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Characteristics of the Deep Carious Lesions of Primary and Permanent Molars Using IOPA Radiographs

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ABSTRACT

***Aim*: To determine the site and pattern of deep carious lesion & its consequences on coronal and radicular structures radiographically in primary molars & first permanent molars using IOPA radiographs.**

***Materials and methods*: It consisted of 200 IOPA of Deep carious of Maxillary & mandibular of primary (n=100) and permanent molars(n=100) X-rays are collected. IOPA radiographs of Deep carious lesion involving only dentin with radiolucency reaching the inner 1/3 of dentin, clinically cavitated that is RC5 Of the ICMMS criteria were taken. Blinded Radiographic evaluation was done by two persons to rule out inter examiner variability.**

***Results*: In primary molars IOPA there was statistically significant difference in Carious adjacent tooth whereas in permanent molars IOPA there was statistical difference in Diffused pattern and lost tooth structures. When compared primary and permanent molars diffused pattern and lost tooth structure showed statistically significant difference.**

***Conclusion*: The deep carious lesions definitely lead to loss of crown structure over a period of time and also capable of spread of caries to adjacent teeth due to food impaction & inadequate oral hygiene. Hence leading to loss of function and arch length.**

Keywords: Dental Caries, IOPA radiographs, Permanent Molars, Primary Molars.

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I. Introduction

Dental caries is a biofilm-mediated, sugar-driven, multifactorial, dynamic disease that results in the phasic demineralization and remineralization of dental hard tissues. Caries can occur throughout life, both in primary and permanent dentitions, and can damage the tooth crown and, in later life, exposed root surfaces. The balance between pathological and protective factors influences the initiation and progression of caries [1]. A deep carious lesion involves a greater depth of dentin, and its complete removal could increase the risk of pulp exposure [2]. A consensus document recently defined deep caries as radiographic evidence of caries reaching the inner third or inner quarter of dentine with a risk of pulp exposure [3]. Radiographic diagnosis of dental caries is fundamentally based on the fact that as the caries process proceeds, the mineral content of enamel and dentin decreases with a resultant decrease in the attenuation of the x-ray beam as it passes through the teeth. This is recorded on the image receptor as an increase in radiographic density [4]. This increase in radiographic density must be detected by the clinician as a sign of a carious lesion. Many different factors can affect the ability to accurately detect these lesions: exposure parameters, type of image receptor, image processing, display system, viewing conditions, and ultimately, the training and experience of the human observer [5]. It has been observed from literature no studies have been reported on interpretation of deep carious lesion of primary molar teeth & first permanent molars with respect to their coronal and radicular consequences using IOPA radiograph. Thus, the purpose of this study is to determine the site and pattern of deep carious lesion & its consequences on coronal and radicular structures radiographically in primary molars & first permanent molars using IOPA radiographs.

II. Materials and Methods

This Cross-sectional study was conducted at Department of Pediatric and Preventive dentistry, Rajarajeswari dental college and hospital, Bengaluru, Karnataka, INDIA before starting the trial, corresponding College ethical approval has been obtained. (*Ethical No* – RRDCH/IEC21/43) The patients Deep dentinal caries x rays were obtained from Department of Pediatric and Preventive dentistry. IOPA radiographs of Deep carious lesion involving only dentin with radiolucency reaching the inner 1/3 of dentin, clinically cavitated that is RC5 Of the ICMMS criteria which is Radiolucency reaching the inner 1/3 of dentin, clinically cavitated and minimum of 2/3rd of Root remaining for primary teeth and complete formed root for permanent teeth are selected. Caries involving pulp/pulpal horn, Deep caries

associated with any other pathologies of oral cavity and Special Children are excluded.

III. Methodology

A total of 200 Deep carious of Maxillary & mandibular of primary (n=100) and permanent molars (n=100) X-rays are collected from department of pediatric and preventive dentistry, Rajarajeswari dental college and hospital. Radiographs were taken with optimal radiation exposure precautions (lead apron and thyroid collar). Dental X-ray unit (ARIBEX NOMAD™ PRO digital dental X-ray unit) comes with pre-set 60 kV and 2.5 mA were used to take IOPA radiograph. For primary molars Size 0 F-speed films and for permanent molars Size 2 E-speed films were used. Radiograph following ICMMS criteria RC5 are taken. Radiograph were matched for standard criteria of exposure of paralleling cone technique and processing for reading clarity were taken. Each radiograph was interpreted independently using light box and 2x magnification x-viewer by two persons to rule out inter examiner variability

IV. Statistical Analysis

A. Descriptive Statistics

This will be expressed in frequency and percentage for the site and pattern of deep carious lesions in primary and permanent teeth in terms of Mean and standard deviation (SD).

B. Inferential Statistics

Chi-square test will be used to compare the site and pattern of deep carious lesion between primary and permanent teeth.

The level of significance [P-Value] will be set at P<0.05

And any other relevant test, if found appropriate during the time of data analysis will be dealt accordingly.

V. Results

A total of Primary IOPA (n=100) and permanent IOPA (n=100) had met inclusion criteria were included in analysis of determination of characteristics of deep carious lesions of primary and permanent molars.

TABLE I: Comparison of Distribution of Site and Pattern of Deep Carious Lesions and Its Consequence on Coronal and Radicular Areas in Primary Molars Group Using Chi Square Goodness of Fit Test

Variable	Category	n	%	χ^2 Value	P-Value
Site	Occlusal	35	35%	0.860	0.65
	Mesial	29	29%		
	Distal	36	36%		
Pattern	Triangle	50	50%	0.000	1.00
	Diffused	50	50%		
Crown Morphology	Intact	45	45%	1.000	0.32
	Lost	55	55%		
Root Pathology	Not Seen	92	92%	..	..
Adjacent Tooth	Carious	36	36%	7.840	0.005*
	Not Carious	64	64%		

Table I Shows Primary molars coronal area of deep carious lesion site (p-value = 0.6), pattern (p-value = 1) and crown morphology (p-value = 0.32) had no significant difference whereas the adjacent tooth (p-value = 0.005) showed significant difference.

