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## Direct Composite Resin Restoration of Anterior Maxillary Teeth and Esthetic Smile Design: A Case Report

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### Cover Page Footnote

The authors would like to thank Naresworo Apsari and Cyntia Dewi Maharani that their case is willing to be used for publication in an accredited/reputable magazine, and her name is entered as an author.

## **CASE REPORT**

### **Direct Composite Resin Restoration of Anterior Maxillary Teeth and Esthetic Smile Design: A Case Report**

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#### **ABSTRACT**

Dental esthetic complex involves more than one caries with malformed shape and malposition. Dental trauma most commonly affects maxillary anterior teeth, and subsequently affects the esthetics, functions, and psychological well-being of the individual. Composite resins have become an integral part of contemporary restorative and minimally invasive dentistry. **Objective:** To summarize the successful use of direct composite resin restoration in the management of a 29-year old male patient. **Case Report:** A 29-year old male patient presenting with multiple secondary caries and crown fractures in the anterior maxillary teeth, resulting in an unaesthetic smile. Comprehensive esthetic dental treatment was carried out. The patient was highly satisfied with the results even after eleven months of follow-up. **Conclusion:** restorative success with composite resins, the dental treatment plan should be carefully executed with attention to factors such as dental convexities and contours, re-establishment of function, and esthetics. Smile design should always be a multifactorial decision-making process that allows the clinician to treat patients with an individualized and interdisciplinary approach.

**Key words:** aesthetic, composite, restoration, smile-design

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#### **INTRODUCTION**

An individual's psycho-social well-being is largely dependent on their dento-facial appearance, and dental restorations can positively impact their self-confidence and overall mental health by improving their smile and appearance.<sup>1</sup> Compared to other ceramic restorations, composite resins offer excellent esthetic potential; are minimally invasive, requiring little or no tooth preparation at all; have acceptable longevity; and are available at a much lower cost for the restoration of both anterior and posterior teeth.<sup>2</sup> Direct composite resin restorations represent a viable alternative to indirect restorations as they allow maximum preservation of sound tooth structure.<sup>3</sup>

Dental trauma to the maxillary incisors is fairly common, and the treatment plan is often influenced by the level of the fracture line, occlusion, and prognosis. However, some cases may require a multidisciplinary approach in order to improve their functional and esthetic outcomes<sup>4</sup>, which are dependent on careful consideration of the shape of the face and head and the

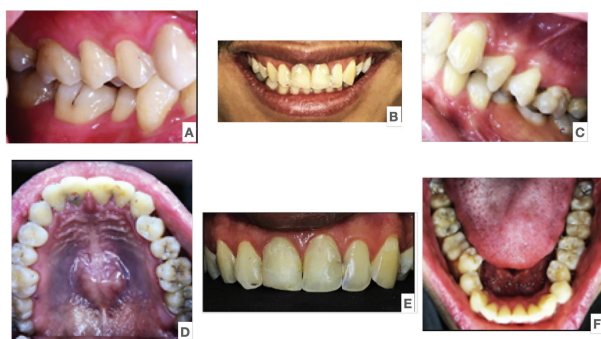
volume, size, ratio, shape, texture, pattern of placement, and color of the teeth. Other factors, such as health and appearance of the soft tissue and gums, gingival line, smile line and width, relationship between the lower lip and upper-incisor line, dark areas at the corners of the mouth, and zenith point may also play a vital role.<sup>1</sup>

#### **CASE REPORT**

A 29-year-old male patient reported to the conservative dentistry clinic at Gadjah Mada University with a complaint of dental trauma caused by a bike accident approximately two years ago. The patient underwent a dental check-up and restorative treatment one week after the accident. However, the patient presented with pain in the same tooth after six months and was prescribed pain medication. Within one week, the gums around the restored teeth were seen to be swollen, and the patient re-visited the dentist at which point performed the opening of the palate of the tooth with a drill. The patient was then referred to RSGM for restoration of the upper front teeth for esthetic reasons.



