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Editorial Board of Dental Follicle – The E Journal of Dentistry

Scientific Editorial - 3D Printing In Dentistry – The Business of 3D dentistry

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Today the dental 3d industry is worth $780 Million & could become a $3.1 billion industry in this sector by 2020, (release by SmarTech in 2015). The prevalence of 3D printing in other markets is expected to grow as well, but better 3D printers and materials are already being manufactured specifically for dentists.

The sale of 3D printing systems to dental labs will double from $240 million today to $480 million by 2020. 3D printing technology is also expected to provide more than 60 percent of all dental production needs by 2025, and perhaps even more in certain areas such as dental modeling.

The present applications of 3D printing are :

- Dental and Orthodontic Models
- Castable Crowns, Bridges, Copings and Partial Denture Frameworks (Direct Crowns and Bridges
- Bite Splints or Night Guards Indirect Bonding Trays
- Surgical Drill Guides
- Flexible Gingiva Masks
- Denture Bases

Summary :

The future of dentistry is 3D . A chairside printer will print models , dentiures, crowns , inlays, onlays, aligners, brackets etc. The dental lab will have its own set of printers for support. The dental research centers will be using the same for the use with BioInk to bring in more biocompatible teeth , pulp , bone for the replacement cases.

Endodontics verses Implants: Treatment Planning Decisions:

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Introduction

Patients who present with significant coronal breakdown of a tooth present challenges with regard to treatment planning decisions for that tooth. Does the practitioner endodontically treat the tooth and augment that treatment with crown lengthening to permit sufficient ferrule of the remaining root structure to allow restoration? Or is it more prudent to extract the tooth and place an implant?

Endodontic therapy has advanced to provide long term clinical success and preservation of the natural dentition is a primary goal of dentistry. Yet endodontic success is closely linked to restorability of the coronal aspect of the tooth. Lack of sufficient coronal structure to retain a crown often leads to failure of the coronal seal and subsequent failure of the endodontic obturation. Unfortunately, with today's improvements in adhesive dentistry the emphasis has drifted away from the principal of restorative ferrule. Practitioners may be relying to heavily on the strength of the "bond" to keep fixed prosthetic restoration margins sealed and thought should be given to how much coronal structure remains when deciding if a tooth should be treated endodontically or replaced with an implant. Prior to initiation of endodontic treatment these restorative decisions need to be made and determine which additional procedures will be necessary to achieve the restorative goals required.

But what is a ferrule? With respect to dentistry, the ferrule is a band of natural tooth that is circumferentially grasped by the crown that prevents lateral displacement of the crown from the tooth. The literature has suggested that a 1.5 to 2mm ferrule is minimally necessary to prevent fracture of the endodontically treated tooth and provide resistance to displacement of the fixed restoration.[1-3] So how do we achieve this in severely broken down teeth?

Raise the bridge or lower the water?

When analyzing how a tooth may be restored following endodontic treatment, one has to determine if sufficient root length remains to allow stability of the tooth once it is restored. Is there adequate supracrestal tooth structure present to provide a restorative ferrule? What ancillary procedures may help increase the amount of supracrestal tooth to ferrule?

Osseous crown lengthening to improve restorative ferrule

Traditionally, when insufficient tooth presented supracrestally, osseous crown lengthening procedures were employed to increase the available coronal tooth structure.[4] This presents challenges in treatment. When the tooth requiring

treatment is bounded by adjacent teeth, an osseous crown lengthening will require removal of crestal bone on the adjacent teeth to create osseous slopes that will allow soft tissue maintenance. One can not just remove bone around an individual tooth as this leads to isolated pocketing and abrupt slopes in the bone which lead to adjacent bone loss as the body attempts to create gentle slopes that it can maintain over time. So we can see that to create adequate coronal tooth structure for restorative purposes we may have to compromise the periodontal structures adjacent to the that tooth.

Additionally, removal of crestal bone may expose furcations on posterior teeth complicating home care and exposing areas that may be difficult to maintain over the long term. This may also be a factor in maxillary first premolars which typically have a mesial root concavity that in it self can create restorative challenges. When the tooth being treated has a short cervical trunk or the furcation is already at or just above the crestal margin, removal of additional bone may be contraindicated and extraction of the tooth and subsequent placement of an implant may be a more prudent option.

