

Direct Coronal Restoration with Composite Resins: An Assessment of 44 Cases Performed by Students at Yalgado Ouédraogo University Hospital Center of Ouagadougou, Burkina Faso

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ABSTRACT

Introduction: Composite resins restoration requires a rigorous approach in its implementation, which should be integrated into the learning process. The objective of this study is to assess the immediate quality of filling carried out by students in the Department of Conservative Dentistry and Endodontics, Yalgado Ouédraogo University Hospital Center.

Materials and methods: This is an evaluative prospective study conducted from April 1, 2018 to May 31, 2018. Direct coronal restorations performed by 1st year PhD students were assessed using well-established clinical and radiographic criteria and data were gathered using a form.

Results: Restorations were performed in 44 patients. Most of them (56.8%) were performed on first maxillary incisors. The fillings contour was in line with the tooth morphology for 39 (88.6%) fillings. Eleven (25%) fillings have gap apparent on radiography. Of the 44 assessed fillings, seventeen (38.6%) received a final score of "Not good" and 27 (61.4%) were rated "Good". All patients were satisfied with their restorations.

Conclusion: This study showed that students perform sufficient high quality restorations. However, the restoration emergence profile and the polishing still need to be improved.

Keywords: Composite resins restorations, Direct coronal restoration, Layering technique.

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INTRODUCTION

Composite resins are composed of resinous organic matrix and reinforcing fillers. A coupling agent or bonding connects the matrix and the reinforcing fillers. This composition is complemented by photoinitiators, setting inhibitors and pigments.¹ Their advent gave rise to the invasive dentistry based on tissue-preserving.^{2,3} For nearly 150 years, conservative dentistry, also called operative dentistry, has been considered in a strictly invasive and surgical concept, using non-esthetic, non-adhesive materials such as the amalgam.⁴ For a long time, other materials such as silicates and polymethyl methacrylate (PMM) resins have been used. Composites, developed in the 1960s, will overcome amalgams esthetic (color) and biological (mercury toxicity, thermal expansion, electro galvanism) problems,⁴ the fragility, solubility and poor biocompatibility of silicates and PMM resins.^{5,6} They are nowadays the most commonly used direct tooth restorations.⁷ However, their use has been challenging both in terms of determining guidance as well as surgical protocol.⁸ The method taught at Yalgado Ouédraogo University Hospital Center (YOUHC) for anterior teeth is the conventional technique of applying hybrid composite resins with a transparent matrix and a wedge. Direct composite restorations are still challenging for practitioners⁹ and, in particular, for the student, especially for interproximal anatomy restoration. This study was conducted in that context and its main objective was to assess composite resins restorations carried out by 1st year PhD students at the Department of Conservative Dentistry and Endodontics, Yalgado Ouédraogo University Hospital Center. A secondary pedagogical objective was to ensure the students' ability to implement composite restoration.

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MATERIALS AND METHODS

It is about a descriptive prospective study regarding composite resins restorations on anterior teeth, carried out in the Department of Conservative Dentistry and Endodontics, Yalgado Ouédraogo University Hospital Center by 1st year PhD students between April 1, 2018 and May 31, 2018. These students were chosen because they are at the end of cycle and because of the clinical experience they acquired in master 1 and 2. Data were gathered using a form based on the Sphinx Plus 2 software version 5.0.0.0.75.

An anteroposterior photopolymerizable micro hybrid composite Charisma (Heraeus Kulzer, Germany) was used with an etchant iBOND Etch gel (Heraeus Kulzer, Germany) and an iBOND® Total Etch adhesive (Heraeus Kulzer, Germany).

The required equipment for the restoration consisted of:

- An examination tray containing a mirror, a 6 probe, a 17 probe, a cotton forceps, a mouth spatula and a suction cannula;
- An ultimate 1400 LED lamp (BA International, Switzerland) for the polymerization;
- A transparent matrix (Henry Schein, USA) or a Coform Directa matrix (Henry Schein, USA) and a wooden wedge;
- An anesthesia equipment consisting of a syringe or carpule and a para-apical needle;
- A VITA classical A1–D4 shade guide (VITA–Zahnfabrik, Germany) for shade selection;
- A dam holder kit composed of clamps, dam frame, dam, clamp-carrying gripper, perforation user guide;
- A Komet diamond cutters kit (Komet Dental, Germany), interproximal strips (Henry Schein, USA) and SwissFlex™ Diatech polishing discs (Coltène, Germany).

