PATTERN OF IATROGENIC DAMAGE TO APPROXIMAL TOOTH SURFACE DURING CLASS II CAVITY PREPARATION IN A CLINICALLY SIMULATED ENVIRONMENT

*[1]A.O Arigbede, [2]D.M Ajayi , [2]I.M.F Abiodun-Solanke

1. Department of Restorative Dentistry, Faculty of Dentistry, College of HealthSciences, University of Port Harcourt, Rivers State, Nigeria
2. Department of Restorative Dentistry, Faculty of Dentistry, College of Medicine, University of Ibadan, Oyo State, Nigeria

*Corresponding Author
E-mail: arisabbey@yahoo.ca OR arisabbey@gmail.com
Phone No: +2347055736436

Abstract

Background/Aim: Iatrogenic tooth damage is a well recognized and longstanding problem that appears to have refused to disappear from restorative clinical practice. This study was designed to determine the pattern of distribution of iatrogenic tooth surface damage caused by a cross section of dental students and residents during Class II cavity preparation in a clinical simulated environment.

Methods: Residents rotating through the Department of Restorative Dentistry and randomly selected 1st year and final year dental undergraduates were told to prepare either mesio-occlusal or disto-occlusal Class II cavity on pre-selected normal upper plastic posterior tooth mounted on phantom head after obtaining inform consent. The type of preparation that is selected is based on the adjacent tooth surface that is intact. At the end, the location of the damage and the type (Groove; indentation; Scratches; Extensive) as described by Medeiros and Seddon (2000) was evaluated under a magnifying lens. Summary statistics was generated.

Results: The frequency of iatrogenic tooth damage was 100% and "indentation" was the commonest pattern, followed by grooves. More damages occurred in the cervical area. Extensive damage formed 19.0% of the total damages and this type of damage was found more adjacent to MO cavity (25.0%) compare to DO (15.4%) but there was no difference between the extensive damage that occurred on the right and left sides.

Conclusion: The frequency of iatrogenic tooth damage was 100% and indentation was the commonest pattern. Extensive type of damage was found more adjacent to MO cavity.

Key Word: Iatrogenic tooth damage, approximal tooth surface, Class II cavity

*Corresponding author

Introduction

Caries experience in Nigeria is said to vary between very low in rural areas and moderate in some urban communities, but the prevalence of the disease appears to be on the increase. [1] The WHO ranked dental decay as number three among all chronic non-communicable diseases that require worldwide attention for prevention and treatment.[2] The lesion may occur in any of the tooth surfaces particularly the occlusal and approximal tooth surfaces.[3] A previous study suggested that occlusal caries was common among individuals below 14years of age while approximal caries on the other hand becomes more prevalent among those above 14 years.[3,4] Caries affecting the approximal surfaces of posterior teeth is referred to as Class II.[5] Treatment of the lesions remains either atraumatic restoration technique or mechanical preparation of the cavity followed by restoration.[5,6]

In the process of treating class II lesions, experience has shown that iatrogenic damage often occurs on the adjoining approximal surface during mechanical preparation of the carious tooth surface. This is because, dental drill often causes unnecessary tooth wear to the adjacent normal tooth surfaces in close contact with the carious lesions.[7-9] A previous study revealed that teeth with iatrogenically damaged surface showed significant increased need for restoration and besides deep defects caused by iatrogenic took surface damage can possibly lead to misinterpretation of radiographs later [8]. This observation is one of the factors that facilitates restoration/re-restoration cycle.[10,11]

Analysis of Class II restorations with damaged adjacent tooth surface in a previous study showed that the cervical areas are more frequently damaged than the coronal portion.[12,13] Vertical grooves in the long axis of the tooth have been the most frequently reported type of damage identified in vitro and in vivo.[12,13] The anterior teeth, approximal tooth surface in contact with disto-occlusal cavity, primary teeth, mandibular teeth and the left hand side of the jaws are said to be less prone to iatrogenic tooth damage.[7,13] Extensive studies had been done on the occurrence and frequency of this anomaly[7,8,9,12,13], its significance and how it could be reduced or prevented[14,15] in dental clinical practice; but the impact of this knowledge on current clinical practice and dental training is still not clear. This study was designed to determine the pattern of distribution of iatrogenic tooth surface damage caused by a cross section of dental students and residents during Class II cavity preparation in a clinical simulated environment and to determine whether the preventive measures taught in class have had impact on their practice. Studies on this important subject are rare in our environment.

