusal reduction	37	19	10	4	18	10	21	18	86 (62.77%)	51 (37.23%)
Axial reduction	23	33	9	5	20	8	22	17	74 (54.01%)	63 (45.99%)
Undercuts	52	4	13	1	25	3	30	9	120 (87.59%)	17 (12.41%)
Cervical finish line	38	18	9	5	18	10	20	19	85 (62.08%)	52 (37.96%)
Sharp lines and/or angles	50	6	12	2	19	9	27	12	108 (78.83%)	29 (21.17%)

A good preparation is essential for a well-adapted crown. One causes of crown failure is lack of retention and primary retention of crown is dependent of tooth height and occlusal convergence. The TOC value is more than the value recommended by prosthetic books, but similar findings were reported by different studies [7, 11-12]. However, there is no

- incisal or occlusal reduction was appreciate as adequate (A) when respected tooth morphology and there was no marking signs from laboratory or inadequate (I),
- axial reduction was appreciate as adequate (A) when respected tooth morphology and there was no marking signs from laboratory or inadequate (I),
- aspect of cervical line was appreciate as adequate (A) when was smooth and clearly or inadequate (I),
- presence (classified as inadequate I) or absence (classified as adequate A) of undercuts,
- presence (classified as inadequate I) or absence (classified as adequate A) of sharp lines and/or angles.
- presence (P) or absence (A) of supplementary retention.

### 3. RESULTS AND DISCUSSION

There were evaluated 137 preparations for PFM crowns made for incisors 56 (40.87%), canines 14 (10.22%), premolars 28 (20.44%) and molars 39 (28.47%).

Mean value of mesio-distalTOC is 26.54° (Table1). Incisal or occlusal reduction is adequate in 62.77% cases, axial reduction in 54.01%, undercuts are present in 12.41% preparations examined, cervical finish line is inadequate in 37.96% and sharp lines and/or angles are found for 21.17% preparations (Table 2). Supplementary retention is present just in one preparation (0.73%).

statistically significant difference of retention between 12° TOC and 20° TOC for a full coverage crown preparation on premolar [13].

An adequate incisal/occlusal reduction is important for crown and tooth resistance, this reduction should be enough for crown fabrication, but respecting tooth morphology and consequently tooth longevity. It was

frequently present absence of functional cusp bevelling, which could lead to thin crown or deficient occlusal contacts [14]. Axial reduction is often inadequate on lingual surface of incisors, where is not respected preparation in two different plans. Similar fact is reported also for all-ceramic crowns [8, 15].

Presence of undercuts impedes insertion of the crown and requires adaptation. Incomplete or uneven finish line determines deficiencies in marginal adaptation that may lead to ceramic fracture.

Supplementary retention is indicated for short teeth to improve retention and TOC should be less than 20° [16].

Errors in tooth preparation could appear due to: lack of experience, poor access, visual errors and anatomical variations.

#### 4. CONCLUSIONS

This study reveals errors in tooth preparation for PFM crown like: inadequate incisal or occlusal reduction, inadequate axial reduction, presence of undercuts, deficient finish line, and existence of sharp lines and/or angles.

A detailed look at all aspects regarding tooth preparation can help to improve clinical results in everyday practice.

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