

## Effects Of Tooth Preparation And Poorly Designed Artificial Crowns On Health Of Periodontium And Esthetics : A Case Report

### Abstract

Knowledge of the response of periodontal tissues to artificial crowns and fixed partial dentures is crucial in the development of treatment plan with predictable prognoses. Crowns and FPDs increases the incidence of gingival inflammation adjacent to restorations, particularly if restoration rests on free gingiva, has sub-gingival finish line, poor marginal adaptation or improper crown contours. The periodontium of the tooth to be restored should be healthy before starting the restorative procedure. The successful functional and esthetic rehabilitation of tooth with predictable prognosis depends on establishing a physiologic periodontal climate and facilitation of maintenance of periodontal health. This case report describes the effects of tooth preparation procedure and poorly designed crowns on health of adjacent periodontal tissues and esthetics.

### Key Words

Periodontium, Esthetics and functional rehabilitation, mutilated tooth, crown contour, smile zone, emergence profile.

### Introduction

Fixed dental prosthesis is one of the most commonly used prosthesis in dental clinical practice for restoring function and health of oral tissues. Proper crown contour, proximal contacts, margin placement, pontic design and occlusion are important for restoring esthetics, function and health of the periodontium. The long-term prognosis of fixed dental prosthesis depends on establishing a physiologic periodontal climate and facilitation of maintenance of periodontal health. To achieve the successful rehabilitation of tooth, the restoration must be a continuation of normal tooth contour and not be overcontoured; a condition which promotes plaque accumulation and resultant gingival inflammation. Restoration must appear to grow from gingiva to give an illusion of natural tooth.

Restoration of carious, fractured, malaligned and mutilated tooth is one of the greatest challenges for a dentist and it becomes much more difficult when the outcome of treatment was unsatisfactory earlier. Esthetics affects the looks, personality of a person and has great psychological effect. Proper evaluation of patient's smile zone (The space present between inferior border of upper lip and the superior border of the lower lip and corner of the mouth while smiling) and

lip line (high, medium/normal and low lip line while smiling) is important for esthetical restoration of teeth falling in the smile zone. Sometimes maxillary first molar also fall in the esthetic zone. For successfully esthetic restoration of all these teeth, particularly in patients having high lip line, subgingival finish line should be placed on the facial surfaces during tooth preparation to give an illusion that artificial tooth is growing from the gums (emergence profile).

Marginal fit of crowns is of clinical importance because when the junction between the prepared tooth and a restoration is discontinuous, a niche is available for accumulation of plaque near gingival margins. The plaque can initiate gingival inflammatory reaction and may lead to deterioration of soft tissue with periodontal disease determined by clinical and histological parameters<sup>[1],[2]</sup>. The severity of periodontal disease is elevated with greater subgingival marginal discrepancy.<sup>[3],[4]</sup> Moreover, Setz and Diehl<sup>[5]</sup> recently reconfirmed that gingival inflammation, measured by sulcular fluid flow rates, increased around artificial crowns compared with adjacent natural teeth.

Proper placement of finish line is very important for successful esthetic and functional restoration of any tooth. Supragingival finish line is placed about 1mm above the free gingival margin and

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it is usually preferred because it is easy to prepare, less chances of gingival laceration during tooth preparation, it is easy to record in impression, easy to evaluate marginal fit of crown/retainer and patient can keep it clean easily. It is placed on the lingual/palatal surfaces of all the teeth and buccal surface of teeth not falling in esthetic zone.

Subgingival finish line is placed about 0.5-1mm below free gingival margin and it is placed on labial and buccal surface of all teeth falling in smile zone to create an illusion that artificial tooth looks like a natural tooth. Finish line should always be placed on sound tooth structure. While preparing subgingival finish line, care should be taken to avoid violating 'biological width' which is the combined width of connective tissue and junctional epithelium from crest of bone to floor of gingival sulcus. If any damage of junctional epithelium takes place during tooth preparation, it may be separated from tooth, resulting in periodontal pocket formation. To maintain the periodontal health and restore the function of the tooth, biological width should not be violated and crown should properly seat on the finish line. It should not extend beyond the finish line otherwise it will act as an irritant and also cause food accumulation resulting in

gingivitis and periodontal problems.

