IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 19, Issue 5 Ser.16 (May. 2020), PP 13-20
www.iosrjournals.org

Prevalence of caries in mandibular first molar and treatment needs in 15 -17 year old students in Calicut district, Kerala, India

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Abstract:
Background: *Permanent first molars occupy a strategic position in the dental arch, so it is necessary to know the caries prevalence in this tooth so that adequate measures can be taken to prevent caries progression or development of new carious lesions. No studies have been conducted till date to evaluate the prevalence of caries in first molars in Calicut district of Kerala, India. Hence, the aim of this present study was to evaluate the prevalence of caries in first molars in Calicut district in 15-17 year old students.*
Materials and methods: *This school based cross-sectional study examined a total of 3200 students after obtaining the institutional ethical clearance and permission from the school authorities. Students were examined and data was collected and recorded based on a questionnaire to evaluate the association of caries in mandibular first molar with respect to age, gender, dietary habits and location. Written consent was obtained from each student prior to the examination. All the data were entered in SPSS (18) software. Both descriptive and analytic approaches were used in data analysis. Mean and standard deviation was calculated for quantitative variables and frequency for qualitative variables. The prevalence was expressed in percentage. Chi-square test was used to compare socio-demographic characteristics and risk factors (oral hygiene practises and personal habits). The level of statistical significance was be set at $p<0.05$*
Results: *The prevalence of caries in mandibular first molars in Calicut district was 44.91%. It was also seen the prevalence of caries in mandibular first molars was equal in urban (45%) when compared with rural areas (44.5%).The prevalence of caries on mandibular first molars was more in females (47%)when compared to males (42%)and the results were statistically significant. There is no statistical significance between the prevalence of mandibular first molar caries and habits. In the sample studied, both mandibular left and right mandibular molars were equally affected by caries. It is also seen that the maxillary first molars were less affected when compared to mandibular molars.*
Conclusion: *Since first molars erupts as early as 6 years of age, sufficient dental care must be taken from childhood to improve general oral health and to prevent dental caries.*
Key Word: *Prevalence, Caries, Mandibular, First, Molar*

Date of Submission: 14-05-2020 Date of Acceptance: 29-05-2020

I. Introduction

Dental caries is a multi-factorial disease involving various factors such as diet, microorganisms, tooth morphology, saliva, environment, gender, location, dietary habits as well as genetic predisposition. The first permanent molars erupt by 6 years of age, thus becoming the earliest permanent tooth to erupt in the oral cavity. It has a strategic role in maintaining the vertical dimension of the face, mastication, and is used for anchorage in orthodontic treatments. They play a major role in occlusion and have mighty control over the teeth erupting later behind and in front of them. [(1)]The first molars are at greater risk of caries because of their special morphology like deep fits and fissures. Caries in first molar may lead to their loss, which can lead to drifting of adjacent teeth and supra-eruption of opposing teeth.[(1, 2)]

Permanent first molars occupy a strategic position in the dental arch, so it is necessary to know the caries prevalence in this tooth so that adequate measures can be taken to prevent caries progression or development of new carious lesions. Many studies [(3, 4)] have stressed the importance of oral hygiene instruction, the regular use of topical and systemic fluoride, and the use of fissure sealants in the prevention of dental caries especially on the first permanent molars.

Understanding caries patterns in mandibular first molars is important, particularly among adolescents, as several environmental and behavioral factors are associated with caries and can be prevented effectively by modifying oral health beliefs during adolescence. Hence, the aim of the present study was to evaluate the prevalence of caries in first permanent molars (FPM) in 15-17 year old students in Calicut district in Kerala state**.**

II. Materials and methods:

This cross-sectional study was part of a prevalence study on dental caries conducted in 15-17 year old students in Calicut district.

Study design: School based cross-sectional study.

Study Location: The Government higher secondary schools in Calicut district were grouped under the four taluks: Calicut, Koyilandy, Vadakara and Thamarassery taluks. Then the schools were further sub grouped under two strata: urban and rural for all the four taluks. In each taluk, two schools each were selected under urban and rural criteria based on simple random sampling (lottery method). Thus, a total of sixteen schools were selected.

Study duration: November 2019-January 2020.

Sample size: 3200 students.

