Research Article

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Comparison of Fracture Strength of Endodontically Treated Teeth Having Different Access Cavity Designs

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ABSTRACT

Background: The main purpose of the study was to check the resistance to fracture for endodontically treated teeth with different designs of access cavities.

Materials and Methods: 40 human extracted maxillary premolars were selected and access cavities were made using endo access burs. The total samples were divided into four groups. The first group (group 1) consisted of teeth in which traditional endodontic access cavities were made ,the second group (group2) consisted of conservative access cavity design group, the third group (group 3)consisted of extremely conservative or ninja access cavity design group and the fourth group consisted of control or the intact teeth (group 4). The teeth were endodontically treated and then restored and the teeth were subjected to load on a universal testing machine. The fracture strength was recorded and the values were statistically analyzed.

Results: The fracture resistance values were lowest for traditional endodontic cavity group as compared to conservative and the ninja group. The intact teeth or the control group had highest resistance to fracture.

Conclusion: The Conservative and the ninja access preparations show higher resistance to fractures as compared to traditional endodontic access cavity group because of the conservation of natural tooth structure.

Keywords: Conservative endodontic access, fracture resistance, ninja endodontic access, Traditional endodontic access.

INTRODUCTION

Access is the most important step in the root canal therapy. The ultimate success of a root canal treatment is directly dependent upon a good access opening. Though the access designs have remained unchanged over many years, nowadays recent modifications have been added to the traditional access designs to improve fracture resistance of teeth and ultimately aim conservation of natural tooth structure.[1]Greater is the removal of tooth structure, more are its chances to fracture under load.[2,3] The most common sequelae to fractured endodontically treated teeth is vertical root fracture and hence extraction.[4]

Conservative access design aims at preserving some pericervical dentin and part of roof of pulp chamber.[5,6] Today in the era of modern endodontics an extremely conservative design for access cavities known as ninja endodontic access has been introduced. It has been made possible by the use of

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adjuncts like CBCT for canal localizations, use of operating microscopes and loupes for enhanced vision.[7,8]

Aim: To compare fracture resistance of endodontically treated teeth having different access cavity designs.

MATERIALS AND METHODS

A total of 40 extracted human maxillary premolars were collected and stored in saline till further use .The total samples were divided into four groups. The first group (group 1) consisted of teeth in which traditional endodontic cavities were prepared , the second group (group 2) consisted of teeth in which the conservative endodontic access cavities were made ,the third group (group3) consisted of extremely conservative access group or the ninja access group and the fourth group (group 4)consisted of control group having intact teeth.

Endodontic Treatment of Samples

Access cavities were made using endo access burs. Root canals were then negotiated using no. 10 k files and working lengths were determined. Final working lengths were calculated 0.5 mm short of the radiographic apex. Canals were then instrumented till no. 40 NiTi K files till estimated working length. Step back was done till no. 55 NiTi K file to ensure a tapered preparation. The canals were intermittently irrigated with 3% sodium hypochlorite and saline. Canals were then dried with paper points and obturation was done using standardized gutta percha cones with lateral condensation technique using a zinc oxide eugenol cement.

Restoration of Samples

The access cavities were cleaned and etched with 37% phosphoric acid gel for 20 seconds. It was rinsed and air dried immediately. A bonding agent was applied (Adper Single Bond -3M) and light cured for 30 seconds. The access cavities were finally restored with Bulk Fill composite (Tetric N Ceram).

Fracture Resistance Test

All the samples were mounted using a self cure acrylic and were subjected to a compressive load on a universal testing machine at a crosshead speed of 1mm/min at the central fossa using a 5mm diameter round compressive head.

RESULTS

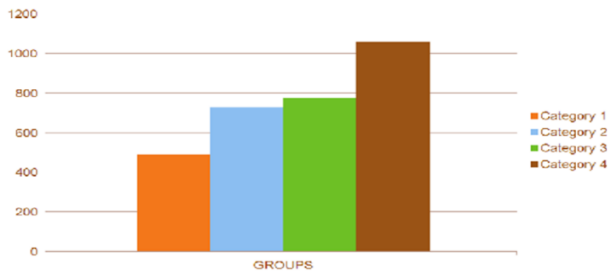
Highest fracture resistance values were obtained for the intact or control group (group4) followed by ninja (group 3) and the conservative (group 2). The least fracture resistance values were obtained for the traditional endodontic cavity group (group 1) {Table I, Graph I}.

Statistical Analysis

The data were statistically analysed using one way ANOVA test and post hoc tukey test for comparison between various groups and the level of significance came out to be 0.05

Table 1: Mean Values of Fracture Resistance in newtons.

Groups	Number of samples	Mean	Std. Deviation	Std. Error	P value
Group 1	10	491.00	45.629	20.406	
Group 2	10	730.80	42.623	19.061	
Group 3	10	777.00	41.267	18.455	0.000(*)
Group 4	10	1059.80	144.136	64.460	
Total	40	764.65	220.286	49.257	



Graph 1: Representation of fracture strength values of different groups.

DISCUSSION

Jeopardization of the tooth structure is said to be the most important cause for fractures of endodontically treated teeth. More is the tooth loss,

more is its susceptibility to fracture under masticatory loads. Moreover the root canal treated teeth have low moisture content because of loss of dentinal fluid so the loss of moisture contributes to their fragility.[9]

The highest mean fracture strength value (1059.8 N) of the control group (group 4) as compared to other experimental groups can be attributed to the intact tooth structure available. The traditional endodontic cavity group (Group 1) showed the least fracture resistance values (491 N) among all the groups. This can be attributed to the fact that there is loss of important structures like cusps, ridges and pulp chamber roof. All these anatomical structures are important in maintaining integrity of tooth structure so as to distribute the masticatory load. [10]

Both conservative endodontic access (group 2) as well as the ninja access (group 3)showed higher fracture resistance values because of the conservation of the required tooth structure. However, the values were not statistically significant to each other and the ninja endodontic access did not prove to be much superior in improving fracture resistance as compared to the conservative endodontic access. This was in accordance with results of previous studies.[11]

Premolars were used in this study as they occupy an important role in the dental arch. These are helpful in aesthetics as they help in creation of a beautiful smile as well as play a very important role in mastication by taking loads of as high as 800-1000 N .[12]

After the completion of endodontic treatment the access cavities were restored with bulk fill resin composites as these are one of the best and the most widely used restorative materials in today's dentistry. These are not only aesthetic but show good mechanical properties too.[13]Same amount of load was used on all access cavity designs for the standardization of the entire procedure.

So, directly preserving enamel and dentin is the proven way of improving fracture resistance of endodontically treated teeth which are otherwise most susceptible to oblique and vertical fractures ultimately leading to treatment failure and other complications. No restorative material available in the market can actually compensate for tooth structure loss hence designing endodontic access cavities that preserve most of the tooth structure is the best way to enhance longevity of endodontically treated teeth .[5,6,14]

Large designs might be slightly favorable in finding canals and ensuring good cleaning and shaping of canal systems but these tremendously weaken the tooth . [15]So the conservative and the modern designs came into being and have proven to be helpful in this regard as modern endodontics revolves around tooth structure conservation at the same time the use of modern aids and equipments like the use of advanced diagnostic aids and use of magnification during the endodontic therapy all of which ensure the success of the treatment.

CONCLUSION

Within the limitations of the study, it was concluded that conservation of tooth structure did result in increase in fracture resistance of endodontically treated teeth.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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