**Figure 1.** (A) Pre-treatment photograph, (B) Pre-operative periapical radiograph



**Figure 2.** Intra-oral and extra-oral pre-operative photos (A) right side, (B) smile view, (C) left side view, (D) maxillo-occlusal view, (E) anterior maxillary view, (F) mandibulo-occlusal view

The patient was no longer in pain, and reported no history of systemic diseases or allergies to any drugs or food.

Patient consent was collected prior to treatment and collection of patient records (including impression, radiographs, and photos) was carried out.

Clinical and radiographic examination revealed a non-complicated crown fracture in teeth 11 and 21. The patient had previously undergone provisional composite resin restoration on the mesial and distal aspects of some teeth (12, 11, 21, and 22). No pulp exposure was detected in 12, 21, and 22 and, although the vitality test was negative, percussion of 11 showed a positive response (Figure 1, 2). Summary of patients oral condition was shown in Table 1.

After taking the position and pattern of the fractures into consideration, a composite resin restoration was considered as the best treatment plan and a diagnostic wax-up was made. Table 2 showed the phases of patient treatment plan. Color selection for the dentin, enamel, and incisal edges of the teeth was carried out for direct restoration. Endodontic assessment revealed a necrotic pulp with normal periapical tissue in tooth 11, and root canal treatment (RCT) was recommended.

Scaling and delivery of oral hygiene instructions was carried out in phase 1 of the treatment plan to improve the patient's oral hygiene habits and gingival health

**Table 1.** Intra oral findings in mandibular and maxillary teeth

Teeth number (FDI)	Findings
Maxillary teeth	Pit and fissure caries
All teeth	Plaque and calculus
15, 16, 17, 18, 24, 25, 26, 27, 28, 34, 45, 46, 47	Arrested caries, pit and fissure
37, 12, 21, 22	Secondary occlusal caries
38, 48	Occlusal caries

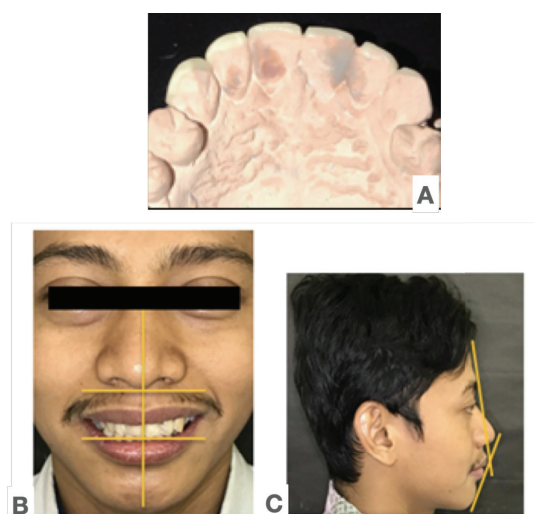
**Table 2.** Three phases of the treatment plan

Treatment phase number	Treatment steps
Phase 1	Patient education; oral hygiene instructions; collection of informed consent; scaling; maxillary and mandibular impressions; wax-up of palatal tooth 21; face, dento-facial, dental, gingival, and space analysis; RCT of tooth 11.
Phase 2	Obturation of tooth 11 with lateral condensation.
Phase 3	Post-cementation in tooth 11
Phase 4	Toilet of the cavity 12, 11, 21, 22; multiple composite restorations and direct veneers on teeth 12, 11, 21, 22.

and to also prevent further dental issues. Diagnostic casts and pre-operative photos were used to analyze the patient's smile, and a wax-up of the palatal tooth 21 was created (Figure 3). This was done to enable the patient to provide his opinion, and also to allow for any adjustment needed in the next phase. Analysis showed that the facial and dental median lines coincided, although the horizontal facial line was not parallel to the incisal edge of the anterior maxillary teeth. The patient also had a convex facial profile (Figure 3).