Sample size calculation: The sample size was calculated on the basis of a previous study[8] using the formula-

$N=4pq/d^2$

(p =prevalence in an earlier study (50.6), q= 100-p, d= effect size 5, n=399.9 rounded to 400)

According to this formula, the sample size in each group (urban and rural) was calculated as 400 each i.e. 800 school children in one taluk. Total sample size for the four taluks together was 3200.

Subjects and selection method: The study was conducted after obtaining Institutional Ethical Committee clearance and permission from the Principals of the respective schools where the study was conducted. Written consent from the students participating in the study was also obtained.

Data collection was carried out by means of clinical examination and structured questionnaire. Participants underwent intraoral examinations performed by five trained dentists and the students had to complete a questionnaire pertaining to their oral hygiene behaviours and dietary habits.

The survey sheet also collected information on age, gender, oral hygiene behaviours such as frequency of cleaning teeth, type of dentifrice used, and use of toothbrush in cleaning. Information about daily habits such as frequency of consuming sweetened tea, snacking in between meals was also recorded. Then all the survey sheets were numbered and bundled according to the respective schools, and the bundles were also given numbers. These bundles were further segregated according to rural and urban areas. Then 1600 survey sheets each was selected from urban and rural areas each to get the required sample size of 3200.

Statistical Analysis

All the data was entered in SPSS (18) software both descriptive and analytic approaches was used in data analysis. Mean and standard deviation was calculated for quantitative variables and frequency for qualitative variables. The prevalence was expressed in percentage. Chi-square test was used to compare socio-demographic characteristics and risk factors (oral hygiene practises and personal habits). The level of statistical significance was set at $p<0.05$

III. Results

The prevalence of caries in mandibular first molars was found to be highest in Thamarassery taluk (52.25%) (Table no1). It was also seen that the prevalence of decay in mandibular first molars was equal in urban (45%) and rural areas (44.5%) in Calicut district. (Table no 2). Total first molar decay was more in 15 year age group (48.9%) ,followed by 16 year age group (46%) and least in 17 year age group 41% (Table no 3) and females showed more prevalence 47% when compared to males (42%) in the prevalence of decay on mandibular first molars (Table no 4).

Table no 1: Prevalence of caries in mandibular first molars in taluks

		Total mandibular first molars decay(36 &46)		
TALUK	**Total**	**Absent**	**Present**	**Prevalence (%)**
Kozhikode	800	486	314	39.25
Quilandy	800	482	318	39.75
Vadakara	800	413	387	48.375
Thamarasery	800	382	418	52.25
TOTAL	3200	1763	1437	44.91

Table no 2. Prevalence of mandibular first molar decay urban versus rural in Calicut district as a whole

		Total mandibular first molars decay(36 &46)		
REGION	**Total**	**Absent**	**Present**	**Prevalence (%)**
Urban	1600	875	725	45.3125
Rural	1600	888	712	44.5
TOTAL	3200	1763	1437	44.91

Table no 3: Analysis based on age

		Total mandibular first molars decay(36 &46)		
AGE	**Total**	**Absent**	**Present**	**Prevalence (%)**
15years	423	216	207	48.94
16years	1576	850	726	46.07
17years	1201	697	504	41.97
TOTAL	3200	1763	1437	44.91

Table no 4: Analysis based on sex

		Total mandibular first molars decay(36 &46)		
SEX	**Total**	**Absent**	**Present**	**Prevalence (%)**
Male	1527	880	647	42.37
Female	1673	883	790	47.22
TOTAL	3200	1763	1437	44.91

The breakdown in Table 5 shows that there is no statistical significance between the prevalence of first molar decay and habits as the p value is greater than 0.05 ,but there is a higher percentage of caries in students who snack between meals (52%), when compared to those who do not snack between meals (46.6%). The percentage of decay cases was comparatively lower in the students who do not use soft drinks (47%) when compared to those who use once a day (54.30%) and once a week (53.2%).

