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Minimally Invasive Endodontics: To access the volume of dental tissue removal of different access cavity designs done through CBCT- An Invitro Study

[1]Dr. Shivani Chauhan, Student, Department of Conservative Dentistry and Endodontics, DAPM RV Dental College, Bangalore, India

[2]Dr. B.S Keshava Prasad, Head and Professor, Department of Conservative Dentistry and Endodontics, DAPM RV Dental College, Bangalore, India

Corresponding Author: Dr. Shivani Chauhan, Student, Department of Conservative Dentistry and Endodontics, DAPM RV Dental College, Bangalore, India

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Abstract

In order to improve the precision and accuracy of endodontic treatments, guided endodontics has become a viable alternative. Access cavity preparation is a crucial stage of root canal therapy. As alternatives to the TEC design, the pericervical dentine (PCD), CEC (conservative endodontic cavity), and GEC (guided endodontic cavity) procedures that involve removing tooth structure were developed (Buchgreitz et al. 2019; Clark and Khademi, 2010). The pulp chamber has a partial roof with CEC, and the maximum quantity of pericervical dentin is preserved. Preservation of the peri cervical dentin is crucial due to the increased stress in the cervical areas, which concentrates as the access cavities gradually enlarge. In order to preserve tooth structure, strengthen endodontically treated teeth (ETT), and regain dentine strength to prevent fracture or tooth loss following treatment, access cavity preparations are therefore made under the supervision of CBCT images.

Keywords: Preparation, Access cavity, Ninja access, Truss access, minimally invasive

Introduction

According to Devan's comment, our aim should be the perpetual preservation of what is still present rather than the meticulous restoration of what is lost. This can be accomplished by changing endodontics from extension for prevention to minimum invasion with the systematic preservation of original tissue. By using the following methods to preserve the tooth's integrity, one can minimise invasion while maximising appropriateness. In-depth understanding of root canal anatomy, diagnosis and decision-making, preservation of the tooth's

structural integrity, alternative access designs, image guided endodontic access, dynamically guided endodontic access, microguided endodontic access, contemporary dur designs, cleaning and shaping are all necessary for the least invasive approach. Utilising surgical operating microscopes, 3D irrigation and disinfection, and root vigoring and magnification tools[3]. The purpose of this study is to use CBCT (cone beam computed tomography) guiding values to assess the pulp and dentine tissue surviving in standard access cavity preparation, ninja access cavity preparation and truss access cavity preparation.

Methodology

with a total of 40 extracted human molars extracted for periodontics reasons were collected from the Department of Oral and Maxillofacial surgery, following inclusion and exclusion criteria as follows: Teeth with fully formed apices, similar length, similar degree of curvature, intact teeth and exclusion criteria includes teeth with internal resorption, with total or partial obliteration of pulp or previously treated teeth.

Selection of teeth

extracted human teeth was cleaned and scaled with handcurette. The teeth was disinfected using 5.25% sodium hypochlorite for 10 minutes and was stored in normal saline until further use. The teeth were then be examined under CBCT and radiograph of these samples were to be recorded. Individual tooth was embedded in modelling wax, acrylic resin holder .

Acquisition of CBCT images

Computed cone beam technology scans were performed at two timepoints:

1. Initial -before the operative stage of coronal Access
2. Final -after coronal access.

The CBCT performed values of samples were divided

GROUP 1 control group no access cavity preparation

GROUP 2 traditional access cavity preparation

GROUP 3 Ninja access cavity preparation

GROUP 4 truss access cavity

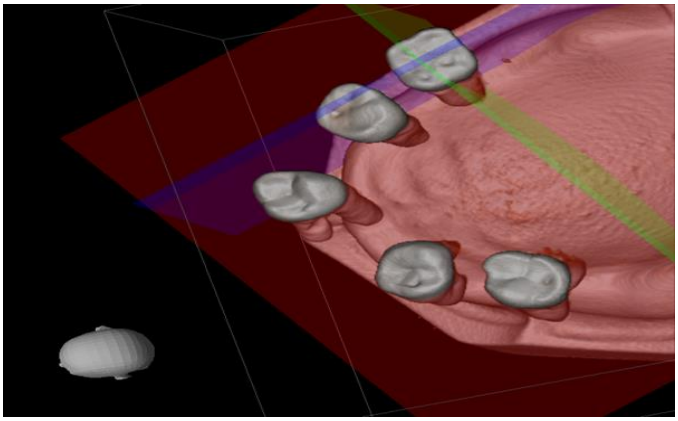


Figure 1: preoperative CBCT image (occlusal view)

