Review Article

Comparative Evaluation of Remaining Dentinal Thickness in Three Different Conservative Access Preparation Techniques in Mandibular Molars using C.B.C.T.

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Abstract

Background: Owing to the fact that peri cervical thickness of tooth structure is directly proportional to ability of it to resist fractures, many access cavity designs have been suggested. **Objectives:** 1. To evaluate remaining dentinal thickness "before and after access cavity preparation performed using Clark and Khademi's technique"; 2. To evaluate remaining dentinal thickness "before and after access cavity preparation performed using Ninja technique"; 3. To evaluate remaining dentinal thickness "before and after access cavity preparation performed using truss preparation technique"; 4. To compare remaining dentinal thickness of access cavities preparation performed using three different techniques namely "Clark's, Ninja and truss preparation technique". **Methodology:** The study will be performed in "Department of Conservative Dentistry and Endodontics, Sharad Pawar Dental College and Hospital, Wardha". 30 teeth fitting in inclusion criteria will be selected for the study. Pretreatment CBCT will be performed to measure dentinal thickness at peri cervical region. 30 samples will be divided into three groups (n=10), according to the access cavity prepared. Access cavity preparation will be performed with help of CK Endodontic Access burs. Post treatment CBCT will be done to measure remaining dentinal thickness at peri cervical region. **Results:** It is expected that Ninja access preparation being most conservative in nature will result in least loss of dentinal volume in peri cervical area followed by Truss and Clark's preparation. **Conclusion:** Ninja access preparation technique is the most conservative technique of cavity preparation.

Keywords

Dentinal thickness, Conservative access preparation, Molars, C.B.C.T

Introduction

Elimination of pathologic micro-organisms and debris from the root canal system and prevent reinfection is the main objective of root canal therapy is.

Mechanical objectives of cleaning and re-shaping which would promote the success of root canal therapy, in 1974 "Dr. Herbert Schielder" suggested.

We as endodontists must also ensure that there is no extensive loss of tooth structure, in the quest of eliminating the pathologic micro-organisms from the canal system. During the endodontic plan of action, all the steps ranging from diagnosis to treatment planning must involve minimally invasive approaches.

This include: Unerring diagnosis and decision making, Minimal but precisely crafted access preparation depending on anatomical hurdles, During access preparation minimal removal of dentin, Cleaning and re-shaping of the root canal to retain maximum amount of sound dentin. Teeth subjected to conventional technique of endodontic access preparation have demonstrated a significantly higher percentage of non-restorable fractures, which is associated with the higher volumetric loss of coronal

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tooth structure. [1] To get ahead of this set back, "Clark and Khademi" altered the approach of endodontic access cavity designing by the idea of minimizing the tooth structure removal and named this design, Conservative Endodontic access Cavity. [2, 3] It aimed towards preservation of a part of the "pulp chamber roof and the pericervical dentin". [4] The dentin that is present "4 mm" superior and "4 mm" inferior to the "crestal bone" is the pericervical dentin. It supports the uniform distribution of "functional stresses" on the treated teeth.

Therefore, it is essential that we conserve this pericervical dentin in order to sustain the biomechanical response of the radicular dentin. [5] Evidence suggests the extent of access preparation significantly affects strength of tooth structure. [6,7]

Shortly after Clark and Khademi's, even more constricted designs were introduced namely Ninja or ultra conservative access and Truss access. The roof of the chambers in both, the bicuspids and molars were accessed similarly in both, the conservative and ninja endodontic cavities. [8] A projection that is located obliquely towards the central fossa of the orifices of the root canal in the occlusal plane is the outline of the "ninja access". [9] Visual localisation of all the root canal orifices is made possible from various angles due to this, as the access required is parallel with the cut enamel. Extensions were such that it positioned between the "buccal and palatal orifices" equally. Sparing a truss of dentin between the two cavities that has been prepared to preserve the dentin is design alteration for truss access. [10] Access cavity are made to the pulp chamber and canals. The distobuccal and the mesiobuccal cavities are approached by a single cavity and a separate cavity is made for the palatal canal for maxillary molars. Whereas two separate cavities has to be made to approach the mesial and the distal canals for mandibular molars.

Objectives

1. To evaluate remaining dentinal thickness "before and after access cavity preparation performed using Clark and Khademi's technique"

2. To evaluate remaining dentinal thickness "before and after access cavity preparation performed using Ninja technique".

3. To evaluate remaining dentinal thickness "before and after access cavity preparation performed using truss preparation technique".

4. To compare remaining dentinal thickness of access cavities preparation performed using three different techniques namely "Clark's, Ninja and truss preparation technique".

