

## The Effect of Preparation in Dentin on Porcelain Veneers' Survival

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### Abstract

**Introduction:** For this study we wanted to evaluate the possible influence of the depth of the preparation on the longevity of porcelain veneers.

**Materials and Methods:** Our study is a randomized clinical trial; on the comparison of 264 veneers stuck on 73 patients. 139 veneers have a preparation in dentin. The patient's recruitment was done according to well-defined inclusion criteria. The information was reported on a clinical record.

The study lasted 64 months with regular checks of 6 months, 12 months, 18 months, 24 months, 36 months, 48 months and 60 months.

**Results:** In this study, the maxillary teeth prepared according to different depth on dentin shown that ceramic veneers have stable esthetic qualities; they are biologically acceptable in so far as the recommendations of current preparations are respected.

The Chi square test revealed that there is statistically no significant difference between the three methods.

"Preparation without palatine return or window, preparation in slight return and preparation in slight return".

**Conclusion:** The depth preparation for ceramic veneers have no influence on porcelain Veneers' survival.

**Keywords:** Dentin; Porcelain Veneers'

### Introduction

Tissue preservation is a prerequisite for any modern dentistry treatment to better ensure the long-term resistance of restorations, maintain pulp vitality and have the possibility to re-intervene in the future [1,2]: veneers meet these expectations.

The veneers allow to have a biomimetic restoration which allows a homogeneous distribution of the stresses without alteration of the tooth. They are described as biomimetic because of their biology, which is essentially guaranteed by the minimum size that does not alter the dentine nucleus and gives the tooth its chromatic tone and saturation [3].

The depth of the preparation is a key element that has given rise to reflection: for some authors, it is preferable to remain in the enamel while for others one can reach the dentine without any particular concern.



**Figure 1:** Veneer compared to a contact lens [18].



**Figure 2:** Illustration of the thinness of the ceramic, hence the name of a thin ceramic film [18].

Several studies have been carried out in the world with sometimes divergent results.

Our study is a randomized clinical trial carried out in the dental prosthesis department. This study covered 264 veneers in 73 patients between 2015 and 2019.

Several parameters were evaluated: the type of coronary preparation, the frequency of the failures, the satisfaction of the patients and the depth of the dental preparation which will be developed in this article.

## Materials and Methods

The subjects are recruited from among those who come to the dental prosthesis service at the Mustapha University Hospital Center in Algiers.

Diagnosis of abnormality; color; form; Minor structure or malposition will be observed with the naked eye during the clinical examination.

### Selection criteria

#### Criteria for inclusion

Included in the study is any previous tooth showing:

- A typical color anomaly: amelogenesis imperfecta due to tetracyclines; fluorosis; stains due to age, dye of external origin (tea, coffee or tobacco) by infiltration of tissues; dyschromic teeth without loss of substance;
- An anomaly of form: microdontics; atypical form cases of conoid incisors;
- An abnormality of structure or texture: dysplasia, dystrophy, erosion, attrition, mechanical or chemical abrasion and coronary fracture;
- A minor malformation type rotation.

Our study will concern both men and women, but in any case, we will include only those patients deemed reliable, cooperative and likely to be followed regularly:

- General condition: healthy patient presenting no general or local pathology;
- Oral hygiene: must be satisfactory;
- Type of teeth: to reduce the variants, it will be limited to the incisivo-canine block.

#### Criteria for non-inclusion

We will not include in our study anyone:

- Judged unable to understand the essay, uncooperative or unstable.
- Presenting a contra-indication to the glued ceramic facets namely:
  - Elderly teeth;
  - Teeth abraded;
  - Presence of parafunctions;
  - Adverse occlusal relationships;
  - Bad oral hygiene.

#### Dental preparation method for ceramic veneers

It differs from conventional preparations in that the retention of the prosthetic element is ensured only by gluing.

#### Materials needed for preparation

The protocols of the preparations use the concept of controlled tissue penetration through the use of diamond burs calibrated for this purpose.

Several authors have proposed several set of burs. Among these authors Bernard Touati, and Galip Gurel. A set of 3 strawberries is enough for a good preparation.

Diamond ball mill which delimits the desired depression in the dentine; Fillet cutter which allows to eliminate the grooves and to draw the cervical limit: Red ring cutter: fine grain for finishing.



