Clinical and Radiographic Evaluation of Crown Margin Shifting Concept
A New Technique in Re-establishing the Biological Width

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Abstract

**Purpose:** to evaluate a new experimental technique named Crown Margin Shifting "CMS", and evaluate it clinically and radiographically in comparison with crowns violating the biological width in the aim of trying to re-establish the biological width.

**Materials and methods:** a split mouth study was done, including seven healthy patients having maxillary bilateral premolars showing a deep proximal caries violating the biological width. Each patient represented the both the control site "CS" and the study site "SS" (n = 7). The CS received a CAD/CAM monolithic zirconia with a heavy chamfer finish line, while the SS received the same restoration and finish line but showing CMS concept at the deep proximal finish line where a heavy rounded shoulder finish line was left exposed with a knife edge crown margin meeting the finish line. Abutment teeth were examined clinically according to the following parameters: modified plaque index "MPI", modified bleeding index "MBI", periodontal probing depth "PPD" and gingival index "GI". Clinical evaluation was done immediately at time of crown cementation then at 6 and 12 months. Radiographic evaluation using CBCT was done to measure crestal bone level at the deep proximal finish line in three positions: at the most buccal crestal bone, the middle apical crestal bone and at the most palatal crestal bone on base line, 6 and 12 months, then, marginal bone loss was calculated on 6 and 12 months. The established biological width was measured at the three examined points.

**Results:** when comparing between CS and SS, clinical results showed that within 12 months, there was statistically significant increase in MBI, PPD and GI parameters in SS and CS up to 6 month, followed by a significant decrease up to 12 month in MBI and GI for both sites, except for PPD in CS, it continued in a non significant increase, while MPI showed no significant difference in both sites.

Radiographic results revealed that MBL increased in control site up to 12 months, whereas in study site, it took place only in the first 6 months.

**Conclusion:** within the limitation of the study, it could be concluded that CS restorations which was placed subgingivally with biological width violation showed better clinical parameters presented as improved GI with decreased MBI. SS crowns with CMS concept showed better radiographic parameters with less marginal bone loss, but added no further improvement on clinical parameters when comparing them with CS. Concluding that
abutments with deep margins violating the biological width can be crowned with no need for crown lengthening or CMS modification as long as the ferrule effect is enough and good oral hygiene can be preserved.

**Key words:** biologic width, subgingival crown margin, crown lengthening, CAD/CAM monolithic zirconia.
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Introduction
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Fixed prosthodontic restorations obligate a thorough periodontal examination and management, in order to protect the periodontium and to preserve its health, especially at the critical contact between the periodontium and the margin of the fixed restoration.

The longevity of the fixed restoration is directly related to preserving the biologic width "BW", it was measured by 2.04 mm by Garcielo et al in 1961. If the restoration margin was violating the BW and placed at a distance less than 2.04 mm away from the alveolar bone, what is remaining from the BW is then measured between the restoration margin and the crest of the bone.

Fixed restorations with margins violating the BW have difficulty in accessibility. Moisture is difficult to be controlled during impression and cementation. Bone loss of an unpredictable nature in addition to gingival tissue recession might probably occur as the body attempts to recreate room between the alveolar bone and the crown margin to allow space for tissue reattachment. Surprisingly, in some cases with deep margin placement, the bone level appears to remain unchanged (Oppermann et al, 2016).

To prevent further bone resorption and to restore gingival health, it's necessary to establish space clinically between the alveolar bone and the margin. This can be accomplished either by surgery to alter the gingival and bone level or by orthodontic extrusion to move the restoration margin farther away from the bone level.

Beside orthodontic extrusion, surgical crown lengthening "CL" is the most followed technique to re-create an optimum distance between the restoration margin and the crest of bone "i.e. BW". Such procedure, relays on bone level repositioning by controlled bone removal, in order to re-produce the lost part of the BW. Such pros are opposed by multiple cons, as uncontrolled recession of the free gingival margin especially in the critical esthetic zone of the dentition, recessions must be closely observed in the healing period after surgical CL, when prosthetic reconstructions are planned on such teeth (Bragger et al, 1992). In surgical CL, the patient's mental and health condition must allow him to undergo surgery, thus, limiting the indicated cases. The surgeon artistic skills are very important, especially in esthetic areas. Cases in which a single tooth is in need for CL represents a unique challenge (Reyes et al, 2011), since the result of a non
esthetic gingival festooning with different levels can't be avoided. Oral hygiene maintenance in deep interproximal areas is difficult. The restoration margins will be in different levels making it difficult for proper examination of crown marginal adaptation (Khuller et al, 2009). A study by Chi et al (1985) reported, after a period of 2 to 12 months follow up, that surgical crown-lengthening procedures resulted in statistically significant changes in alveolar bone height. CL in the interdental area is done also to the sound adjacent tooth, which is unfortunately non avoidable.

As an alternative, preserving the bone level as it is, and gaining more coronal natural structure seems to be a great idea to avoid sacrificing any of the natural structures, this was achieved by trying to alter the restoration margin design by applying the new tested Crown Margin Shifting technique.

The idea came by studying the Platform-Switching technique in implants. This concept serves in crestal bone level and papillary preservation, thus, when reducing the diameter of the abutment in relation to the diameter of the implant body, it will result in less resorption of peri-implant crestal bone, which in theory can preserve soft tissues (Abrahamsson et al, 1996). Several studies was done by Vela et al in 2006, by Hurzeler et al in 2007 and by Canullo et al in 2009, they have found that soft tissues respond more favorably to platform switching of implants than to platform matching, in which the same diameter of implants and abutments is used. Many hypotheses have been proposed in an attempt to explain the benefits of using abutments with platform switching, such as: positioning the implant-abutment connection away from the bone crest, thus allowing the BW to be determined horizontally; increasing the distance between the inflammatory cell infiltrate and the bone crest; and improving the distribution of the load level of the implant abutment (Lazzara and Porter, 2006).

According to that, a question can be asked and a hypothesis can be made: Is this design capable to be applied to natural dentition? If a tooth has a deep proximal carious lesion was prepared to be crowned, the deep prepared tooth finish line will act as the implant fixture margin, and the fixed restoration will act as the implant abutment. Creating by that, the same junction in relation to the bone level "fixture-abutment = finish line-crown margin" if the prepared tooth finish line was left to be exposed with an inner
position crown margin, it will resemble the horizontal plate form switching surface creating the new tested Crown Margin Shifting Technique "CMS".

Since Platform Switching technique improved the fixture-Abutment-bone relation, the suggested CMS technique might improve the finish line/crown margin/periodontium condition. It might allow us to deal effectively with BW violation. Our hypothesis is that the new technique could improve the prognosis of deep finish line violating the BW.
References
References


