The new dental restorability index to assess tooth restorability–adding the pulpal chamber lateral walls considerations for classifying the badly damaged teeth.

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ABSTRACT:

For a successful dental clinical practice, the teeth that is very badly damaged has to be restored in the best way possible. Still, enough justification is needed for restoring such teeth, even though there are advanced materials and techniques available which are widely accepted. In restoring the teeth that are severely damaged, there has to be enough scientific basis for the practice of such techniques. The preservation of whatever remains is the chief concern. Care has to be taken to reduce the reduction of the tooth as much as possible. Hence in this article, we aim to formulate the steps and the protocols that can help in classification and treatment strategies in the badly damaged teeth.

1. Introduction

Severe tooth damage by the extensive caries, lost filling, tooth fracture, or failed post core endodontic treatments may be described as the severely damaged teeth [1-5]. These teeth are usually endodontic filled, however, few studies have shown different conclusions that are contradictory. In these severely damaged teeth, the challenge is posed in the prosthodontic restoration as the remaining structure is weak. Due to this, many clinicians have resorted to replacement of the severely damaged teeth by the dental implants. The long term success of the dental implants is multifactorial. However, based on the various implants systems, the success of the implants is satisfactory [6-8]. But it has to be emphasized that the clinician should try to keep the natural tooth instead of the rushing with the rehabilitation. Various factors have to be considered in restoring a damaged tooth [9,10]. Hence, in this article we aim to formulate the steps and the protocols that can help in classification and treatment strategies in a badly damaged tooth.

Estimating the Restoration's success

Residual tooth structure

The most vital feature for restoration is the volume of the sound tooth remaining to accept the restoration, especially the remaining dentin. Studies have differed for the amount of the dentin thickness that is needed for the success of the restoration [11,12]. On an average, the dentin thickness of >1mm is advised for the success of the restorations. The mesial and distal sides play very less role than the buccal and/ or palatal sides [4,13-15]. Various authors have considered the ferrule effect for decreased failure rates [4,6,9,16-22]. The post and core restorations can be used when there is no adequate tooth structure to support the crown. Greater than required tooth removal for the sake of the post is not advised as it may weaken the final natural tooth [1,9,23-25].

Biological Considerations

The fractures, faulty restorations, and the carious lesions may also impact on the gingival tissues and in turn, the periodontium [22-25]. This may bring about increased inflammatory mediators and may lead to weakening of the tooth structure. In these cases, the care should be taken to restore the health of the periodontium. Caution should be exercised to improve the compromised soft tissue around the tooth [26-34].

Endodontic Considerations

The apical seal of the endodontically treated tooth plays a significant role [4,5,10,35]. Also, whether the new endodontic treatment will worsen the already compromised tooth, or the complications that may arise if the treatment is done, should be assessed.

Occlusally effecting features

The success of the restoration of the tooth is also a factor of the load taken by the tooth occlusally. In few studies, the failure of the partial denture was attributed to the heavily restored endodontically treated teeth supporting the denture. This failure was seen twice as more as the non-endodontically treated teeth. Thus, greater the damage of the tooth, the lesser it should be considered as the abutment for the fixed or the removable partial denture. Similarly, the various para-functional habits like bruxism have also be taken specifically into consideration before planning a treatment [4,8,9,11,35].

Protocol for the clinical diagnosis of the badly damaged teeth.

Considerations in case of the damaged teeth:

- The previously done restoration has to be removed, and the caries has to be excavated thoroughly.
- The restoration of the healthy periodontium is very crucial.
- Consideration should be given to the tooth like the esthetic significance, occlusion, or its strategic importance.

Recently the “Dental Practicality Index (DPI)” is proposed to define clinically, the ‘practicality’ of dental restorative therapies. Appropriate to daily practice clinically, the DPI also targets to support the dentist in determining at what time to pursue, assist and/or refer a patient for higher dental facilities.