Table no 5: Prevalence of total first mandibular molar decay versus habits

Brushing Methods		**First mandibular molar decay**		Total	Chi square	p value
		Absent	**Present**			
Finger	Frequency	14	21	35	2.632	**0.268**
	% within Brushing aids	40.00%	60.00%	100.00%		
Brush	Frequency	1481	1681	3162		
	% within Brushing aids	46.80%	53.20%	100.00%		
Others	Frequency	1	2	3		
	% within Brushing aids	33.30%	66.70%	100.00%		
Total	Frequency	1503	1697	3200		
	% within Brushing aids	47.00%	53.00%	100.00%		
Frequency of brushing						
Once	Frequency	672	744	1416	0.26	**0.868**
	% within Frequency of brushing	47.50%	52.50%	100.00%		
Twice	Frequency	948	827	1775		
	% within Frequency of brushing	53.40%	46.60%	100.00%		
Between meals	Frequency	4	5	9		
	% within Frequency of brushing	55.60%	44.40%	100.00%		
Total	Frequency	1503	1697	3200		
	% within Frequency of brushing	47.00%	53.00%	100.00%		
Mouth wash						
Yes	Frequency	125	135	260	0.14	**0.709**
	% within Using mouth wash	48.10%	51.90%	100.00%		
No	Frequency	1378	1562	2940		
	% within Using mouth wash	46.90%	53.10%	100.00%		
Total	Frequency	1503	1697	3200		
	% within Using mouth wash	47.00%	53.00%	100.00%		
Snacking between meals						
	Frequency	837	934	1771	0.136	

Yes	% within Snacking between meals	47.30%	52.70%	100.00%		
No	Frequency	763	666	1429		
	% within Snacking between meals	53.40%	46.60%	100.00%		
Total	Frequency	1503	1697	3200		
	% within Snacking between meals	47.00%	53.00%	100.00%		**0.712**
Use of pan masala						
Yes	Frequency	7	16	23		
	% within Use of Pan Masala	30.40%	69.60%	100.00%		
No	Frequency	1496	1681	3177		
	% within Use of Pan Masala	47.10%	52.90%	100.00%	2.543	**0.111**
Total	Frequency	1503	1697	3200		
	% within Use of Pan Masala	47.00%	53.00%	100.00%		
Use of soft drinks						
Once a day	Frequency	122	145			
	% within Use of soft drinks	45.70%	54.30%			
Once a week	Frequency	828	943	267		
	% within Use of soft drinks	46.80%	53.20%	100.00%	0.388	0.824
No usage	Frequency	609	553	1771		
	% within Use of soft drinks	52.40%	47.60%	100.00%		
Total	Frequency	1503	1697	1162		
	% within Use of soft drinks	47.00%	53.00%	100.00%		

The breakdown in Table 6 shows the various treatment needs in mandibular lower molar among males and females. Females exhibited higher percentage of cases in already filled cases, cases indicated for RCT, and cases indicated for replacement when compared to males. The percentage of cases indicated for restoration and indicated for extraction were same in females and males, 3% each.