TABLE II: Comparison of Distribution of Site and Pattern of Deep Carious Lesions and Its Consequence on Coronal and Radicular Areas in First permanent Molars Group Using Chi Square Goodness of Fit Test

Variable	Category	n	%	χ^2 Value	P-Value
Site	Occlusal	44	44%	5.18	0.08
	Mesial	29	29%		
	Distal	27	27%		
Pattern	Triangle	22	22%	31.360	<0.001*
	Diffused	78	78%		
Crown Morphology	Intact	18	18%	40.960	<0.001*
	Lost	82	82%		
Root Pathology	Not Seen	100	100%	..	..
Adjacent Tooth	Carious	49	49%	0.040	0.84
	Not Carious	51	51%		

Table II shows Permanent dentition coronal area of deep carious lesion showed different results the site (p-value = 0.08) had no statistical difference whereas pattern (p-value = 0.001) and crown morphology (p-value = 0.01) showed significant difference.

TABLE III: Comparison of Site and Pattern of Deep Carious Lesions and Its Consequence on Coronal and Radicular Areas between Primary & Permanent First Molars Group Using Chi Square Test

Variable	Category	Primary		Permanent		χ^2 Value	P-Value
		n	%	n	%		
Site	Occlusal	35	35%	44	44%	2.311	0.32
	Mesial	29	29%	29	29%		
	Distal	36	36%	27	27%		
Pattern	Triangle	50	50%	22	22%	17.014	<0.001*
	Diffused	50	50%	78	78%		
Crown Morphology	Intact	45	45%	18	18%	16.893	<0.001*
	Lost	55	55%	82	82%		
Root Pathology	Present	92	92%	100	100%	..	..
Adjacent Tooth (Next to carious lesion)	Carious	36	36%	49	49%	3.458	0.06
	Not Carious	64	64%	51	51%		

Table III shows the comparison of Primary and Permanent dentition of deep carious diffused pattern (p-value = 0.001), the crown morphology (p-value = 0.001).

VI. Discussion

Histopathology of pit and fissure caries is cone or triangle shaped with its apex at outwards and base towards dentinoenamel junction as caries follows direction of enamel rods. Smooth surface caries particularly proximal has a distinct pattern of triangular or cone shaped lesion with apex towards the dentinioenamel junction and base towards the surface of teeth [6]. As the caries progress, the deep dentinal caries will assume the shape of triangle with apex towards the pulp and the base towards the enamel [7]. However, this pattern of caries may further involve into dentin and may change its characteristic appearance and the same was observed in our study (Table I and II).

We have studied deep carious lesion of IOPA of primary & permanent dentition molars involved occlusal as well as

proximal surfaces. In primary molars(Table I) there were not much significant difference in the triangular and diffuse pattern as it was equally distributed in the test subjects. The crown morphology lost in 55% of test subjects. The root pathology in primary molar was not seen. The deep caries involving occlusal surface didn't showed any adjacent teeth involvement but proximal surface involved adjacent teeth.

The deep carious lesion IOPA of permanent molars (Table II) involved occlusal and proximal surface were studied. It was first noted that teeth showing of diffuse pattern caries crown morphology was lost. There were no changes seen in root pathology. The adjacent teeth involvement with caries was observed when proximal caries was present.

When comparing primary and permanent teeth radiograph it was noted that smooth surface caries particularly proximal caries was more in permanent dentition whereas in primary molars it showed both occlusal and proximal caries. The reason could be that the interproximal caries involvement will only increase in primary dentition after 3yrs of age when occlusal contact establishes [8]. The physiological root resorption was seen in primary molars and no other root pathology was noted due to deep caries. The permanent molars showed no root pathology in test samples. Further change in arch length requires long term dental care especially noted whenever proximal side was involved with caries.

Due to masticatory force or accidental opening of pit and fissure caries with destructed dentin leads to big cavitated lesion in Pit and fissure surface due the plaque retentive nature of pits and fissures make them difficult to clean, thereby causing them to be more susceptible to caries than smooth surfaces [9]. This was more common in permanent teeth compare to primary teeth due to their morphological complexity, making dental hygiene more challenging leading to increased plaque accumulation [10]. This also explains the bite force variation from primary teeth to permanent teeth as growth and development occurs in children.

The deep carious lesion involving occlusal surface didn't showed any adjacent teeth involvement but proximal surface showed adjacent teeth involvement due to food impaction and less cleansing. Also, thus could increase during partially erupting stage if cavitated lesion doesn't have food retention there will be no caries in adjacent teeth. When the adjacent teeth get demineralized showing white chalky appearance is only seen clinically can't be appreciated in IOPA.

VII. Limitation

1. IOPA X-ray can be easily distorted through improper technique, anatomic limitation, or processing errors.
2. Buccal-lingual dimension is absent on a single film.
3. Radiographs in which necrotic and healthy pulp cannot be distinguished.

VIII. Conclusion

So, our study concludes that caries in children should be diagnosed and treated in early stages. The Intra oral radiographs are useful adjuvant to diagnose initial caries lesion. The deep carious lesions definitely lead to loss of crown structure over a period of time and also capable of spread of caries to adjacent teeth due to food impaction & inadequate oral hygiene. Hence leading to loss of function and arch length.

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