The students followed several execution protocol stages. After daylight shade selection and performing periapical comfort anesthesia, the dam was inserted. Then, the cavity was sized up to the removal of the tooth decay and the enamel peripheral preparation. This preparation is carried out according to classic methods (peripheral bevel). For classes III, the cervical bevel was carefully made to avoid any gap or overcontour. For classes IV, a peripheral chamfer will increase the esthetics, or alternatively a wider bevel (2–3 mm). The approach is lingual or vestibular. The cavity's edges were beveled at 6°–10° cervically and 8°–18° at the vestibular and lingual edges. Then, the etching gel is applied for 30 seconds for the enamel and 15 seconds for the dentine, rinsed and dried without desiccation using water/air spray. The transparent matrix and the wooden wedge were then placed to marginally improve the adaptation. A transparent mold was used for considerable deformities. The adhesive is applied to the enamel and dentine surfaces and cured for 15 seconds before the composite resin is applied with a mouth spatula in successive layers not exceeding two millimeters thickness. The first layer is cured for 30 seconds before the next layer is applied until the cavity is completely filled. Finishing, sculpting, occlusion adjustment and polishing completed the restoration.

The assessment was conducted immediately. It took place in another care room so that assessors and the patient would not be influenced in their responses. The sculpture, the marginal integrity and the shade of each filling were reviewed with two rating criteria: "Good" or "Not good." The scoring was done by three different dentists who were not from the department and who did not know the students. The contours, shade and finishing (polishing, presence or absence of scratches, scores, etc.) were visually assessed. A 17 probe was used to assess the "tooth-filling" seal. In the event of a difference between two practitioners, the third reviewer acted as arbitrator and decided between them. The emergence profile and the presence or not of a gap were radiographically assessed to complete the clinical assessment.

The restoration is rated "Good" if:

- The filling contour is in line with the tooth morphology;
- No color difference and/or translucency between the filling and the adjacent dental structure;

- 17 probe does not stick to the tooth-sealing interface;
- And a perfect polishing.

The restoration is rated "Not good" if:

- The contour shape is inadequate;
- 17 probe sticks to the tooth-sealing interface;
- The difference in color and/or translucency between the filling and the adjacent dental structure is significant;
- And a not perfect polishing.

RESULTS

Patient's Characteristics

A total of 44 patients were seen. Of these, 32 (72.7%) were literate. Twenty five upper first incisors were treated, that is 56.8% cases. There were thirteen (29.5%) upper lateral second incisors and six (6) canines (13.6%). Eighteen teeth were vital (40.9%) and the remaining were endodontically treated. Twenty one (47.7%) teeth were classified G. V. Black class IV and nineteen (43.2%) teeth class III. Four teeth (9.1%) were heavily decayed on more than two sides.

Clinical and Radiographic Results

The fillings' contour was in line with the morphology of the tooth for 28 (63.6%) fillings. The 17 probe stuck to the tooth-filling interface on nine (11.4%) restorations. There were nine, that is 20.5%, not perfect polishing fillings (Table 1). Eleven (25%) fillings had a gap apparent on radiography (Fig. 1). There were four (4) cases of over contour and two cases of under contour (Table 2).

Overall Results and Patient's Satisfaction

Of the 44 assessed fillings, seventeen (38.6%) received a final score of "Not good" and 27 (61.4%) were rated "Good." All patients (100%) were satisfied with their restorations (Figs 2 and 3).

Table 1: Clinical criteria

Criteria	Tooth N = 44 (%)
Filling contour in line with the tooth morphology	Yes: 28 (63.6) No: 16 (36.4) Total: 44 (100)
Overcontoured obturation	Yes: 10 (22.7) No: 34 (77.3) Total: 44 (100)
Undercontoured obturation	Yes: 6 (13.6) No: 28 (86.4) Total: 44 (100)
17 probe sticks to the material-tooth seal	Yes: 9 (20.5) No: 35 (79.5) Total: 44 (100)
No difference in color or translucency between the filling and the tooth structure	Yes: 28 (63.6) No: 11 (36.4) Total: 44 (100)
Established contact point	Yes: 28 (63.6) No: 16 (36.4) Total: 44 (100)
Perfect polishing	Yes: 29 (69.9) No: 15 (30.1) Total: 44 (100)



Fig. 1: Defective restoration on the 21st (presence of gap)