Dento-facial analysis showed that (1) the upper lip smile line (shown in red) was precisely at the gingival margin for teeth 11 and 21 and above the gingival margin for teeth 13, 12, 22 and 23; (2) the lower lip smile line (also shown in red) was unbalanced in relation to the incisal plane of the anterior maxillary teeth (yellow line); and (3) the lip lines were not symmetrical during active smiling (Figure 4).

Analysis of the anterior teeth from the front showed convergence of the axis toward the incisal edge. Tooth 11 appeared to be longer than tooth 21, with the incisal edges being slightly asymmetrical although this was not visible during active smiling; Tooth 23 was seen to be inclined labially to a greater extent than tooth 13 (Figure 5).



**Figure 3.** (A) Study model made using wax mockup, (B) Frontal view of patient's face; (C) sagittal view of patient's face



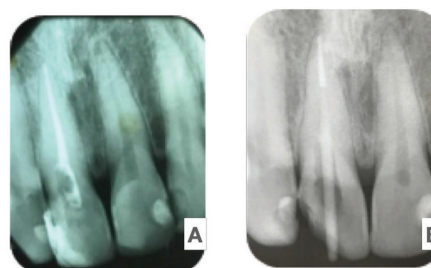
**Figure 4.** (A) rest position; (B) passive smile; (C) active smile

Space analysis (Figure 5) was Inter-canine distance = 53.47 mm, distance between right canine and median line = 26.72 mm, distance between left canine and median line = 26.75 mm, mesio-distal widths of teeth as seen from the front: 13 = 8.81 mm, 12 = 8.88 mm, 11 = 9.03 mm, 21 = 9 mm, 22 = 8.89 mm, 23 = 8.86 mm and the dental median line was seen to be deviated toward the facial median line. As per the “Golden Proportion Theory”, the available space for teeth 11-21 = 18.03 mm, and the portion each tooth: Canine: Incisor lateral: Incisor central = 0.618: 1: 1.618. Tooth width 11/21 = 18.03: 2 = 9.01 mm, tooth width 12/22 = 9.01: 1.618 = 5.57 mm and tooth width 13/23 = 5.56 x 0.618 = 3.43 mm.

Dento-facial analysis of the widths of 11 and 21 (contact mesio-distal), i.e., 1/16 of the distance from the



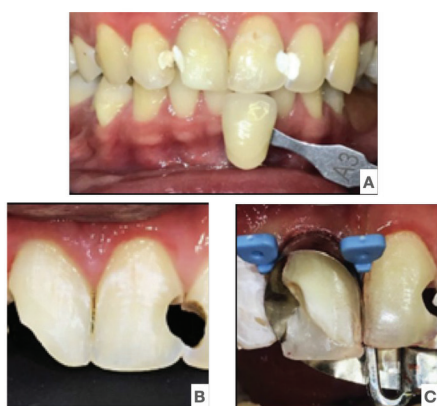
**Figure 5.** (A). Dental axes of anterior maxillary teeth (black lines); (B) Gingival zenith position for the anterior maxillary teeth; (C) Space analysis (red line- mesio-distal width of the tooth; blue line - inter-canine distance for the anterior maxillary teeth)



**Figure 6.** (A) Radiograph of obturated tooth 11; (B) Radiographs of fitted pre-fabricated fiber post in tooth 11

zygomatic prominence through the imaginary central line of the face were zygomatic prominence distance = 144 mm, width 11 and 21 =  $143/16 = 8.93$  mm. The ideal height for teeth 11 and 21 is 1/16 of the distance between the menton and glabella. Menton - glabella distance = 145 mm, the ideal height of teeth 11 and 21 =  $140/16 = 9.06$  mm

Based on the 1/16 theory, the ideal width for teeth 11 and 21 was 8.93 mm, while the available space, as per the golden proportion theory, was 9.01 mm. Tooth placement was based on the available space after selective contouring so that the teeth did not look too wide and appeared masculine. Teeth 11 and 21 did not increase the width of the teeth during restoration. The median line of the tooth was not corrected as it was parallel to the facial median line and shifting it to the left would have created more space for 12 but left inadequate space for 22. As a result, the golden proportion was not achieved.



