

## ORIGINAL ARTICLE

## Caries Susceptibility of Proximal Surfaces in Permanent First Molars: A Cross Sectional Survey

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### ABSTRACT

**Objective:** To report the caries frequency of proximal surfaces of permanent first molars.

**Study Design:** Descriptive study.

**Place and Duration of the Study:** Department of Operative Dentistry, Dow Dental College, Dow University of Health Sciences Karachi. One month from 1<sup>st</sup> October 2015 to 31<sup>st</sup> October 2015.

**Materials and Methods:** The study was conducted on retrospective data of 374 patients presenting to the department of Operative Dentistry, Dow University of Health Sciences. Diagnosis of dental caries was made on selected periapical radiographs using criteria provided by Senel. Caries data and other independent variables e.g. age; gender, arch and side were analyzed with SPSS for windows version 17. Chi square test was used to measure association between proximal caries and qualitative variables such as gender, age group and tooth group.

**Results:** There were more mesial proximal lesions (56.4%) than distal lesions (43.6) in all age groups except for 41-50 years and above 50 years ( $p=0.109$ ). When maxillary and mandibular teeth were compared with proximal surfaces, mesial surface of maxillary first molar was found to be more carious statistically ( $p=0.000326$ )

**Conclusion:** Mesial surface of maxillary permanent first molar was associated with increased risk for dental caries.

**Key Words:** Caries Diagnosis, Dental Caries, Permanent First Molar, Mesial Proximal Surface

### Introduction

Permanent first molar due to its early eruption and posterior location is most caries prone and most treated tooth in dentistry.<sup>1,2</sup> A different caries risk has been associated with its different surfaces. A study from USA reported a higher caries incidence for buccal and occlusal surface as compared to proximal.<sup>1</sup> Hopcraft reported a possible association of age with site of tooth, occlusal caries been more common in young while proximal caries was observed more in older subjects.<sup>2</sup> Similarly, early diagnosis of caries in these teeth is of paramount importance. For occlusal and smooth surfaces, only

visual clinical examination might be enough.<sup>3</sup> Proximal surfaces on the other hand, are more likely to be under-diagnosed even with radiographs.<sup>4-6</sup> previous caries experience especially in early childhood might also be used to assign a higher risk of developing proximal caries.<sup>7</sup> The proximal surfaces of first molar therefore, must be thoroughly examined and accurately diagnosed. It has been reported that proximal decay is the most common reason for endodontic therapy in this tooth.<sup>8,9</sup> Site specific studies have been published internationally reporting a different caries incidence for proximal and smooth surfaces of permanent first molar. Lith reported an increased incidence of dental caries in mesial surface of first molar.<sup>10</sup> Distal surface of first molar was found more at risk in a study that reported caries risk in proximal surface according to eruption order.<sup>11</sup> A Swedish longitudinal study on adolescents also found more caries incidence on distal surface.<sup>12</sup> In contrast, proximal surface of first molar was not considered at more risk in another study.<sup>1</sup> Although there is abundant caries data on local population, site specific studies have not been conducted so far.<sup>13,16</sup> Few studies reported caries incidence, however data on specific sites was pooled and tooth

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level site specific data was not provided.<sup>17,18</sup> It was therefore, the objective of this study to report the site specific caries data for proximal surface of permanent first molar. The aim of the study was to evaluate the caries frequency of mesial and distal surfaces of permanent first molar.

### Materials and Methods

This descriptive study was undertaken at the Department of Operative Dentistry, Dow Dental College. The study was based on retrospective patient data stored in the records of the Department. Duration of study was one month, during the month of October 2015. Ethical approval for the study was obtained from the institutional review board (IRB-585/DUHS/Approval/2015/110). The sample size for this study was calculated at 95% confidence level and 80% power, a sample size of 362 was calculated (62% occurrence of class 2 lesions).<sup>19</sup> Sample size calculation was made by using Open Epi version 2 (open source calculator SS-proper). We included 374 permanent first molars in our study by consecutive sampling method based on following criteria. We included permanent First molars in either arch, teeth with primary proximal decay and radiographs of acceptable quality. Cases with more than one carious first molar were also included. The exclusion criteria included teeth with secondary carious lesions and a tooth with both the proximal surfaces involved. Selected radiographs were viewed under standard conditions. An illuminator was used to view and score selected radiographs. A calibrated examiner made all the readings. The radiographic diagnosis of dental caries was made according to the criteria modified from Senel, where 0 was scored for no caries and 1 for caries confined to enamel or involving dentin.<sup>20</sup>