Materials and Methods

Randomly selected dental undergraduates and residents having their clinical training in the university College Hospital, Ibadan were recruited into the study. The undergraduates were selected from among the final year class and those who just finished their pre-clinical cavity preparation and restoration dental course in clinical skills laboratory. The residents included those rotating through the department of Restorative Dentistry at the time of the study. They were told to prepare either mesio-occlusal or disto-occlusal Class II cavity on pre-selected normal upper

plastic posterior tooth mounted on phantom head depending on which adjacent approximal tooth surface is intact. Fast hand piece was employed under illumination provided by the lighting system attached to the phantom head machine.[12] They were told their cavity preparation will be assessed upon completion but the criteria were not disclosed as everybody is expected to have mastered these criteria and applied them as appropriate. No time constraint was imposed and candidates were given the liberty to employ any technique of Class II cavity preparation they found convenient. However, similar burs were supplied to the participants. Before the experiment, the tooth, the type of cavity to be prepared and the level of the participants were recorded. The experiment was done group by group to avoid feeling of insecurity.

All the participants were duly informed that the cavity will be examined and that the study was designed to generate data that may improve Restorative dental practice. Invited participants who declined participation were excluded from the study and they were assured that there would be no consequences. In order to preserve the identity and confidentiality of the participants, the participants and the jaws they worked upon were coded. The sample size was based on convenience.

After the procedure, the cavity preparation was examined for minimum standard (adequate depth, flat floor, occlusal lock and proximal box design).The prepared tooth was then unscrewed and the adjoining approximal surface was examined with a magnifying lens to determine the location and type of damage.[13] A surface was regarded as undamaged if there was a smooth intact curved approximal surface on inspection. Each damaged surface was classified according to its morphological appearance[13] as follows:

G- Groove (a deeper defect, length greater than width with a vertical groove or horizontal orientation.

I- Indentation (a regular defect without an orientation, roughly circular or triangular in shape).

S- Scratches (narrow, shallow score lines, usually multiple with a consistent orientation).

X- Extensive damage (damage involving a large area of the approximal tooth surface or combinations of the defects above).

The subjects were blinded to the fact that iatrogenic damage to the adjacent approximal tooth surface was the parameter of special interest. Data collection was supervised by two of the authors while the third author who was blinded to the identity of the subjects and their cavity preparation analyzed the coded specimen. Summary statistics was generated.

Results

Forty-two individuals participated in the study. Twenty-three (54.8%) of these were in the final year, 14 (33.3%) were first year clinical students and the remaining five participants (11.9%) were dental residents rotating through the Department. All the examined adjacent proximal tooth surfaces were found with one degree of damage or the other. In order of prevalence, indentation (42.9%) was the commonest type of damage among the study participants. This was followed by tooth damage classified as Grooves and this occurred in 26.2% of

the cases. Extensive tissue damage occurred in19.0% of the cases and scratches type of damage was the least frequent (12.0%).

When the different types of iatrogenic damage was considered along with the outlined variables, more scratches occurred in DO cavity (15.4%) than in MO (6.3%), but extensive tooth damage occurred more in MO (25.0%). More scratches and more indentation occurred on the right side of the upper arch as against groove type of damage which occurred more on the left (38.1%). The proportion of extensive damage that occurred on the right and on the left was the same. No extensive damage occurred among the few cases done by the resident doctors and no scratches were also found among those cases done by the 1st year clinical students. All the possible tooth damages were fairly distributed among the final year clinical students. When the location of the damage was considered on the prepared tooth, more damages were located around the cervical areas compared to the coronal portion. **Figure I shows a severe iatrogenic tooth damage made by one of the operators.**

Table 1: Pattern of tooth damage and characteristics of the cavities and participants