**Figure 3:** Set of retained cutter for preparation for ceramic veneers [4].

#### Materials needed for preparation

Our study is a randomized clinical trial comparing three types of coronary preparations for bonded ceramic veneers.

During this test, the allocation to the different treatment groups is randomly made by lot, thus ensuring the comparability of these groups

The same operator will proceed to the draw as follows: The distribution in all the different groups will be based on chance.



Figure 4: Vestibular view.

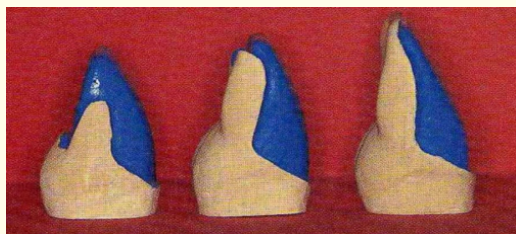


Figure 5: Proximal view [5].



Figure 6: Palatal view [5].

From left to right preparation in semi-jacket; preparation in slight return; preparation without palatine return.

#### Technique of realization of the coronary preparations

All clinical stages of the ceramic veneers performed in the study (dental preparation, bonding and control) were made by the same practitioner.

The ceramic veneers were made by a single prosthetist who used the same technique and the same ceramic to avoid the realization bias.

The clinical stage begins with the establishment by the practitioner of a clinical file to list the information necessary for the study. This sheet is completed by the taking of photographs before any dental preparation, to allow us to archive the case and to give the necessary information to the prosthetist.

Before any prosthetic intervention, we start with preoperative steps: such as motivation to hygiene; restoration of the oral cavity: descaling; pulpal vitality tests; drilling of the gingivo-dental grooves and repair of old fillings if necessary.

Once this stage is complete, study models are made from preliminary impressions made using an irreversible hydrocolloid type alginate.

The study of these models will give us the dental formula and information regarding static occlusion: overjet, overbite, molar class, canine class, incisal covering etc. These templates will be archived and constitute the patient's record.

Then we go to the preparation of the teeth, for that we can use two methods:

1. The technique of progressive reduction: use of grooves and a silicone key;
2. Or the technique of masks.

We opted for the technique of progressive reduction; the technique of masks being applied when several teeth are involved in faceted restorations to align the teeth for example; while in our study we have sometimes had to treat a single tooth.

We begin with the realization of a high viscosity silicone key for this we must cover at least one tooth on each side of the tooth concerned by the preparation to have good stability. Then we will cut vertically this key to check its good adaptation.

Once the wrench is made, we go to the size of the concerned tooth using an air turbine; under water jet whatever the case; using burs from a Komet France® box marketed under the name "cabinet for ceramic veneers". This box contains three burs:

1. A ball mill whose references are (801, 314, 018);
2. A milling cutter green ring whose references are (6856, 314, 018);
3. A flame red ring cutter for finishing whose references are (868, 314, 012).

The realization of the horizontal grooves is done by means of the ball mill which will determine the depth of the preparation.

This depth is considered sufficient when the mandrel of the bur will come into contact with the tooth surface. The cutter used has a diameter of one millimeter and its penetration until contact with the mandrel will correspond to a depth of 0.5 mm.

Each tooth has three planes on the buccal surface: a cervical plane, a median plane and an incisal plane. A groove is made on each plane. In some cases where the teeth are small (distance taken between the free edge and the collar) only two horizontal grooves will be made.

Then we place the green ring leave cutter and remove persistent enamel bridges between the different grooves. The bur used is a working end mill, its use at the cervical level will lead to a draft of the preparation limit which initially will be at a distance from the gingival ring.

Once the enamel bridges have been removed, the dental fluorosis has disappeared, giving way to a dental surface of ordinary hue, and in this case we opt for a supragingival cervical limit, so that the hue remains dark and then, in this case, it is better to make a juxta-gingival limit.

This kind of preparation concerns type I (without palatal return).

With regard to type II; the dental preparation described above will be continued by reducing the free edge with the bur. Palatine concavity will be reduced palatally by always using the same strawberry and at the same time a fine leave will be drawn which will form the limit at this level. The preparation is completed by ensuring a continuity between the buccal face and the palatal face to have a sufficient thickness for the ceramic.