**Figure 7.** (A) Color-matching of teeth using a shade guide - shade A3 selected; (B) Anterior teeth after removal of caries and an old composite resin restoration, (C) Setting up the greater curve matrix



**Figure 8.** (A) The final restoration - labial view, (B) The final restoration - palatal view, (C) Appearance of restoration at follow-up at 11 months

In phase 2 of the treatment plan, RCT was performed on tooth 11 (25 mm in length, Figure 6), and the orifice was sealed using glass ionomer cement. Post-operative follow-up was carried out after 1 week, and a post (21 mm in length) was inserted into the tooth in phase 3 of the treatment plan (Figure 6B).

In phase 4 of the treatment plan, the tooth color (shade A3) was determined using a shade guide. Cavity preparation was carried out in teeth 12, 11, 21, and 22 using rotary instruments, and the teeth were sealed using temporary restorative material (Figure 7).

Treatment for teeth 11 and 21 included subgingival retraction cords were placed on teeth 11 and 21. The teeth were then prepared using a veneer design and a chamfer finish line. The incisal surface was reduced and prepared, and the interproximal portion of the cervical area was cut. The palatal section was given

a short bevel. In tooth 21, the short bevel was created on the palatal aspect as a class III cavity. The cavities were cleaned, the enamel surfaces were etched with phosphoric acid, and the teeth were washed and dried. Application of bonding material (single bond, 3M, USA) adhesive was carried out using a regular-sized micro brush, and then light-cured as per the manufacturer's instructions. A palatal guide was attached to the teeth to mark the edge of the restoration. With the help of the guide, the palatal walls of teeth 11 and 21 were built using light colored enamel composite resin.

The cervical and incisal parts of the proximal walls were built using composite resins shades A3 and A2, respectively. A greater curve matrix (on the cervical section) and celluloid strips were used to assist with this, and the composite resins were then polymerized using light-curing (Figure 7). The dentin color composite resin was applied and light-cured. Composite resin shades A3 (cervical third and body) and A2 (incisal third) were used on the labial aspect of the teeth, and light-curing was carried out.

Treatment for teeth 12 and 22 included re-contouring of the composite resin overlays and class III cavity preparation and restoration was carried out on the mesial incisal third, well as class III cavity deposition and addition of 1/3 of the mesial incisal side. Treatment for tooth 13 and 23 included selective contouring of the incisal 2/3 of the labial aspect of 13 was carried out. Selective contouring was carried out on the labial aspect of 23 which was protruding in relation to 13 in order to achieve a balanced appearance and convex smile lines. The final restorations and at 11 month follow up visit are shown in Figure 8.

All restorations were finished and polished using an extra-fine finishing bur and rubber polishing bur. Finally, the restorations were checked for any traumatic occlusal adjustment.

The follow-up visit after 11 months showed that the edges and marginal adaptation of the restoration were still good (Figure 8C).

## DISCUSSION

Dental esthetics is a primary concern for all patients<sup>5</sup>, and dental trauma involving both enamel and dentin most frequently occurs in the maxillary central incisors. This case report presents a conservative, time-saving, inexpensive treatment option for this common esthetic problem.<sup>6,7</sup>

In the current case, the non-aesthetic appearance of the existing restorations in teeth 21, 12, and 22 could be attributed to the fact that the contours of the restoration were not well-formed. Foaming and bubbly saliva indicates increased viscosity which, in turn, decreases

the self-cleansing ability of the oral cavity. The higher the viscosity of the saliva, the more plaque retention and debris deposits occur on the restoration. This, in turn causes pathogenic bacteria from the plaque to develop rapidly and cause demineralization of the tooth surface, leading to increased tooth porosity and caries. Clinical examination revealed caries under the old restorations in teeth 12 and 22. Moreover, dental trauma caused an intra-pulmonary arterial rupture in the apical region of tooth 11 which, in turn, led to a periapical inflammatory response and subsequent pulp necrosis.