### Case Report

A 22 year old female patient reported to the department of Prosthodontics with the chief complaint of poor esthetics and bleeding from gums particularly during tooth brushing. On clinical examination, it was found that the two maxillary central incisors restored with porcelain fused to metal crowns had poor shade matching and improper alignment. (Fig 1). The free gingival margin was also found to be inflamed related to these two teeth (Fig 1, 2). On removal of the two crowns, it was found that gums were severely inflamed with continuous bleeding. (Fig 2) and both central incisors were inadequately prepared (Fig 3). The crowns were almost resting on gums instead of finish lines.

It is very important that periodontium should be completely healthy before starting tooth preparation for any type of crown or fixed partial denture. If subgingival finish line preparation is done with inflamed gums, the finish line tends to become equigingival or Supragingival once the gums become healthy. This affects esthetics, particularly if the teeth are in esthetic zone. In this particular case, after the removal of crowns we wait for few days before starting teeth preparation to allow the gums to become healthy (Fig 3). Once the gums returned to normal health, we did tooth preparation with tapered flat end diamond bur to provide shoulder type of finish line. This finish line is prepared perpendicular to long axis of tooth and is about 1mm wide. It is indicated for all ceramic and PFM crowns (labial/buccal side upto contact area where ceramic is applied over the metal coping) because ceramics are brittle material with poor edge strength. Shoulder finish line provides bulk of ceramic at the margin to prevent fracture and also develop proper crown contour to achieve optimal esthetics. In this particular case, on optimum tooth reduction, we found that there was insufficient tooth structure left in relation to 11 (Fig 4) to retain crown and just Incisal 2mm of 21 is needed to be restored to retain the crown. So 21 was restored with light cure composite resin and 11 was restored with custom post and core (Fig 5). The pattern for custom cast post and core was made with self cure acrylic resin (Fig 4) which was later casted. After evaluating fit of cast post and core, it was cemented with glass ionomer cement (Fig 5). The two teeth



Fig 1 : Poorly Designed Pfm Crowns



Fig 2 : Gingivitis With Bleeding Gums



Fig 3 : Inadequately Prepared Central Incisors



Fig 4 : Labial View - Optimal Prepared Teeth With Subgingival Finis Lines And Self Cure Acrylic Resin Pattern For Cast Post And Core In 11.



Fig 5 : Cemented Custom Cast Post And Core In 11 And Core Buildup With Composite Resin In 21

were finally restored successfully both functionally and esthetically with porcelain fused to metal crowns. (Fig 6). Three year follow up of patient revealed excellent patient satisfaction with well maintained health of periodontium



Fig 6 : Labial View- Central Incisors Restored With Pfm Crowns

indicating good prognosis.

### Discussion

Optimal gingival tissue health must be established before initiating any fixed prosthodontic procedures and extreme care must be exercised during all stages of treatment to maintain it.<sup>[6],[7],[8]</sup> Patients with faulty, overcontoured existing restoration have exaggerated responses to the slight tissue insults<sup>[9]</sup> whereas if gingiva is healthy before procedure the slight trauma during tooth preparation do not produce lasting effects.<sup>[7]</sup>

Impressive evidence supports the supragingival placement of margins for artificial crowns,<sup>[10],[11]</sup> in part because these margins are easier to clean and to visualize<sup>[12]</sup> However, their chief disadvantage has been reported as poor esthetics evident in visible areas. Intracrevicular margins are associated with the development of plaque-related inflammation and regarded as a risk factor in the progression of periodontitis. Restorative margins are routinely placed subgingivally when dental carious lesions, preexisting restorations, short clinical crowns, or esthetic demands are present<sup>[13]</sup> or when there is loss of tooth surface in the cervical area. However, periodontal health and success of the restoration are dependent not only on the depth of tooth preparation and marginal quality of the restoration but also on the health of the entire masticatory system.