For type III (semi-jacket) the preparation is the same as that of type II but it will be pushed more in the palatal direction to end just before the cingulum.

For these last two types of preparation type II and type III we will take care to objectify with articular paper the impact of the opposing tooth to prevent the tooth-ceramic junction from being at this level.

For all three types of dental preparation, the finishing will be done in the same way and will consist in the elimination of all the sharp angles using a flame mill with fine granulometry red ring.

Once the preparation is complete, the silicone key is positioned and the homothetic aspect will be checked.

Dentin hybridization is indicated when there is dentinal exposure or type I (without palatal return) is an enamel preparation; only type II and III are concerned, but to avoid any kind of bias in our study we preferred to apply this dentin treatment to all teeth regardless of the importance of tooth preparation.

To do so we will use a dentine bonding agent compatible with the adhesive that will be used later during bonding (Excite, Ivoclar Vivadent, lot No. L23818) in accordance with the manufacturer's instructions.

The final imprints were taken according to Wash technique using a high viscosity silicone relined by a low viscosity silicone.

Temporary restorations were made at the chair, modeling with the fingers of the light-curing composite (Arabesk, Voco, lot no. 1236135). We took care to stay away from the gum to avoid bleeding that may compromise the session collage.

Occlusion is checked during the various mandibular excursions.

The patient will be released only after giving a number of instructions and emphasizing the importance of good oral hygiene.

For the realization in the laboratory, all the facets were elaborated with the same low-melting ceramic (Finesse® All-Ceramic, Ceramco, U.S.A).

It was treated according to the lamination technique using the conventional method of lost wax and following the manufacturer's instructions. The models were cast with extra-hard plaster and are used in one piece. After placing the wax models in the coating cylinders, they were preheated in a conventional preheating furnace (type 5636, KaVo Dental GmbH, Biberach, Germany) at a final temperature of 850°C. ceramic was pressed into the preheated hollow mold (EP 500, Ivoclar Vivadent, Schaan, Liechtenstein) at 910 - 920°C.

Coating cylinders and ingots were placed in the center of the press furnace and pressed at a temperature of 1050°C. The pressed facets were separated from the casting rods with a disc. Facet adjustment has been verified on the master models.

Two glazing procedures were performed in a porcelain baking oven. The intrados of the facets is treated with 5% hydrofluoric acid; contained in the cabinet of the ceramic used; for 60 seconds and neutralized in a bath of bicarbonate then the facets are dried.

We go to facet gluing for this we start by depositing the provisional by means of a probe. If the composite persists on the

tooth we will do a surfacing with a strawberry being careful not to touch the tooth. Afterwards we clean the dental surfaces and try the facets.

For the choice of glue we have taken as reference the work of Hikita., et al. who evaluated the adhesion strength to enamel and dentin, different adhesives tested with different adhesives. This study shows that the best results are achieved by the bonding composites requiring the use of an adhesive system preceded by a total etching.

A dual composite has therefore been used: a mixed adhesive resin, which can offer, thanks to porosities, a potential for the absorption of additional stresses to that of the only photopolymerizable resins [6,7].

Once the facets are deemed satisfactory, they are washed with water to remove the "liquid strip" which is water soluble, air dried and then brushed with a silane agent (Monobond S, Ivoclar Vivadent) (the facet being already etched in the laboratory), it is allowed to act for 1 minute then it is dried. An adhesive layer (Excite®DSC, Ivoclar Vivadent) is again added to the silanized surface without light curing, the thus prepared facet is protected from light in a metal can.

All veneers were glued with Variolink II® (Variolink II, Ivoclar Vivadent, lot # M10683, lot # M34435, lot # P22457), a dual curing composite prepared according to the manufacturer's instructions.

The preparations were isolated using cotton rolls combined with effective salivary aspiration. The surfaces of the teeth were cleaned with a rubber cup lined with a fluorine-free polishing paste mounted on a contra-angle, then washed Dried and etched for 15 seconds with a 37% phosphoric acid gel (Total Etch, Ivoclar Vivadent) and then with a jet of water, they are washed for at least 15 seconds.