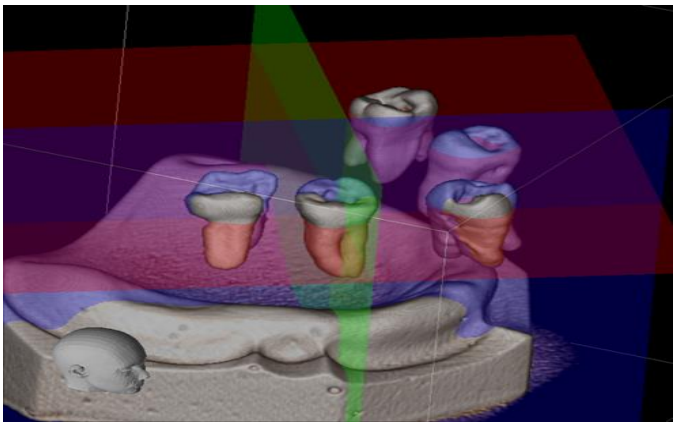


Figure 2: preoperative CBCT image (sagittal view)

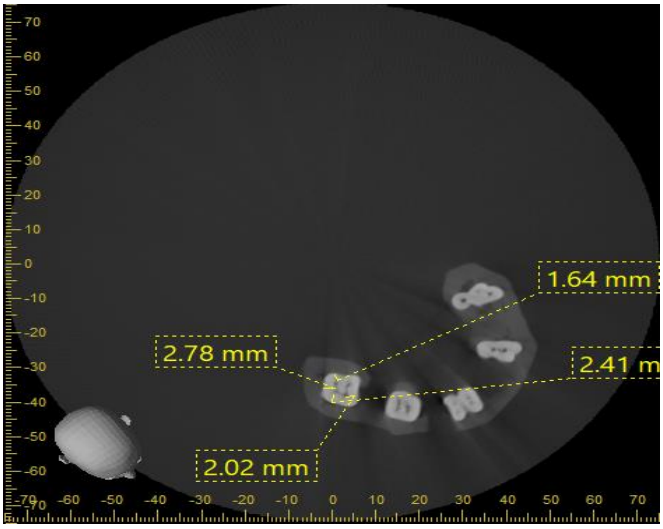


Figure 3: preoperative CBCT image with measurements of dental tissues space

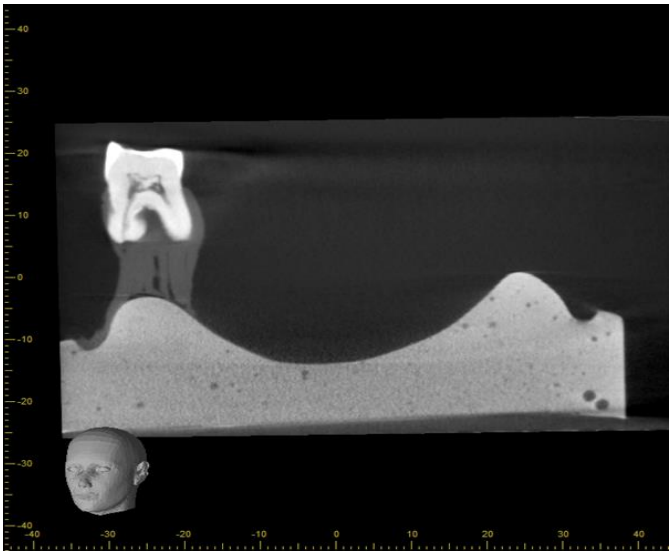


Figure 4: preoperative CBCT image sagittal view in sagittal plane

Coronal access

Access cavities was performed using following round burs and diamond instruments of access preparation kit by dentsply. Diamond access bur connected to the high speed hand piece (airotor) and under water cooling, round long – neck burs connected to contra- angle piece for all groups, gates glidden burs for canal orifice opening respectively, CBCT images are already recorded. After access cavity preparation the CBCT images taken for comparison of dentin and pulp tissue remaining in each group.