2. Suggested Classification

Evaluation of the restorability of the extensive caries tooth is a challenging decision as discussed before. The lack of reference points for restorability measurement, and the need of urgent decision for saving or extracting the tooth in an emergency situation, creates a dilemma for the restorative dentist. In a teaching institute, restorability reference and the clinical assessment by different faculties are subjective. Thus, the restorability assessment becomes difficult to teach for undergraduate level. In addition, it is increasing the difficulty for the faculties in the dental clinic to provide a clinical decision in short period of time for many patients without caries control and diagnostic preparation to avoid the drastic changing in treatment plan like extraction after planning to save the tooth. The new diagnostic index is devised to reduce the chance of drastic changes in treatment planning, to assess the treatment risk level, and for an estimation of treatment difficulty and requirements. Also, it will be included as a teaching practice for undergraduate students to evaluate tooth restorability. The new restorability diagnostic index is considering caries extension in relation to the floor of pulp chamber as the main reference to evaluate the restorability, treatment complexity, and risk factors.

Dental Restorability Index:

The index is based on periapical, bitewing radiograph and clinical evaluation after caries excavation of severely caries tooth.

The main rules of restorability assessment are:

- The pulpal chamber lateral walls above the pulp floor is utilized as the reference points to assess the tooth remaining structure and restorability.

- The intact pulp chamber lateral wall more than 2mm width and more than 2mm height from the pulpal floor is considered as the restorability indicator.

- Thin pulp chamber wall less than 1 mm after caries excavation and tooth preparation should not be counted in the class or consider for restorability indicator.

- The post can be utilized to improve retention of the core material.

- Thin and missing walls can be substituted with the post and core. The distal wall for mandibular molars or palatal wall for the maxillary molars can be substituted with a post placed in the canal.

- The surgical horizontal crown lengthening can be performed to the level of the pulp floor to expose sound tooth structure and to gain additional ferrule effect without violation of furcation area, or crown to root ratio.

- The reduced healthy periodontal condition can be utilized to simplify the restorative treatment or increase the apical extension of the carving crown. However, it is a risk factor for reducing the cleansability of restoration, caries and periodontal disease.

1- Class 1 (Favourable): Tooth with intact pulp roof and the remaining tooth structure lateral walls of pulp chamber are intact without caries to the pulp roof or above. Minimum 2mm height ferrule effect can be achieved circumferential to the intact pulp walls.

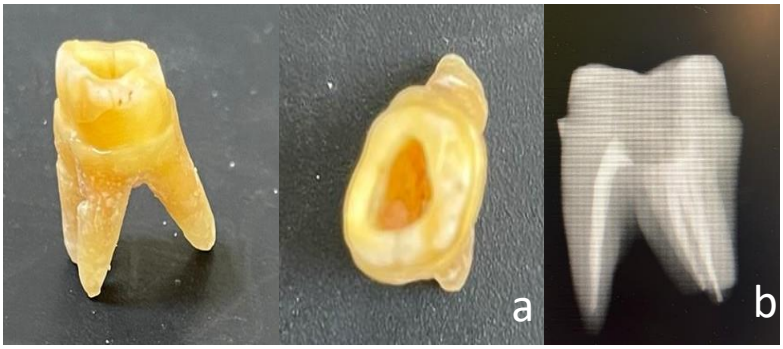

Figure 1: Class 1 (Favourable: Intact pulp roof, lateral walls of pulp chamber intact, minimum 2mm height ferrule effect circumferential to the intact pulp walls. a) Clinical picture, b) IOPAR

2- Class 2 (Restorable) The four lateral walls of pulp champers are intact with 2 mm width and 2 mm height from the pulp floor. Minimum 2mm height ferrule effect can be achieved circumferential to the intact pulp walls.

Figure 2: Class 2 (Restorable: Intact four lateral walls of pulp champers, minimum 2 mm width and 2 mm circumferential ferrule from the pulp floor. a) Clinical picture, b) IOPAR)

3- Class 3 (Acceptable) Three lateral walls of pulp champers are intact with 2mm width to 2mm height from the pulp floor. The missing wall is level with pulpal floor. The minimum 2mm partial ferrule effect can be utilized in the intact 3 pulp walls.