The surface thus treated is dried in air, avoiding desiccation of the dentin. The adhesive (Excite®DSC, Ivoclar Vivadent) was applied with microbrushes, rubbing gently for 20 - 30 seconds, and then spread with an air jet for at least 10s to facilitate penetration into the dentine.

Always thanks to the jet of air the residual solvents will evaporate and also allow the formation of an adhesive film which will leave the dental surface shining.

The dual composite is mixed just before use. It is applied, polymerized for 10 seconds with light with an energy density of

480 mW/cm<sup>2</sup> (Optilux, Demetron, Danbury, CT, USA) at the incisal edge to stabilize the facet and to be able to easily remove excess composite.

The complete polymerization is done section by section for 40 seconds, starting with the proximal areas. Once the polymerization is complete, the edges of veneer are checked with a probe for any excess of composite particularly at the interdental spaces.

Checking occlusion in static and dynamic state. After equilibration, all surface alterations are repolished.

Before releasing the patient, care should be taken to mention the contact of the opposing tooth with the facet: the contact can be made:

- On the palatal side;
- On the ceramic to 1/3 incisal;
- On the medium 1/3 ceramics;
- On the incisal edge;
- No contact.

Patient appreciation will also be mentioned to assess the degree of satisfaction that may be: none; medium or good.

#### Control sessions

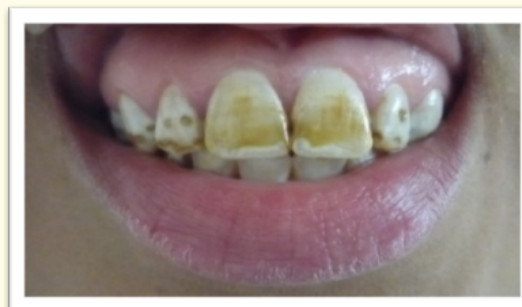
Patients are invited to follow-up sessions after: 6 months, 12 months, 24 months, 36 months, 48 months and 60 months.

During these appointments, facets were inspected visually and evaluated according to the criteria studied.

#### Clinical case

Patient aged 23 presented to our service following an aesthetic discomfort: dental fluorosis type II of Dean. This patient, well informed, asked for a treatment by ceramic facets.

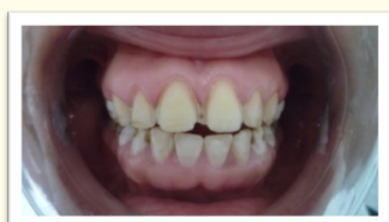
In this stage of fluorosis prosthetic restoration is the rule and ceramic veneers are the most conservative form.



**Figure 7:** Case presentation: Dean's type II fluorosis.



Figure 8: Penetration grooves.



Vestibular view



Palatal view

Figure 9: Coronary preparation.

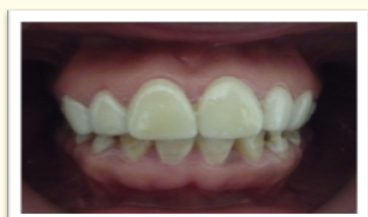


Figure 10: Final result after veneers bonding.

### Results

In this study 264 veneers were placed in 73 patients represented by 52 women and 21 men. The average age of patients at the start of treatment was 27 years with a range of 13 to 49 years.

The veneer's number varies from "one" to "six" per patient. All veneers were performed at the level of the upper anterior block.

Once the treatment is finished, patients are invited to come back if there is any problem with their facets or abutment teeth.

Patients will be checked after 6 months; 12 months; 24 months; 36 months; 48 months; 60 months. The information collected during these checks is reported on the clinical sheet.

All the patients participated in the various controls, only one patient, who benefited from two restorations on the central incisor, did not participate in the study and this from the second recall (12 months), which is equivalent to an abandonment or loss of sight of 1.40% of patients (0.76% of restorations).

### Descriptive study

#### Number of veneers depending on the type of prepared tooth

| Tooth type      | Numbers | Percentage |
|-----------------|---------|------------|
| Central incisor | 120     | 45,45%     |
| Lateral incisor | 86      | 32,58%     |
| Canine          | 58      | 21,97%     |
| Total           | 264     | 100,00%    |

Table 1: Number of veneers by type of prepared tooth.