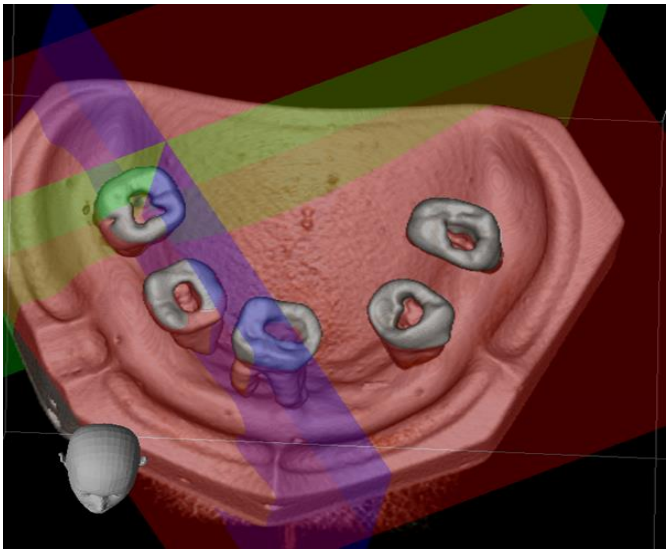


Figure 5: post operative CBCT image (occlusal view)

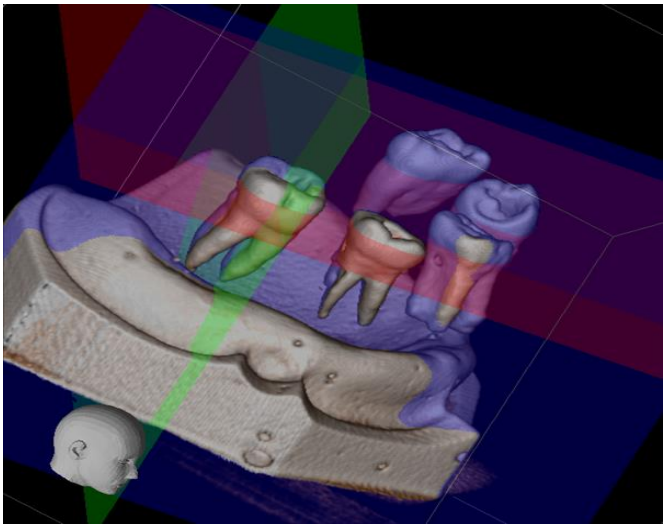


Figure 6: post operative CBCT image (sagittal view)