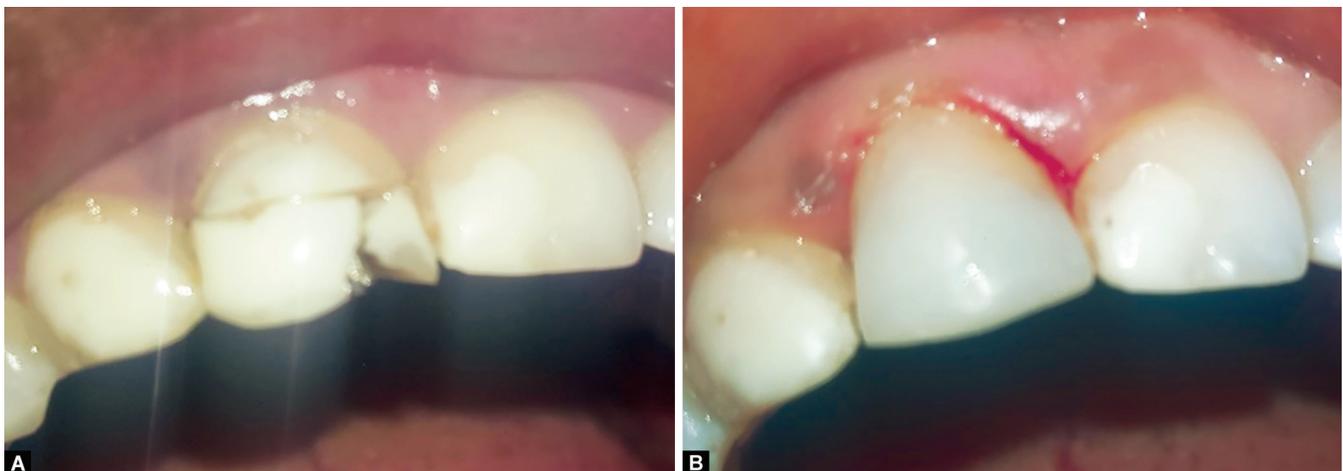
Table 2: Radiographic criteria

Criteria	Tooth N = 44 (%)
Visible gap	Yes: 11 (25)
	No: 33 (75)
	Total: 44 (100)
Overcontoured obturation	Yes: 14 (31.8)
	No: 30 (68.2)
	Total: 44 (100)
Undercontoured obturation	Yes: 4 (9.1)
	No: 40 (90.9)
	Total: 44 (100)

DISCUSSION

Any esthetic restoration success depends on now well-known criteria and they apply to direct and indirect techniques (integration of the teeth shape within the smile and face; the shade in its overall sense in relation to tissues and adjacent teeth; the surface micromorphology and gloss of the restorative material and the biological, the restorations functional and esthetic durability).¹⁰ But this success is based on standardized therapeutic approach and clinical protocol. In industrialized countries, esthetic dental

therapy is done with scientific advances such as esthetic planning using technology tools.¹¹ This study showed that thirteen of the 44 fillings, that is 29.5%, received a final score of “Not good” and had to be redone. Generally, a perfect composite resin restoration depends on working conditions and operating procedures. The conventional technique of applying the material using a transparent matrix and a wedge has some disadvantages. Indeed, when the wedge deforms the transparent matrix it can alter the emergence profile.⁹ However, it is still challenging for the student to stabilize the transparent matrix without using a wedge. Moreover, because filling the space between the matrix and the tooth at the cervical level of the emergence profile with material is laborious and instrument handling is difficult.⁹ For this reason, 40.9% of carried out restorations were not in the tooth emergence profile. Nevertheless, the composite remains the best material with physicochemical, mechanical and esthetic qualities when a direct composite restoration is recommended.¹² This study showed that restoring the marginal integrity, point of contact and the polishing are the biggest issues of restoration. Several factors at different levels may explain the scant results. Stress and the rush to restorations without instruments or failure to follow the surgical technique are the negative influencing factors to the final result. The composite used combines important mechanical, physical and optical properties with esthetic potential and high polishing ease. Eleven (36.4%) restorations shade choice was rated “not good.” However, the composite used is micro hybrid and provided with a very high esthetic rendering. Not using the layering technique with different materials to restore the dentine, the high diffusion layer and the enamel could be linked to the final failure of the color rendering. The layering method provides with better results, but it seems difficult to resort to complex multi-layering techniques in the students’ daily practice.¹⁰ Indeed, for a reconstitution as close to the natural tooth as it could be, it is necessary to reconstitute the enamel tissue with enamel composite and the dentine tissue with dentine composite. The composite three layering technique provides with the best and reproducible esthetic result (a natural integration of the material). This layering method would be better taught in continuing education. Moreover, finishing and polishing steps that restore the tooth macro and microgeography are not yet well mastered; while the clinical stability of composite resins depends on finishing and polishing processes.¹³ Smooth, well-polished restorations are more esthetic and easier to maintain than



Figs 2A and B: Restoration of the 11th redone. (A) Broken old restoration of the 11th; (B) Newly restored 11th



Figs 3A and B: Restoration by a student of the 11th and 21st; (A) Class III carious lesions on, (B) Restored 11th and 21st

restorations with a rough surface.¹⁴ Obtaining a quality interface also remains a big challenge. Only following a rigorous operating protocol can optimize this key area. Polymerization tightening or polymerization technique can also explain the lack of marginal sealing. Indeed, the polymerization quality will depend on the irradiance and radiation flux of the photopolymerization lamp.^{15,16} Successive thin layering technique compensates for this defect (used in the layering technique). Thus, the distance between the material and the lamp tip will influence the polymerization degree. The thicker the composite layer, the less the light transmission is good. To under-polymerize the resin may have caused most failures.¹⁷⁻¹⁹ However, in this study, despite some inadequacies, all patients reported being satisfied with their restoration, certainly due to their lack of knowledge of an esthetic restorative treatment. All restorations marked “not good” have been re-scheduled.

CONCLUSION

This study shows that the quality of restorations depends on a rigorous implementation. Students are able to perform satisfactory restorations. However, mastering composite restorations protocols by strengthening teaching with the integration of new layering techniques on one hand and preclinical and clinical supervision on the other hand can optimize them.

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