120 central incisors (11 and 21) were treated with ceramic veneer which represents 45.45% of all veneers. 32.58% represents the percentage of lateral treated veneers while the canines represent only 21.97% of the whole.

#### Distribution of facets according to the characteristics of prepared teeth

| Characteristics of the teeth | Numbers | Percentage |
|------------------------------|---------|------------|
| Healthy, alive               | 26      | 9,80%      |
| Obtured, alive               | 27      | 10,20%     |
| Obtured, mortified           | 27      | 10,20%     |
| Angular fracture, alive      | 1       | 0,40%      |
| Fluorosis, alive             | 181     | 68,30%     |
| Fluorosis; mortified         | 2       | 1,10%      |
| Total                        | 264     | 100,00%    |

Table 2: Frequency of facets according to the characteristics of prepared teeth.

A healthy tooth is any tooth with no loss of substance or texture anomaly. These teeth, although healthy, have been restored by facets for aesthetic purposes: improving the hue or correcting a slight malposition.

For angular fractures, it is a class IV of black not exceeding 2 mm of amplitude. The majority of teeth were included in our sample at 68.30%. The remaining teeth are distributed as follows: 10.20% live plugged, 10.20% mortified plugged; 1.10% mortified fluorosis and 0.40% have angular fracture and are alive.

| Pillar tooth | Numbers | Percentage |
|--------------|---------|------------|
| Unsealed     | 208     | 78,79%     |
| Sealed       | 56      | 21,21%     |
| Total        | 264     | 100,00%    |

**Table 3:** Frequency of veneers according to the unsealed tooth character closed tooth.

The veneers were stuck on 208 unclosed teeth which corresponded to 78.79% of all the teeth while 56 of the facets were 21.21% glued on closed teeth.

**Distribution of veneers according to the limit of the preparation**

| Limit of the preparation | Numbers | Percentage |
|--------------------------|---------|------------|
| In the enamel            | 125     | 47,30%     |
| In the dentine           | 139     | 52,70%     |
| Total                    | 264     | 100,00%    |

**Table 4:** Frequency of veneers according to the limit of preparation.

The limit of the preparations in the dentin are majority for 125 facets which is equivalent to 53% against a frequency of 47% of the preparations in the enamel.

**Distribution of the type of preparation according to the limits of the preparation**

| Type of dental preparation          | Situation of the limit of preparation | Numbers | Percentage |
|-------------------------------------|---------------------------------------|---------|------------|
| Type I<br>"Without return palatine" | In the enamel                         | 74      | 85,10%     |
|                                     | In the dentin                         | 13      | 14,90 %    |
|                                     | Total                                 | 87      | 100,00%    |
| Type II<br>"Slight return palatine" | In the enamel                         | 43      | 46,70%     |
|                                     | In the dentin                         | 49      | 53,30%     |
|                                     | Total                                 | 92      | 100,00%    |
| Type III<br>"Semi-jacket"           | In the enamel                         | 08      | 09,40%     |
|                                     | In the dentin                         | 77      | 90,60%     |
|                                     | Total                                 | 85      | 100,00%    |

**Table 5:** Frequency of the type of preparation according to the limits of the preparation.

Ceramic veneers are restorations whose retention is ensured by gluing. This bonding can be at the level of the enamel, the dentine or at the level of both.

Since the structure of enamel and dentin is different, the question has been asked whether the behavior of ceramic facets can be different for these two structures.

**Analytical study**

Although the Kaplan-Meier statistics were initially designed to deal with individuals, the use of the tooth as a statistical unit in the person's place is justified [13].

In the present study, the Kaplan-Meier analysis was done in two different ways: the first analysis is patient-related, the second was done by taking the restoration as a statistical unit.

Our study is a clinical trial that seeks to evaluate the effectiveness of one type of preparation compared to two other types and this by comparing the results obtained in each group.

Given an observed difference between groups, there are two possibilities either this difference is only due to chance, or this observed difference is real.

We applied the test of "Chi2" to check the dependence or not between the variables and the different groups. This probability is

called "p". The value of p is the threshold from which the observed difference is considered to be statistically significant. It means that it is real and has a small chance of being due to chance.

When p is ≤ 0.05 the difference is significant.

When p is > 0.05 the difference is not significant.

### Analysis of facets according to the limit of the preparation

Survival rate of facets according to the limit of the preparation.