Table no 6: Treatment needs within gender in mandibular first molars

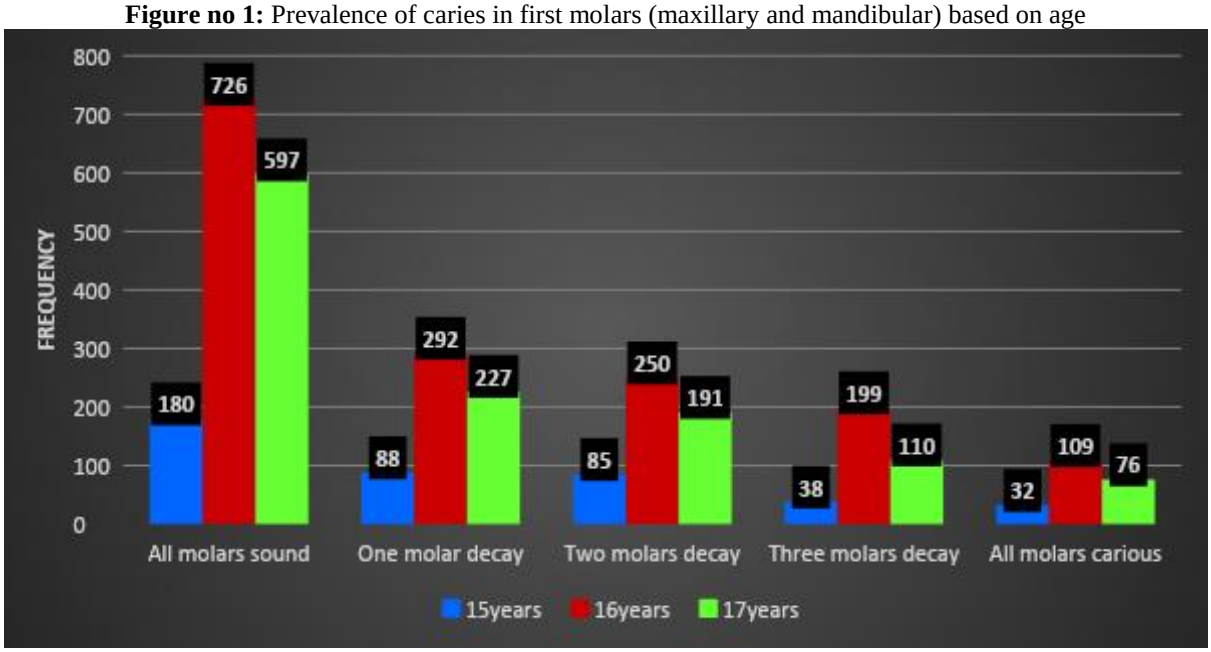
Treatment needs	Tooth No	No of cases in males (1527)	% within the total mandibular molar decay	% in males	No of cases in females (1673)	% within the total mandibular molar decay	% in females
Already filled	46	45	2.90%	8.2%	70	4.20%	12%
	36	42	2.80%		65	3.90%	
	Both 46 and 36	38	2.50%		58	3.90%	
	No filling present	1402	91.80%		1480	88.50%	
RCT Indicated cases	46	23	1.50%	2.5%	32	1.90%	4%
	36	12	0.80%		31	1.90%	
	Both 46 and 36	3	0.20%		3	0.20%	
	No RCT indicated	1489	97.50%		1607	96.10%	
Replacement indicated cases	46	22	1.40%	3%	28	1.70%	4%
	36	22	1.40%		31	1.90%	
	46 and 36	8	0.50%		9	0.50%	
	No replacement needed	1475	96.60%		1605	95.90%	
Restoration indicated cases	46	115	10%	32%	184	11%	32%
	36	164	10.70%		163	9.70%	
	46 &36	175	11.50%		201	12%	
	No restoration needed	1035	67.80%		1125	67.20%	
	46	20	1.30%		19	1.10%	

Extraction indicated cases	36	18	1.20%	3%	25	1.50%	3%
	Both 46 & 36	12	0.80%		11	0.70%	
	No extraction needed	1477	96.70%		1618	96.70%	

Table no 7: Prevalence of caries on first molars (Maxillary and Mandibular) based on age

AGE		**Total First molars decayed**					**Total**
		All molars sound	**One molar decay**	**Two molars decay**	**Three molars decay**	**All first molars carious (16,26.36 &46)**	
15years	Frequency	180	88	85	38	32	423
	% within Age	42.60%	20.80%	20.10%	9.00%	7.60%	100.00%
16years	Frequency	726	292	250	199	109	1576
	% within Age	46.10%	18.50%	15.90%	12.60%	6.90%	100.00%
17years	Frequency	597	227	191	110	76	1201
	% within Age	49.70%	18.90%	15.90%	9.20%	6.30%	100.00%
Total	Frequency	1503	607	526	347	217	3200
	% within Age	47.00%	19.00%	16.40%	10.80%	6.80%	100.00%
p-value		**0.016**					

Figure no 1: Prevalence of caries in first molars (maxillary and mandibular) based on age



From Table no 7 and Figure no 1 it was observed that out of the 3200 subjects examined all molars was sound in 1503 (47%), one molar decay was found 607 (19%),two molar decay 526 (16.40%), three molar decay 347 (10.80%),and all molars were decayed in 217 (6.80%). These findings were statistically significant as the p value was less than 0.05. It was also observed that there is reduction in percentage of caries experience on all first molars as age advances as seen in the breakdown in table 5 with values (7.60%) in age group 15 years, (6.90%) in age group 16 years and (6.30%) in age group 17 years.