A specially designed proforma was used to collect the data. Data analysis was performed with SPSS version 17 for Windows. Mean and standard deviation of qualitative variable like age and percentages of qualitative variables e.g. gender and proximal surface were calculated. Chi square test was used to determine Association between the two proximal surfaces and categorical variables like gender, age group and tooth group was determined with chi square test at 95% of significance.

### Results

The current study included 374 permanent first

molars based on our inclusion and exclusion criteria. The basic descriptive details of our sample are summarized in table no. I. The mesial surface was found to be carious (n=211, 56.4%) more than the distal surface (n=163, 43.6%). The association of proximal carious surface to the age groups ( $p=0.109$ ) and gender ( $p=0.423$ ) was found to be insignificant (Table No. II). The percentage of mesial and distal surfaces was found to be equal for <20 age group, where-as for age group 20-40 mesial surface had an increased occurrence. However, age group 40-50 had both surfaces equally affected and in >50 age group an increased percentage of distal carious lesions was found (Graph no. I). The association of proximal decay on mesial surface of maxillary permanent first molar was found to be significant ( $p=0.00032$ ) (Table No. III).

**Table I: Basic Demographic Data**

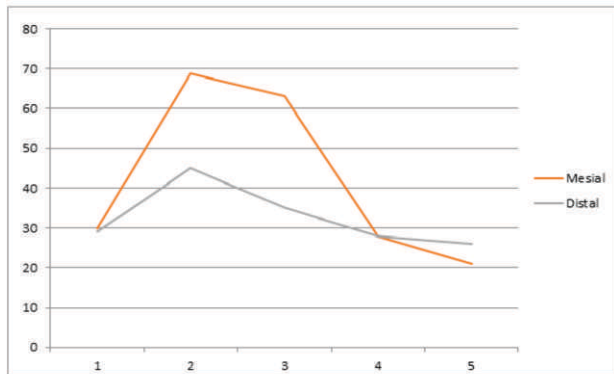
|                  | Frequency | Percentage | Mean $\pm$ SD                     |
|------------------|-----------|------------|-----------------------------------|
| <b>Age</b>       |           |            | <b>34.36<math>\pm</math>13.39</b> |
| Gender Male      | 174       | 46.5       |                                   |
| Female           | 200       | 53.5       |                                   |
| Age Group        |           |            |                                   |
| <20              | 59        | 15.8       |                                   |
| 21-30            | 114       | 30.5       |                                   |
| 31-40            | 98        | 26.2       |                                   |
| 41-50            | 56        | 15.0       |                                   |
| >50              | 47        | 12.6       |                                   |
| Proximal Surface | 211       | 56.4       |                                   |
| Mesial           | 163       | 43.6       |                                   |
| Distal           |           |            |                                   |
| Tooth            | 85        | 22.7       |                                   |
| Maxillary        | 97        | 25.9       |                                   |
| Right            | 100       | 26.7       |                                   |
| Left             |           |            |                                   |
| Mandibular       | 92        | 24.6       |                                   |
| Right            |           |            |                                   |
| Left             |           |            |                                   |

**Table II: Association of Proximal Caries Frequency with age**

|                   |   | Site   |        | Total | P Value |
|-------------------|---|--------|--------|-------|---------|
|                   |   | Mesial | Distal |       |         |
| <b>Age Groups</b> | 1 | 30     | 29     | 59    | 0.109   |
|                   | 2 | 69     | 45     | 114   |         |
|                   | 3 | 63     | 35     | 98    |         |
|                   | 4 | 28     | 28     | 56    |         |
|                   | 5 | 21     | 26     | 47    |         |
| <b>Total</b>      |   | 211    | 163    | 374   |         |