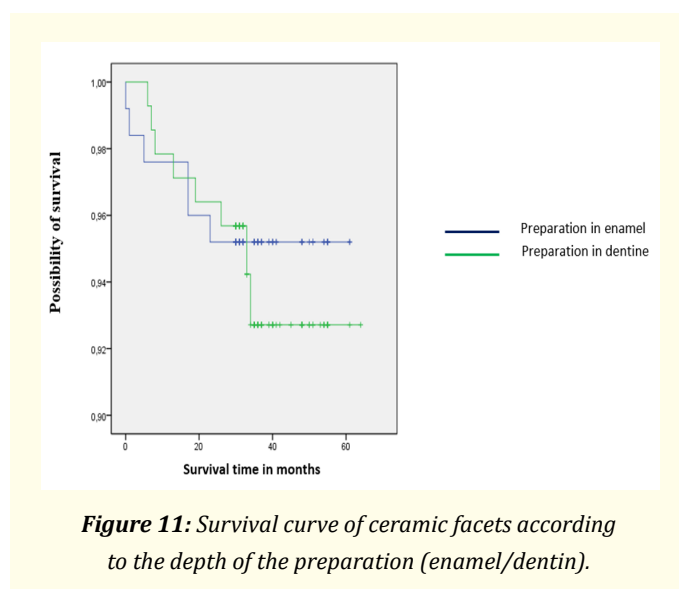


Figure 11: Survival curve of ceramic facets according to the depth of the preparation (enamel/dentin).

In our study, which included 264 facets, 125 facets presented an enamel preparation of which 6 showed an event while 139 veneers had a preparation at the dentin level, 8 of which showed an event.

The analysis of these results gives:

- Survival rate of ceramic facets with an intra-amolar preparation of 95.20% (95% CI, [91.50%, 99.00%]) and an average survival time of 58.57 months (IC at 95%, [56.65 months, 60.50 months]).
- A survival rate of ceramic facets with a dentinal preparation of 92.70% (95% CI, [87.60%, 98.10%]) and an average survival time of 60.90 months (95% CI), [58.80 months, 63.00 months]).
- An overall survival rate of ceramic facets according to the preparation depth of 93% and an average survival time of 61.1 months (95% CI, [59.59 months, 62.60 months]).
- The Log rank test gives a value p = 0.79 (p > 0.05) and therefore the difference is not significant between the two preparation depths as to the occurrence of the events.

### Occurrence of secondary caries according to the limit of the preparation

| Secondary caries | Limit of the preparation |           | Total   |
|------------------|--------------------------|-----------|---------|
|                  | In enamel                | In dentin |         |
| Yes              | 123                      | 137       | 260     |
|                  | 47,31%                   | 52,69%    | 100,00% |
| No               | 2                        | 2         | 4       |
|                  | 50,00%                   | 50,00%    | 100,00% |
| Total            | 125                      | 139       | 264     |
|                  | 47,35%                   | 52,65%    | 100,00% |

Table 6: Frequency of caries according to the limit of preparation.

The incidence of caries was recorded evenly between dentinal and enamel preparations (50%, 50%).

The Chi-square test gives a p = 0.91 (p > 0.05) and thus the incidence of caries is not related to the depth of dental preparation.

### The change of color of the facet according to the limit of the preparation

| Color change of the veneer | Limit of preparation |           | Total |
|----------------------------|----------------------|-----------|-------|
|                            | In enamel            | In dentin |       |
| No                         | 123                  | 124       | 247   |
|                            | 50%                  | 50%       | 100%  |
| Yes                        | 2                    | 15        | 17    |
|                            | 12%                  | 88%       | 100%  |
| Total                      | 125                  | 139       | 264   |
|                            | 47%                  | 53%       | 100%  |

Table 7: Frequency of changing the color of the face according to the situation of the preparation.

The hue of a veneer is the result of three elements: the shade of the stump, the color of the gluing composite and the hue of the ceramic used.

So, if we talk about changing the color of the facet, we generally exclude the ceramic that does not change and we look for the side of the stump or collage composite.

The Chi<sup>2</sup> test gives a p = 0.01 (p < 0.05) and therefore the depth of the preparation affects the change in color of the veneer: when the depth is in the dentin there is probability of change of color of the veneer.