Table no 8: Prevalence of caries on first molars (maxillary and mandibular) based on sex

SEX		**Total First molars decayed**					**Total**
		All molars sound	**One molar decay**	**Two molars decay**	**Three molars decay**	**All molars carious**	
Male	Frequency	751	289	235	154	98	1527
	% within Sex	49.20%	18.90%	15.40%	10.10%	6.40%	100.00%
Female	Frequency	752	318	291	193	119	1673
	% within Sex	44.90%	19.00%	17.40%	11.50%	7.10%	100.00%
Total	Frequency	1503	607	526	347	217	3200
	% within Sex	47.00%	19.00%	16.40%	10.80%	6.80%	100.00%
p-value		**0.130**					

Table no 8 shows the breakdown according to gender wherein females 44.90% all molars were sound ,19% had one molar decay, 17.40% had two molars decay,11.50% had three molars decay and 7.10 % had all molar decayed. In males 49.20% had all molars sound, 18.90% had one molar decay, 15.40% had two molars decay, 10.10% had three molars decay and all molars were decayed in 6.40 %.

Table no 9: Prevalence of caries on first molars (maxillary and mandibular) based on sex

SEX		**Total First molars decay (maxillary and mandibular)**		**Total**
		Absent	**Present**	
Male	Frequency	751	776	1527
	% within sex	49.20%	50.80%	100.00%
Female	Frequency	752	921	1673
	% within sex	44.90%	55.10%	100.00%
Total	Frequency	1503	1697	3200
	% within sex	47.00%	53.00%	100.00%
Chi square		5.741		
Df		1		
p-value		**0.017**		

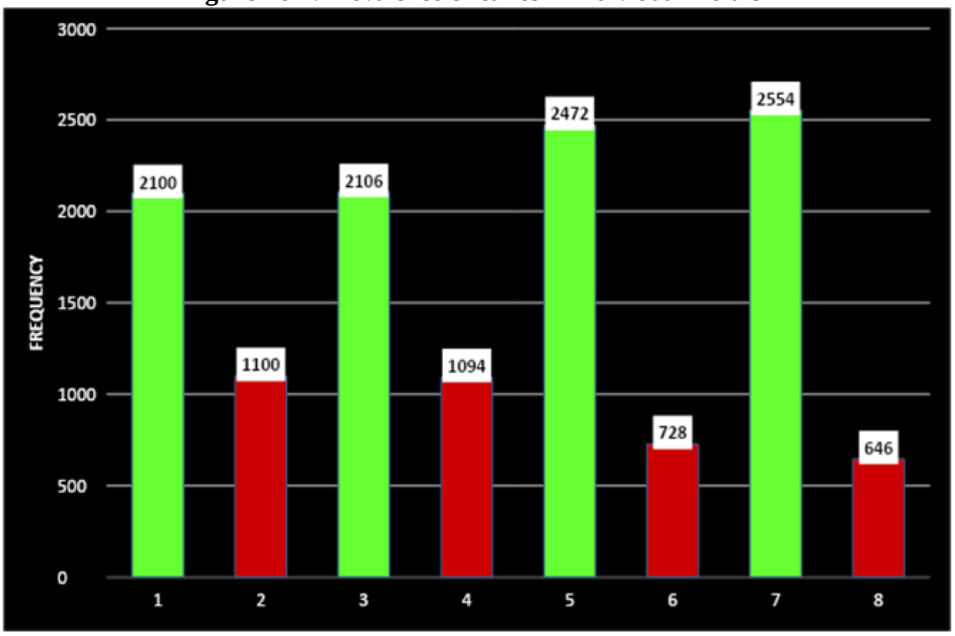
The results of Table 9 show a statistical significance since the p value was less than 0.05 when total first molar decay was analyzed with respect to gender. In males the prevalence was 50.80%and in females it is 55.10%

Table no 10: prevalence of decay in individual molars

Tooth no		**Frequency**	**Percentage**
46	Sound(no caries)	2100	65.6
	Decayed	1100	34.4
	Total	3200	100
36	Sound(no caries)	2106	65.8
	Decayed	1094	34.2
	Total	3200	100
16	Sound(no caries)	2472	77.3
	Decayed	728	22.8
	Total	3200	100
26	Sound(no caries)	2554	79.8
	Decayed	646	20.2
	Total	3200	100

Table no 10 and Figure no 2 shows that the decay on lower left mandibular molar and lower right mandibular molar were equally affected by caries in the sample studied. It is also seen that the maxillary first more were less affected when compared to mandibular molars.