Gingival health and position can be maintained in the presence of subgingival finish lines, but it requires careful execution of clinical procedures and presence of restoration with excellent marginal fit and contour. Extreme care must be taken while preparing subgingival finish line to avoid/minimize injury to tissues especially where attached gingiva is minimum because even a slight injury most likely causes recession. The epithelial attachment is the most vulnerable of all the supporting structures and procedural trauma can initiate its apical migration and resulting

in periodontitis and recession.<sup>[9]</sup> subgingival finish lines must be terminated at least 0.5mm short of the epithelial attachment. Deeper the subgingival tooth preparation extension; greater is the risk of injury to epithelial attachment.<sup>[14]</sup>

The potential of gingival trauma while preparing subgingival finish line is related to type of subgingival finish line being formed. A shoulder finish line can be established subgingivally while keeping the entire rotary instrument diameter within the peripheral tooth contours where there is less chance of gingival contact. The formation of chamfer and beveled shoulders requires that part of the rotary instrument diameter be located outside peripheral tooth contours with greater potential for gingival trauma.<sup>[5]</sup> This relationship does not mean that greater gingival trauma will always occur with chamfer and beveled shoulders but it does indicate the need for extra care when these finish lines are being prepared subgingivally. Gingival retraction cord and hand instruments with flat blades can be used to retract the gingiva to minimize soft tissue trauma from rotary instruments as subgingival finish lines are formed.<sup>[5]</sup>

Successful esthetic rehabilitation of a tooth requires adequate tooth reduction to provide space for esthetic thickness of ceramic and normal tooth contours.<sup>[15]</sup>

The use of depth guide cuts in the early stages of tooth preparation ensures optimum and uniform tooth reduction. The restoration must be a continuation of normal tooth contour and should have good marginal fit because marginal defects permit plaque formation with resultant recurrent caries and gingivitis. Facial, lingual and interproximal surfaces should be normally contoured and should not impinge on the soft tissues because overcontouring promotes plaque accumulation and affects the esthetics. The location and form of proximal contacts must be restored. Marginal ridges of adjacent teeth should be of even height. Embrasures should be opened as much as practically to permit access to oral hygiene aids. Contra-lateral tooth is the best guide for restoring the form (contours, proximal contacts, level of marginal ridges, occlusal/Incisal morphology) and function of a tooth to be restored.

The emergence profile of artificial crown/restoration affects the esthetics. The restoration should emerge from

gingival sulcus in such a way that it should give an illusion that restoration is emerging from gums like a natural tooth. Provisional restoration must be given after reduction of a vital or nonvital tooth. It serves to preserve the position, form, function and color of the gingiva while the definitive restoration is being made<sup>[8]</sup>. To achieve this, provisional restoration must be properly contoured with well fit marginal adaptation and smooth polished surface. Gingival recession has been associated with improperly contoured provisional crowns and rough surfaces which promote plaque accumulation.

After cementation of provisional crown, it is important to remove all the traces of provisional luting cement from the gingival sulcus to prevent unfavorable gingival healing. All traces of luting cement which extrude into gingival sulcus facially and proximally after cementation of definitive crown should be completely removed because it may act as gingival irritant and results in gingivitis, periodontal pocket formation and gingival recession.

Patient must be instructed to maintain adequate oral hygiene. Inadequate oral hygiene can produce detrimental biologic and esthetic changes even in the presence of excellent restoration and careful execution of technical procedures.

### Conclusion

A natural tooth restored with artificial crown should be a harmonious part of the whole dentition which can be achieved by restoring facial, lingual and proximal contours, occlusal / Incisal anatomy, proximal contacts, embrasures / spillways, marginal adaptation, esthetics and function as close as possible to adjacent or contra-lateral natural tooth. The gingiva around the tooth to be restored should be healthy before starting tooth preparation. Every effort should be taken for careful execution of technical / clinical procedures to avoid / minimize the trauma / laceration of gingiva particularly when placing subgingival finish line. By considering all these facts, both central incisors were successfully restored with excellent prognosis.

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