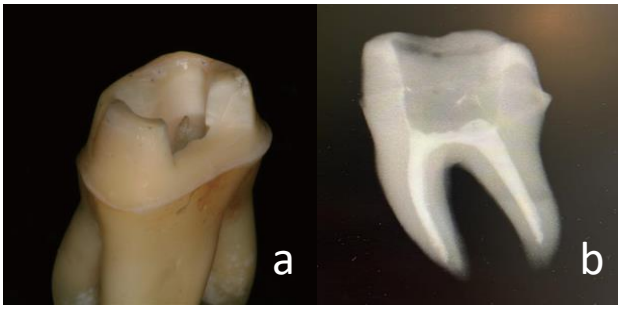

Figure 3: Class 3 (Acceptable: Three lateral walls of pulp champers intact with 2mm width to 2mm height (partial ferrule) from the pulp floor. a) Clinical picture, b) IOPAR)

4- Class 4 (Questionable) A minimum of two opposing lateral pulp walls are intact with 2mm width to 2mm height from the pulp floor. The two missing walls are level with pulpal floor. The minimum 2mm height ferrule effect can be achieved associated with intact pulp wall.

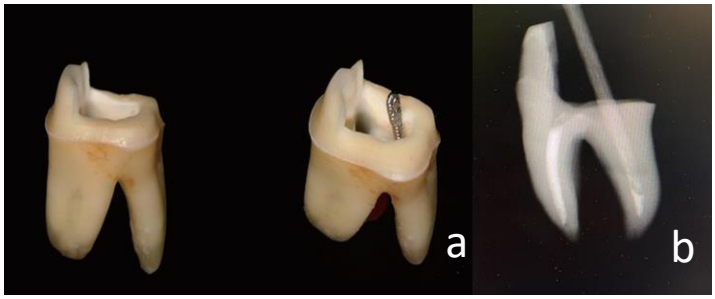

Figure 4: Class 4 (Questionable: A minimum of two opposing lateral pulp walls intact with 2mm width to 2mm height (ferrule) from the pulp floor. a) Clinical picture, b) IOPAR)

5- Class 5 (unfavourable) a minimum of one lateral pulp wall is intact 2mm width with 2mm height from the pulp floor. The condition of the tooth will be improved if the location of the wall is at the opposite side of the canal with post to retain the core, buccal for maxillary molar, or mesial of the mandibular molar. The minimum ferrule effect can be achieved.

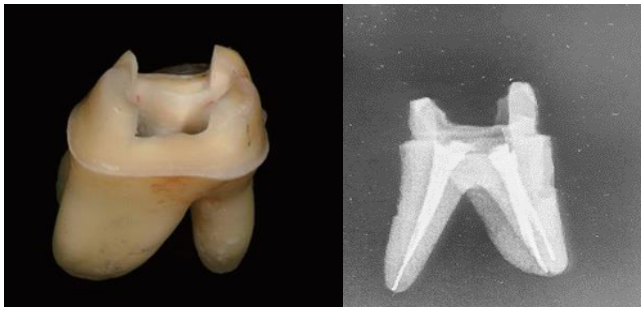

Figure 5: Class 5(unfavourable: minimum of one lateral pulp wall intact with 2mm width and 2mm height from the pulp floor. a) Clinical picture, b) IOPAR)

Non restorable conditions are:

- No intact lateral pulp walls with width of 2mm and 2mm height from the pulp floor.
- The missing walls are at the level of the pulpal floor and there is need for horizontal crown lengthening inferior to the pulpal floor.
- No ferrule effect can be achieved.

Additional Clinical Concerns

- Initial classification may be affected by pre-prosthetic treatment.
- Concern about special stress patterns (bruxism, abutments for a removable partial denture, cantilevers, extensive bridges or secondary abutments) raises the class level from I to II or from II to III.

- Class level also increases by 1 if there are aesthetic concerns.
- In cases where there is no antagonist, no occlusal issues, the antagonist is a removable denture or there is clinical evidence of small to no loads over the remaining tooth, the class level decreases by 1.
- For patients with poor oral hygiene, uncontrolled periodontal disease or caries, an extensively damaged tooth should be considered Class III.

3. Conclusions

The criteria presented may assist the dental clinician to achieve a proper diagnosis and accordingly plan a proper treatment. This method if employed may aid in avoidance of the mistakes and may help achieve a good final outcome. This review is one of the firsts that has provided guidelines in the treatment of the badly/ severely damaged teeth. Further studies are suggested for applying these guidelines.

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