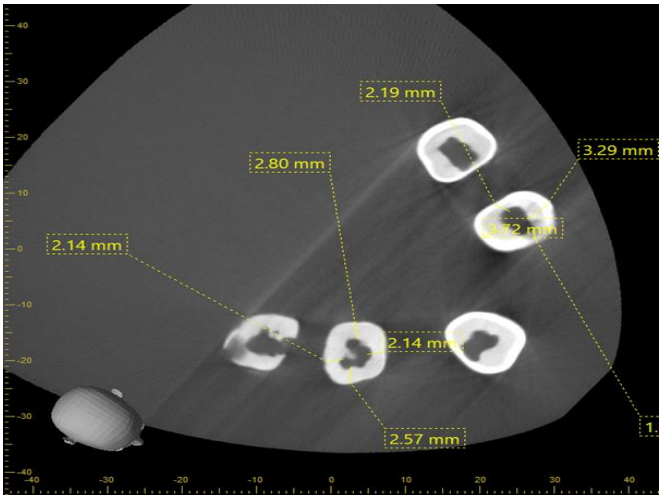


Figure 7: post operative CBCT image with access cavities

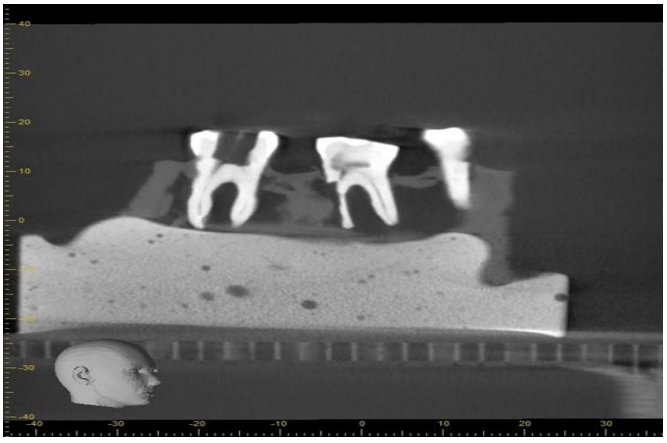


Figure 8: post operative CBCT image with access cavity sagittal view in sagittal plane

Working length determination

Working length was determined using hand K- files ISO #08-20 for negotiation and a crown – down technique with trunatomy rotary system was used for cleaning and shaping of samples. The root canals was irrigated for sodium hypochlorite 3% followed by saline solution and 17% EDTA.

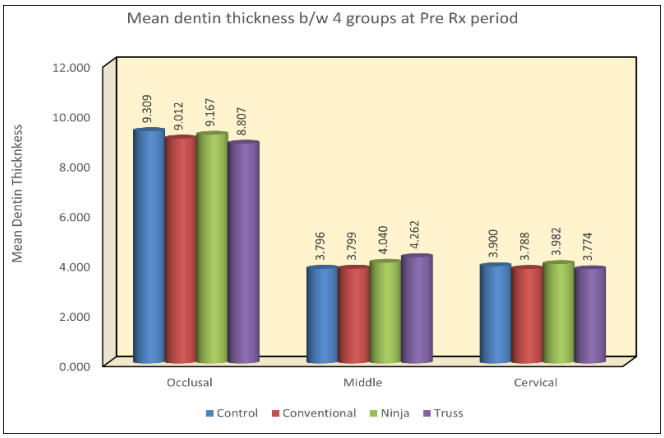
Analysis of the volume of dental tissue

Evolution of tooth structure wear in terms of volume and area will be performed using the Galaxis Software (Germany). The initial and final volume and area of dentin and pulp of each tooth was calculated in cubic millimeters.

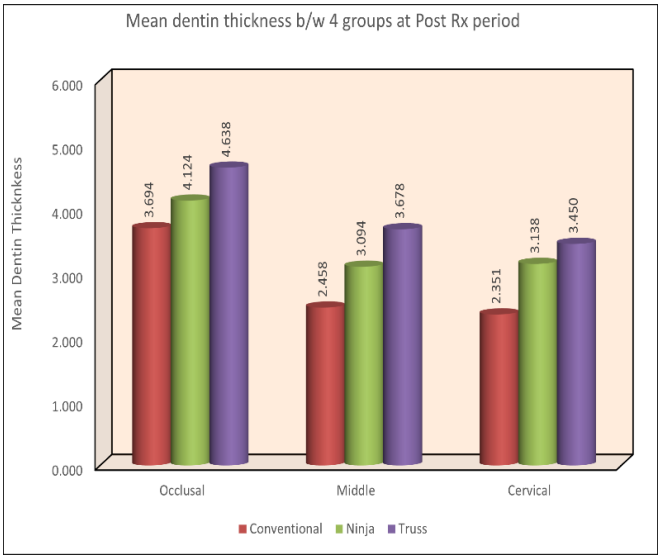
Results

The mean dentin thickness in occlusal region for control group was 9.309 ± 0.549, Conventional group was 9.012 ± 0.365, for Ninja group was 9.167 ± 0.703 & Truss group was 8.807 ± 0.910. In the middle region, the mean dentin thickness for control group was 3.796 ± 0.413, Conventional group was 3.799 ± 0.625, for Ninja group was 4.040 ± 0.637 & Truss group was 4.262 ± 0.269. In the cervical region, the mean dentin thickness for control group was 3.900 ± 0.377, Conventional group was 3.788 ± 0.665, for Ninja group was 3.982 ± 0.397 & Truss group was 3.774 ± 0.361.