The patient reported to the clinic with considerable dental esthetic problems, and the composite resin layering method was found to be the key to obtaining esthetically successful results. Direct composite resin restorations are the most common treatment option as they are conservative, predictable, repairable, and inexpensive in comparison to indirect restorations.<sup>8</sup> Moreover, with this method, esthetic restoration of most teeth can be completed in a single appointment in a cost-effective manner and with no requirement for luting. Additional benefits of direct restorations include increased bonding area and strong and durable physical properties, thus decreasing the need for frequent repair.<sup>7</sup> Final estimation of the width and length of the maxillary anterior is an essential step during diagnostic wax-up.<sup>9</sup>

Enamel deficiency often results in sensitivity of the tooth to thermal and contact stimuli; however, this can be treated with the help of composite resin restorations as they protect the remaining structure. The patient had no further esthetic complaints following restoration of his teeth using direct composite resins.<sup>10</sup> Most composite resin systems have a standard shade guide manufactured from unfilled methacrylates and, therefore, do not accurately represent the exact shade, translucency or opacity of the final polymerized restorative material.<sup>11</sup>

Dental proportion is closely related to facial morphology, and is an essential part of creating an esthetically pleasing smile. The width to length ratio of the center of the tooth should be approximately 4:5 (0.8–1.0), with the width being approximately 75–80% of the length. The shape and location of the facial median line also influences the appearance and placement of the laterals and canines. The Golden Proportion (GP) concept was first introduced by Lombardi in an attempt to achieve balance between the dentition and the facial profile.<sup>12</sup> The important point to be noted here is that it is not the actual size but, instead, the perceived size when viewed from the facial aspect that these proportions are based on. As per this principle, the width of each anterior tooth should not be greater than 60% of the width of the adjacent tooth (the mathematical ratio being 1.6:1:0.6)<sup>13</sup> when viewed from the facial aspect. In the current case, the proposed GP ( $1/1.618 = 0.618$ )

resulted in the visible (perceived) width of the canine being 62% (0.618) of the lateral incisor, and the visible width of the lateral incisor being 62% (0.618) of the central incisor.<sup>12</sup> Aesthetic post and core restoration of the anterior teeth was also indicated for better results<sup>14</sup>, and a fiberglass post was selected due to its increasing popularity.<sup>15</sup>

Factors that must be taken into consideration when designing a smile include tooth components [such as dental midline; incisal length; tooth dimensions; zenith points; axial inclinations; interdental contact area and point (ICP); incisal embrasure; sex, personality, and age; symmetry components] and soft tissue components (gingival health; gingival level and harmony; interdental embrasure; and smile line).<sup>12</sup>

Anatomic wax-up represents one of the most vital steps in the process of redesigning a patient's smile<sup>16</sup> as it provides an opportunity to correct temporary restorations and verify final restorations (including intra-oral occlusion, length of the restoration, and relationship with the neighboring teeth and gingiva, position of lips at rest or while smiling, phonation, and harmony with the patient's face). As all these parameters can be visualized and experienced by the patient immediately, it is highly recommended that the clinician takes the patient's opinion of the mockup into consideration.<sup>17</sup> The fundamental criteria for esthetic analysis should include facial, dentogingival, and dental esthetics.<sup>18</sup>

## CONCLUSION

In order to achieve restorative success with composite resins, the dental treatment plan should be carefully executed with attention to factors such as dental convexities and contours, re-establishment of function, and esthetics. Smile design should always be a multifactorial decision-making process that allows the clinician to treat patients with an individualized and interdisciplinary approach. In order to reach these goals, the clinician should pay attention to the patient's expectations with regard to phonetics, biomimetics, and esthetics.

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## CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

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