S/N	Type of tooth damage	Freq (%)	Cavity location		Side of the upper jaw		Level		
			MO	DO	Right	Left	Graduate	Final year	1st year clinical
1	Scratches	5(11.9)	1(6.3)	4(15.4)	4(19.0)	1(4.8)	2(40.0)	3(21.4)	-
2	Indentation	18(42.9)	7(43.8)	11(42.)	10(47.6)	8(38.1)	2(40.0)	4(28.6)	12(52.2)
3	Groove	11(26.2)	4(25.0)	7(26.9)	3(14.3)	8(38.1)	1(20.0)	3(21.4)	7(30.4)
4	Extensive	8(19.0)	4(25.0)	4(15.4)	4(19.0)	4(19.0)	-	4(28.6)	4(17.4)
	Total	42	16	26	21	21	5	14	23

Fig I: Example of a severe iatrogenic tooth damage that occurred during Class II cavity preparation in a clinical simulated environment

Discussion

The quality of a Class II cavity preparation is said to depend on the training, skill and experience of the operator and also on the clinical situation and environment.[13] Our result shows that all the participants committed iatrogenic tooth damage. This result supports the finding from a previous publication which reported iatrogenic damage in all

the cases evaluated in everyday clinical practice.[12,13] It should however be noted that variation had been found in the frequency of iatrogenic tooth damage between in vivo and in vitro studies in favour of the in vivo. [7,8,13,15]Generally, literature revealed that the frequency of iatrogenic tooth damage varied between 49-100%.[7,8,1215] Lower frequency of damage may occur when the participants are aware of the parameter being assessed, as they are likely to show extra diligence in preventing the occurrence of iatrogenic tooth damage in such cases. This informed why the specific variable of interest was not disclosed to the operators.

A previous publication[13] suggests that vertical grooves type of damage was the most common type of iatrogenic damage unlike indentation that was discovered to be the most prominent in our study. However, our result supports the previous finding in that scratches type of injury was not common. The result on the location of damage from our study lends credence to the already published finding[12] which stated that cervical areas are more frequently damaged that the coronal portion. Our data on frequency of extensive damage (19%) was close to 17% reported by Medeirose and Seddon (2000). The distribution of the types of damage along the outlined variables did not show any consistent pattern. However, more approximal teeth surfaces adjacent to MO cavities suffered extensive damages in our study. Literature suggests that this surface is more prone to damage perhaps because the operator has to depend on indirect vision to assess the surface.[13] There was no difference in the frequency of extensive damage recorded between the right and left sides and the final year committed more extensive damage than the 1st year clinical students suggesting that attitude may play some role in the occurrence of this phenomenon. Only few graduates participated in the study making comparison difficult. Qualified dental surgeons caused more iatrogenic damage than undergraduate students in a previous study[13].

Traditionally, dental students are taught the technical skills required for mechanical tooth preparation and restoration prior to treating patients on mannequin/phantom heads equipped with jaws and synthetic teeth as well as tooth drilling apparatus partly due to concern for patient safety (Clancy et al, 2002). To prevent the phenomenon of iatrogenic tooth damage, students are often taught that while the proximal box is being prepared, a shell of enamel should be left between the preparation and the adjacent tooth. The plate of proximal enamel is then fractured with a hand instrument to prevent damage to adjacent tooth by bur. The fractured margins are then planed with gingival margin trimmer or hatchet. [14]In addition, it is also suggested that approximal iatrogenic damage might be prevented by using matrix bands. Our results combined with published data suggest that these techniques are either not applied or ineffective.[12]

The instruments designed by Lussi and Gygax had been reported to show a promising result while the use of surgical telescopes did not decrease the damage to adjacent tooth surfaces during class II preparations.[12] The clinical benefits of these instruments should be explored further to the point that they may necessitate practice and curriculum change. At the moment, iatrogenic tooth damage remains a well recognized problem with weak or not readily available practical solution. In

conclusion, Iatrogenic proximal tooth surface damage occurred in all the evaluated cases and indentation was the commonest pattern of presentation. Extensive type of damage was evenly distributed between the right and left side of the upper jaw and it was found more adjacent to MO cavity. Final year dental students committed more extensive damage than 1st year clinical undergraduates. In line with published finding, it appears that iatrogenic tooth damage preventive techniques often taught in dental schools are either not being applied or are ineffective.

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