## Discussion

### Particularity of the enamel

Enamel is the hardest of dental tissues; its elasticity and permeability are practically nil; its density is 3 while it is 2.30 for dentin and 2.01 for cementum. The enamel consists of 2.30% water, 96% mineral elements and 1.70% of organic elements.

Enamel is produced by ameloblasts, which are responsible for its structure. The enamel is made up of mineral elements called enamel prisms separated by the interprismatic substance which is mineral and organic.

This structure is more visible if the enamel is etched with phosphoric acid.



Figure 12: Surface of a tooth observed in SEM [19].

We visualize very well the twisted appearance of the prisms of the enamel. Some prism groups appear in longitudinal section, others in cross-section.

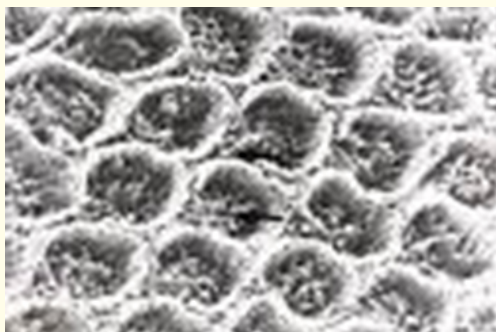


Figure 13: Enamel prisms in cross-section [19].

At a higher magnification, we see the variability of the disposition of the hydroxy-apatite crystals.

### The mode of adhesion to the enamel

Untreated enamel has a very low surface energy and is not suitable for bonding. It is covered with a bio film of polysaccharides coming from saliva. The enamel milling eliminates the aprismatic superficial enamel that is not conducive to bonding [16] as well as this bio film. Enamel etching with 37% phosphoric acid will increase the surface energy of the enamel and create a micro-retentive surface to a depth of 10 to 20µ which can be optimally penetrated by the resins. Hydrophobic di-acrylics.

### Particularity of dentin

Dentin has a very heterogeneous chemical composition: to the inorganic part of hydroxyapatite (70%) is added a rather large organic part, consisting of collagen (18%) and water (12%).

The hydroxy-apatite, arranged in an irregular manner, contains the organic matrix composed mainly of collagen fibers.

The dentine is traversed by canaliculi or tubuli, which contain the extensions of the odontoblasts and the pulpal fluid which filters the pulp up to the amelo-dentinal junction.

The tubuli increase in number and in diameter as we approach the pulp: at 1mm distance from the pulp, we can count about 40000/mm<sup>2</sup> on the occlusal side and 80000/mm<sup>2</sup> on the cervical side. Their diameter varies from 1.8 µm at the occlusal level to 3.5 µm at the cervical level.

This microstructure varies continuously due to physiological and pathological changes.

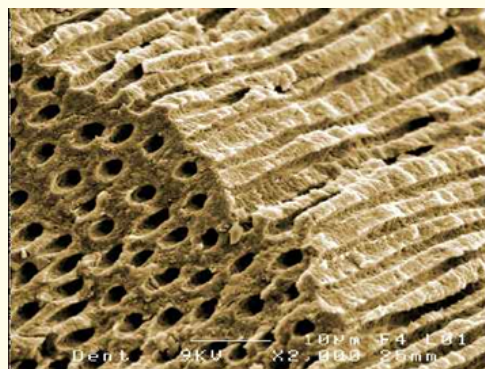
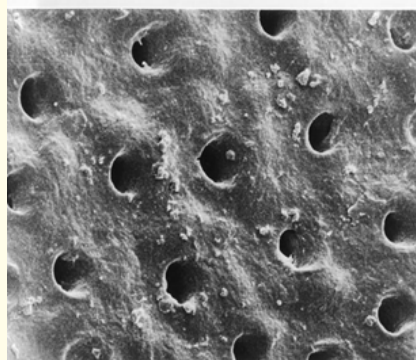


Figure 14: Transverse disposition of dentinal tubulis [19].



**Figure 15:** Electron microscopic image of dentinal tubuli constituting dentin [19].

### The mode of adhesion to dentin

Dentin bonding is more complex and difficult than enamel bonding. Therapeutic approaches have changed the treatment philosophy:

- The dentin must be etched, which does not hurt the pulp;
- View the presence of water in the dentine; hydrophilic resins must be used so that they can penetrate into the smeared dentinal surface despite its wet state [5,9].