Methods

Materials required

- Dental operating microscope
- CK Endo access bur
- Dentsply propexpixi apex locator
- Rotary Endomotor and hand piece
- Universal rotary protaper gold files
- 5.25% sodium chloride solution
- 17% EDTA irrigant.
- Dentsply 6% gutta-percha cones

Inclusion criteria

- Mandibular molars,
- Teeth devoid of any prior restoration.

Exclusion criteria

- Extensively Carious teeth
- Previously restored teeth
- Fractured teeth
- Teeth with internal or external resorption
- Abrasion, attrition, fluorosis, or other enamel defects

Extracted mandibular molars fitting inclusion criteria will be selected. Pre-treatment CBCT will be performed to measure dentinal thickness at peri cervical region. 60 samples will be divided into three groups (n=10), according to the access cavity prepared.

Group I- Conservative access preparation by Clark and Khademi Technique

Group II- Ninja access preparation

Group III- Truss access preparation

Group I: Conservative endodontic cavity performed using Clark and Khademi technique under isolation using rubber dam.

Group II: Samples in group II will undergo similar procedure as group I apart from the fact that access will be prepared using ninja technique.

Group III: Samples in group III will undergo similar procedure as group I apart from the fact that access will be prepared using truss technique.

The study will be performed in "Department of Conservative Dentistry and Endodontics, Sharad Pawar Dental College and Hospital, Wardha". 30 teeth fitting in inclusion criteria will be selected for the study. Pre-treatment CBCT will be performed to measure dentinal thickness at peri cervical region. 30 samples will be divided into three groups (n=10), according to the access cavity prepared. Access cavity preparation will be performed with help of CK Endodontic Access burs. Post treatment CBCT will be done to measure remaining dentinal thickness at peri cervical region.

Sample size estimation:

Sample size formula with difference between two means

Where, Zα is level of significance at 5% i.e. 95% confidence interval=1.96

Zβ is the power of test = 80%=0.84

δ1 = SD of maximum distance in MA group = 0.41

δ2 =SD of maximum distance in DNS group = 0.19

K = 1

Δ = Difference in means of maximum distance

= 0.88-0.34=0.54

Formula reference – VK Chadda sample size determination in health studies, NTI Bulletin 2006, 42/3 and 4, 55-62

Study reference: Gianluka Gambanni et al.

Statistical Analysis

Method: Chi square test, one way ANOVA

Multiple Comparisons: Tukey test

Software used: SPSS24.0 V1 Graph Pad Prisma 7.0 V

Expected Results

It is expected that Ninja access preparation being most conservative in nature will result in least loss of dentinal volume in peri cervical area followed by Truss and Clark's Preparation.

Discussion

In year 2018 Jiang et al conducted a finite element analysis on maxillary first molars with different access preparation to assess their bio mechanical behaviour and found increase in size of access cavity causes loss of volume of dentine in peri cervical region of tooth, compromising fracture resistance of tooth. The aim of this study was to compare the biomechanical properties of first maxillary molars with different endodontic cavities using the finite element method. Methods: Three finite element analysis models of a maxillary first molar were designed and constructed with 3 different types of endodontic cavities: a traditional endodontic cavity, a conservative endodontic cavity, and an extended endodontic cavity. An intact tooth model was used for comparison. Each model was subjected to 3 different force loads directed at the occlusal surface. The stress distribution patterns and the maximum Von Mises (VM) stresses were calculated and compared. Results: The peak VM stress on all models was at the site of the force load. The occlusal stresses were spread in an approximate actinomorphic pattern from the force loading point, and the stress was much higher when the force load was close to the access cavity margin. The peak root VM stresses on the root-filled teeth occurred at the apex and was significantly higher than that on the intact tooth, which appeared on the peri cervical dentin. The area of pericervical dentin experiencing high VM stress increased as the cavities extended and the stress became concentrated in the area between the filling materials and the dentin. Conclusions: The stress distributions on the occlusal surface were similar between the conservative endodontic cavity, the traditional endodontic cavity, and the extended endodontic cavity. With enlargement of the access cavity, the stress on the peri cervical dentin increases dramatically.

In year 2020 Saber et al conducted a finite element analysis to compare bio mechanical properties of traditional endodontic access, constricted access and truss access preparation and found constricted and truss access preparation offered better bio mechanical properties. This study aimed to compare the biomechanical properties of a mandibular first molar with different endodontic cavity designs and increasing sizes of root canal preparations using Finite Element Analysis (FEA).