**Table III: Association Of Proximal Caries frequency with Individual Tooth**

| Tooth No     |                              | Site   |        | Total  | P Value |
|--------------|------------------------------|--------|--------|--------|---------|
|              |                              | Mesial | Distal | Mesial |         |
|              | Right Maxillary First Molar  | 55     | 30     | 85     | 0.00032 |
|              | Left Maxillary First Molar   | 68     | 29     | 97     |         |
|              | Left Mandibular First Molar  | 41     | 51     | 92     |         |
|              | Right Mandibular First Molar | 47     | 53     | 100    |         |
| <b>Total</b> |                              | 211    | 163    | 374    |         |



Graph No. 1 Relationship between Age Groups and Proximal Caries

**Graph No.1 Relationship between Age Groups and Proximal Caries**

**Discussion**

We included data of 374 permanent first molars in our cross-sectional study. We found carious lesions more frequently on mesial proximal. Also mesial surface of maxillary first molar was found to be more carious statistically. However a reverse trend was observed for age group of >50 where distal surface was found to be affected more. Moreover, the association of proximal decay with age and gender was non-significant. DMFT score of Pakistan is high. In 12 year olds it has increased from 1.2 in 1998 to 1.6.<sup>14</sup> Therefore, it is important to be aware of local demography before one can draw any conclusions or make comparisons with other studies. Our study was the first of this kind that was done locally. Although local caries burden is known, site specific study on permanent first molar was lacking.<sup>13,14</sup> Our results differ from studies reported from other parts of the world. Regional variation in rate and pattern of dental caries may be responsible for these differences. Our main finding that mesial surface of first molar may be more caries susceptible agrees

with Lith.<sup>10</sup> This longitudinal study followed patients from 6 years of age till age 20, and found this condition remained at an elevated level throughout the period of study. They also found a high frequency of carious and restored distal surface of second premolar, a finding which may partly explain a high caries rate on mesial surface of first molar. This was one of a limitation of our study that we did not consider the caries status of adjacent teeth. Bachelor on the other hand reported buccal pits and occlusal fissures in first molars to be most caries susceptible, while proximal surfaces were found to be less prone.<sup>1</sup> Better access to health care facilities, a regular checkup and fluoride intake may be responsible factors for a different disease pattern in this American study. A longitudinal Swedish with a cohort study design found distal surface of first molar to be more caries affected as compared to mesial surface.<sup>12</sup> Since the methodology of this study differed considerably from our study due to its cross sectional study, this fact could help explain the differences in results. A difference in the proximal surface morphology and enamel maturation has been proposed previously as a possible reason for the conflicting result of our and other studies.<sup>21</sup> the mesial surface of maxillary first molar presents a flatter surface with a more buccally placed contact area with a concavity cervical to this contact area. Distal surface on the other hand, has a more convex profile and a wider contact area and a minimal sub contact concavity. This anatomical difference may be responsible for increased plaque retention and caries experience. In contrast, the mandibular first molar lack a concavity and it's both mesial and distal contact areas are broad and much flatter.<sup>22</sup> These observations support our results of significantly greater involvement of the maxillary first molar when compared to the mandibular first molar. Edward and Burchell have proposed another interesting association, that the proximal surfaces of a tooth that erupts earlier and thus exposed for longer periods of time are more susceptible.<sup>11,23</sup> This explanation however don't support the results that were derived in our study. The distal surface of the first molars have a longer exposure time to the oral environment as second molar is one of the last teeth to erupt. Whereas the mesial surface forms a contact with deciduous second molar immediately after

eruption and is therefore less exposed. In a study by Norblad and Larmas no such association was found.<sup>24</sup> In fact the early contact formation could be used to explain the greater risk of mesial surface. Also in case of a carious deciduous second molar, it can inoculate its permanent neighbor with infection. Studies have shown this relationship.<sup>25</sup> This fact combined with a high prevalence of dental caries in local pediatric population supports the results of our study.<sup>14</sup>

### Conclusions

We found mesial surface of maxillary first molars with greater caries frequency.

### Limitations

We report following limitations of our study

- We did not take the caries status of adjacent tooth into account. This can alter the caries susceptibility and help explain the results better.
- We did not consider the overall oral hygiene status of the patients and this can potentially act as a confounder.
- Our study was a snap shot; a better design may be a longitudinal one which is also a limitation of our study.
- Single calibrated examiner made all the readings and inter-examiner reliability could not be calculated.
- Our results conflict with published data.

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### Disclaimer

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