Forced Orthodontic Eruption

An alternative to osseous crown lengthening when additional tooth structure is needed restoratively, is the use of forced orthodontic eruption.[5] Following completion of endodontic treatment, orthodontic forces are used to erupt the tooth coronally exposing more root structure upon which a ferrule may be placed.[6] When considering this option one needs to assess how much root length will remain within the osseous housing and will this allow adequate crown to root ratio to maintain tooth stability over a period of time. As with crown lengthening, forced eruption of multi-rooted teeth may create furcation issues and may be a contraindication to this treatment modality. This approach does work well on single rooted teeth.[7]

Under normal orthodontic extrusion, slow forces with low intensity are exerted on the tooth. As the tooth extrudes the crestal bone and gingival apparatus moved together coronally. When heavier traction forces are exerted, as seen in rapid extrusion, coronal migration of the tissues supporting the tooth is less pronounced as the rapid movement exceeds their capacity for physiologic adaptation and the tooth erupts coronally beyond the crestal bone.[8] When rapid extrusion is utilized it must be followed by an extended period of retention to allow remodelling and adaptation of the periodontium in the new tooth position.[9]

Clinical Decisions

Typically in clinical practice we encounter with respect to loss of coronal structure teeth that are single-rooted and multi-rooted.

Single rooted teeth

A patient presents with coronal breakdown of a single rooted tooth that is at or close to the crestal bone margin. (Figure 1) First, we need to determine the length of the root subcrestally. Is there sufficient root length that movement of the crestal margin in relation to coronal of the remaining tooth via crown lengthening or extrusion will not compromise the crown to root ratio of the restored tooth? If the answer is yes, then we have two options, clinical crown lengthening (Figure 2) or orthodontic extrusion (Figure 3). Should the answer be no, then extraction and replacement with an implant is the indicated treatment.

Figure 1: A patient presents with a single rooted tooth that has lost coronal structure to the crestal margin of bone.

Figure 2: To achieve a ferrule, an osseous crown lengthening may be performed but this requires removal of bone from the adjacent teeth to create the proper contours.

Figure 3: An alternate treatment option to achieve ferrule without affecting the osseous levels on the adjacent teeth is forced eruption of the affected tooth.

Multi-rooted teeth

A common occurrence involves presentation of a molar with significant coronal breakdown either as a result of fracture or decay. (Figure 4) The presence of furcations present unique variables compared to single rooted teeth. When analyzing the restorability of the molar we need to ask, will repositioning the crestal bone margin either through osseous crown lengthening (Figure 5) or extrusion (Figure 6) expose the furcation and complicate maintenance? Teeth with short cervical trunks limit what treatment we may perform in order to provide restorative ferrules. Those teeth with long cervical trunks or fused roots may be better suited to these procedures and provide clinical outcomes that can be maintained over the long term. When these objectives can not be met extraction and implant placement offer a better prognosis.

Figure 4: A multi-rooted tooth with coronal breakdown close to the osseous crest.

Figure 5: Osseous crown lengthening to achieve a ferrule requires recontouring of the supporting bone on the adjacent teeth possibly leading to furca exposure on the affected or adjacent teeth.

Figure 6: Forced eruption of multi-rooted teeth can lead to exposure of the furcation and complicate patient home care and long term survivability of the tooth.

Conclusion:

Dentistry is restoratively driven, supplemented by endodontic and surgical (be it Periodontal or Oral Surgical) components. When a tooth can not be restored then it does not matter what endodontic treatment can or is rendered to the tooth. Treatment planning decisions need to focus on the restorability of the tooth when deciding what treatment will provide reasonable long term success. If the tooth can be restored then pursuing endodontic treatment is the best treatment decision. But when this can not be accomplished or the restorative prognosis cannot provide reasonable long term success then extraction and implant placement is the more prudent treatment option.

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Pictorial Apical Third Perforation

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Using anterior clamp to isolate prepared tooth