Methods: The experimental FE models were designed with three different endodontic access cavities and two sizes of canal preparations; Traditional Access Cavity (TRD), Conservative Access Cavity (CON), and Truss Access Cavity (TUS), and #30/.04 and #40/.04 of root canal preparations. Vertical and oblique loads were applied with a 250 N static force to simulate masticatory forces. Mathematical analysis was done to evaluate the stress distribution patterns and maximum Von Mises (VM) stresses was assessed at the occlusal surface, cervical line and 1 mm, 3 mm, 5 mm, and 7 mm from the root apices. Results: Decreasing the size of the access cavity was associated with higher magnitude of cervical stresses. The magnitude of VM stresses was maximum at the 7 mm level and was minimum at the 1 mm level from the root apex. Increasing the size of the access cavity was associated with the transmission of stresses to a further apical direction regardless of the extent of root canal enlargement. The root canal enlargement from #30 to #40 increased radicular VM stresses within all models. Conclusion: Within the limitations of this study, CON and TUS access designs preserved a significant volume of tooth structure. The extent of root canal enlargement should be as small as practical without jeopardizing the biologic objectives of root canal treatment.

In year 2017 Plotino et al conducted a study on 160 freshly extracted teeth , The purpose of this study was to compare in vitro the fracture strength of root-filled and restored teeth with Traditional Endodontic Cavity (TEC), Conservative Endodontic Cavity (CEC), or ultraconservative ‘‘ninja’’ Endodontic Cavity (NEC) access. Methods: Extracted human intact maxillary and mandibular premolars and molars were selected and as- signed to control (intact teeth), TEC, CEC, or NEC groups (n = 10/group/type). Teeth in the TEC group were pre- pared following the principles of traditional endodontic cavities. Minimal CECs and NECs were plotted on cone- beam computed tomographic images. Then, teeth were endodontically treated and restored. The 160 specimens were then loaded to fracture in a mechanical material testing machine (LR30 K; Lloyd Instruments Ltd, Fare- ham, UK). The maximum load at fracture and fracture pattern (restorable or unrestorable) were recorded. Fracture loads were compared statistically, and the data were examined with analysis of variance and the Student-Newman-Keuls test for multiple comparisons. Results: The mean load at fracture for TEC was significantly lower than the one for the CEC, NEC,

and control groups for all types of teeth (P < .05), whereas no difference was observed among CEC, NEC, and intact teeth (P > .05). Unrestorable fractures were significantly more frequent in the TEC, CEC, and NEC groups than in the control group in each tooth type (P < .05). Conclusions: Teeth with TEC access showed lower fracture strength than the ones prepared with CEC or NEC. Ultraconservative ‘‘ninja’’ endodontic cavity access did not increase the fracture strength of teeth compared with the ones prepared with CEC. Intact teeth showed more restorable fractures than all the prepared ones.

References

1. Jiang Q, Huang Y, Tu X, Li Z, He Y, Yang X. Biomechanical properties of first maxillary molars with different endodontic cavities: a finite element analysis. J Endod. 2018; 44:1283-1288.
2. Saber SM, Hayaty DM, Nawar NN, Kim HC. The Effect of Access Cavity Designs and Sizes of Root Canal Preparations on the Biomechanical Behavior of an Endodontically Treated Mandibular First Molar: A Finite Element Analysis. J Endod. 2020; 46:1675-1681.
3. Plotino G, Grande NM, Isufi A, Ioppolo P, Pedullà E, et al. Fracture strength of endodontically treated teeth with different access cavity designs. J Endod. 2017; 43:995-1000.
4. Mookhtiar H, Hegde V, Srilatha S, Chopra M. Conservative endodontics: A truss access case series. Int J Appl Dent Sci. 2019; 5:213-218.
5. Clark D, Khademi J. Modern molar endodontic access and directed dentin conservation. Dent Clin North Am. 2010; 54:249-273.
6. Varma M, Sedani S, Nikhade P. Comparative Evaluation of 5th- and 7th-Generation Bonding Agents: An In vitro Study. Journal of Datta Meghe Institute of Medical Sciences University. 2019; 14:166-170.
7. Rathi S, Nikhade P, Bajaj P, Motwani N, Mahapatra J. Reattaching the fractured fragment in Ellis Class 3, without extraction/removal of that fragment. Medl Sci. 2020; 24:2445-2451.
8. Nikahde PP, Kibe AN, Thote AP, Gawarle RS, Ali AT. Assessment of penetration of low surface tension vehicles in dentinal tubules using stereomicroscopy. World Journal of Dentistry. 2019; 10:135-139.
9. Khatod S, Agrawal D, Ikhar A, Jaiswal P. Reattachment of complex tooth fracture: A boon in dentistry. Medical Science. 2020; 24:1392-1396.
10. Rathi S, Nikhade P, Bajaj P, Motwani N, Mahapatra J. Reattaching the fractured fragment in Ellis Class 3, without extraction/removal of that fragment. Medl Sci. 2020; 24:2445-2451.