During the mechanical preparation of a tooth (milling); a thick dentine sludge of 1 to 5  $\mu\text{m}$  is formed consisting of soft elements which seal the dentinal tubules.

Etching dissolves the mineral components of this smear mud and the hydroxyapatite of the underlying dentin a few microns deep [10].

The application of a hydrophilic primer on the thus open dentinal tubuli will facilitate the diffusion of the adhesive into the collagen network. This infiltration into collagen will result in the formation of a mixed layer called a "hybrid layer" or a resin-dentine inter-diffusion zone [11].

### Incidence of the limits of the preparation on the occurrence of cracks, fractures and detachments

In our study among the 264 facets studied, 125 had a preparation at the level of enamel and 139 at the dentinal level. Among the preparations at the level of the enamel 6 manifested an event whereas at the dentine level 8 showed an event.

The analysis of these results gives:

- Survival rate of ceramic veneers with an enamel's preparation of 95.20% (95% CI, [91.50%, 99.00%]) and an average survival time of 58.57 months (IC 95%, [56.65 months, 60.50 months]).

- A survival rate of ceramic facets with a dentinal preparation of 92.70% (95% CI, [87.60%, 98.10%]) and an average survival time of 60.90 months (95% CI, [58.80 months, 63.00 months]).
- An overall survival rate of ceramic facets according to the preparation depth of 93% and an average survival time of 61.1 months (95% CI, [59.59 months, 62.60 months]).

The Chi<sup>2</sup> test gives a value  $p = 0.795$  ( $p > 0.05$ ) and therefore the difference is not significant between the two preparation depths. Whether the preparation is at the level of the enamel or at the dentin level the difference is not significant.

Over the past decade the boundaries of a ceramic facet had to be in the enamel. 50% of the surface of preparation on the enamel, it was a rule inevitable. Studies have even shown [18] that the preparation made in dentin negatively affects the survival of these restorations.

The result of our study shows that there is no significant difference between a preparation that stops at the level of the enamel or the level of the dentine.

This result is in agreement with the Christensen and Christensen studies cited by Çöterta [14]; from Stappert, *et al.* [15] and Çöterta, *et al.* which are more recent (clinical study, 2009) [14].

This can be explained by the evolution of dentinal adhesives: dentine bonding has become as reliable as enamel bonding.

Christensen and Christensen cited by Çöterta [14] state that restorations with fine enameled ceramic facets adhered to enamel were as successful as ceramic restorations related to dentin. In their study, the survival time of ceramic facets with and without dentine exposure were compared, and the difference was considered negligible.

However, the majority of the authors were for an enamel preparation.

Burke F.J.T [13] reports in a meta-analysis that included 24 documents that there is sufficient evidence to indicate that the facet preparation in dentin negatively affects the survival of these restorations. This result is confirmed by Calamita, *et al.* cited by Tramba [16] in his retrospective study.

Dumfahrt and Schaffer [17] in a retrospective study presented very satisfactory clinical results (4% failures represented by fractures and fissures).

But also found that almost all failures were observed on facets assembled with preparations where the dentin had been at least partially exposed.

### Conclusion

Within the methodological limits of our clinical trial which evaluated 264 facets placed in 73 patients (52 women and 21 men) from 13 to 49 years old with an average age of 27.71 years and at the end of 64 months of follow-up (5 years and 4 months) the following results were drawn.

#### The depth of the preparation:

- Does not affect the occurrence of cracks, fractures or detachments: thanks to the improvement of dental adhesives, the bonding has become as secure at the dentinal as at the enamel.
- Does not affect the occurrence of cavities: The ceramic veneer is indicated in patients who have good oral hygiene, it is an element that is in favor of the very low rate of secondary caries on the one hand and the hermeticity of the margins of the preparation is ensured by the collage which reduces the bacterial infiltrations.
- Has an impact on the change of color of the veneer: when the depth is in the dentine there is possibility of change of color of the veneer. This observation is due to the fact that the more one cuts a tooth, the more one finds oneself in dentin. The latter tends to change over time to a darker color; the facet being generally translucent this coloring will appear over time.

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