Graph 1:



However, there was no significant difference in the mean dentin thickness between 4 groups at pre-treatment period.

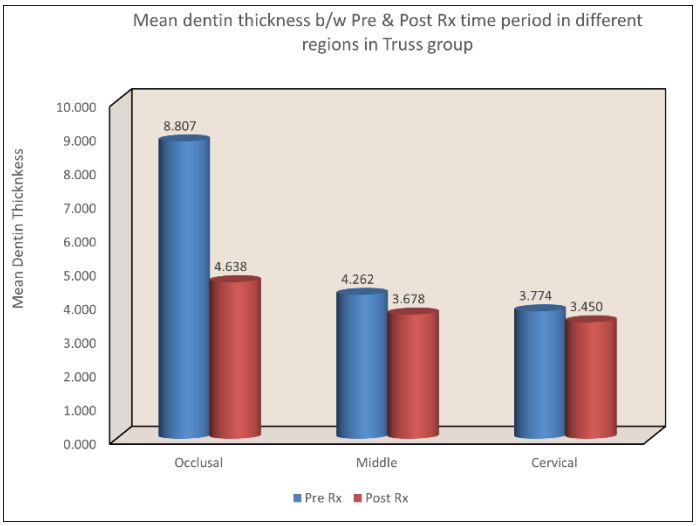


Graph 2: The mean dentin thickness in occlusal region for Conventional group was 3.694 ± 0.184, for Ninja group was 4.124 ± 0.177 & Truss group was 4.638 ± 0.431. In the middle region, the mean dentin thickness for Conventional group was 2.458 ± 0.356, for Ninja group was 3.094 ± 0.423 & Truss group was 3.678 ± 0.240. In the cervical region, the mean dentin thickness for Conventional group was 2.351 ± 0.320, for Ninja group was 3.138 ± 0.502 & Truss group was 3.450 ± 0.389. There was a significant difference observed between 3 groups in occlusal region at p=0.001, in middle region at p<0.001 & in cervical region at p=0.003.

Summary

Multiple comparison of mean difference between groups in occlusal region revealed Truss group with significantly higher mean dentin thickness as compared to Ninja & Conventional groups respectively.

Graph 3



Discussion

Endodontic cavity preparation and dentin reduction decreased the teeth's ability to fracture, and they increased cuspal deflection during function[4]. In order to avoid difficulties that can arise during endodontic treatment, the regulated removal of tooth structure is supported in traditional endodontic cavity (TEC) preparation. After the final restoration, the tooth may fracture due to the loss of dentin and anatomical features including cusps, ridges, and the roof of the pulp chamber. Conservative endodontic cavity (CEC) preparation, in contrast to TEC preparation, is a minimally invasive technique that can protect tooth components including pericervical dentin[9].

Truss access is a constricted endodontic cavity method, which uses separate cavities that have been created to approach the canal systems through an orifice-directed design. These access cavity designs' primary goal is to preserve dentin by leaving a truss of dentin between the two cavities they have created. Truss access approach places a strong emphasis on preserving good dental structure while using a minimally invasive technique[13]. The central fossa of the root orifices is the target of the oblique projection made during access preparation in the Ninja endodontic access cavity (Orifice-Directed Dentin Conservation Access)[13]. Due to the fact that the endodontic access is made parallel with the enamel cut of 900 or more to the occlusal plane, it is simpler to find the root canal orifices even from diverse visual angulations. The development of adhesive technology has made it possible for post-endodontic repair to be both conservative and aesthetically pleasing. The comparisons were done and held as legitimate using the recordings of CBCT images. Therefore, the goal of this study was to use the CBCT, a noninvasive technique, to examine how different access cavity preparations affected the peri-cervical dentin[14]. The risk of utilising a round bur for creating endodontic access is correctly noted by Clark and Khademi (CK).

Conclusion

In comparison to conservative access cavity preparation, conventional access cavity preparation caused a considerable loss of tooth structure in the peri-cervical region. As a result, it can be said that the ninja and truss cavity design is a more cautious method of accessing permanent molars. Providing strength to the concerned tooth structure as a result.

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