Figure no 2: Prevalence of caries in individual molars



IV. Discussion

Dental caries is an infectious and transmissible oral condition and it is possible that caries in first permanent molar in addition to its proximity can initiate caries development in second permanent molar and premolars [5].The first permanent molars which erupts by 6 years of age, is the first tooth to erupt in the oral cavity. .Due to their anatomical structure, early eruption, and positioning in the mouth as well as *Streptococcus mutans* levels in the mouth, FPMs were observed to be highly susceptible to carious attack.[6] An early preventive program like application of fissure sealants and the use of fluoride among primary school children could help reduce the prevalence of caries in these teeth [7].

In our study, the prevalence of caries in first mandibular molars in Calicut district was 44.91% and there was no difference in prevalence rate of caries in first mandibular molars in comparison to urban and rural areas. This was contrary to the findings of Thushara et al [8] in which prevalence of first molar caries is high in rural (85.1) as compared to urban (81.8%).

In our study, the prevalence of caries in mandibular first molars was high in females (47%) when compared to males (42.37%). This is contrary to the findings of the study conducted by Thushara et al [8] and Hedge et al [9] where no significant difference in prevalence of caries was observed in mandibular first molars among males and females.

In the present study, it was found that in 1503 (47%)students caries was absent and in 1697 (53%) students caries was present when maxillary and mandibular first molar decay was analysed in relation to age group with more percentage of caries in first molars in 15 year age group. This finding was statistically significant as the p value was less than 0.05. It was also observed that as age advances caries rate decreased. This may be due to the increased knowledge about caries preventive programmes. On the contrary, findings by Weine reported that as the age of children increased ,they were exposed to cariogenic factors and more and more tooth became carious.[10] Previous studies by Wamakulasuriya[11] and Hunter [12]reported that aging is accompanied with increase of caries prevalence of first permanent molar among children .

Another finding in our study was the higher rate of prevalence of decay of mandibular first molars when compared to that of maxillary molars. Similar findings were observed in the study conducted by Hedge et al [9] in which mandibular molars were commonly affected than maxillary molars with a prevalence of 64%. This finding may be due to the fact that mandibular first permanent molar erupts slightly earlier than its maxillary counterpart and hence exposed to the oral environment for a longer period of time, making it more susceptible to caries than maxillary first permanent molar.

When habits were analysed with the prevalence of decay in mandibular first molars, it was found that the prevalence of decay in mandibular first molar was comparatively less in students who used brushes, brushed between meals and used mouthwash .Therefore, it can be concluded as better oral hygiene habits lead to a decrease in the prevalence of caries which was also reported in a study conducted in Italy by Petti et al. [13] in 1997 and Mitra et al [14] in 2014.

When the various treatment needs in mandibular lower molar among males and females were analysed it was observed that females exhibited higher percentage of cases in already filled cases, cases indicated for RCT, and cases indicated for replacement when compared to males.

Summary

When the prevalence of caries in mandibular molars were analysed the results obtained are as follows:

- Prevalence of decay in mandibular first molars in Calicut district was 44.91%and found to be highest in Thamarassery taluk (52.25%) when compared to the other taluks.
- It was also seen the prevalence of decay in mandibular first molars were equal in urban (45%) when compared with rural areas (44.5%) in Calicut district.
- Total first molar decay was more in 15 year age group (48.9%), followed by 16 year age group (46%) and least in 17 year age group (41%)
- Prevalence of decay on mandibular first molars was more in females (47%) when compared to males (42%)
- When total first molar decay (tooth number 16,26, 36 and 46) were analyzed with respect to gender, the prevalence was 50.80% in males and in females it is 55.10% this result is statistical significant since the p value was less than 0.05
- There is no statistical significance between the prevalence of first molar decay and habits as the p value is greater than 0.05 ,but there is a higher percentage of caries in students who snack between meals (52%) when compared to those who do not snack between meals (46.6%). the percentage of decay cases was comparatively lower in the students who do not use soft drinks (47%) when compared to those who use once a day (54.30%) and once a week (53.2%).
- In the sample studied, both lower left mandibular molar and lower right mandibular molar were equally affected by caries. It is also seen that the maxillary first molars were less affected when compared to mandibular molars.

- When various treatment needs in mandibular lower molar among males and females were analysed females exhibited higher percentage of cases in already filled cases, cases indicated for RCT, cases indicated for replacement when compared to males. The percentage of cases indicated for restoration and indicated for extraction were same in both females and males 3% each

V. Conclusion

First permanent molars are very important teeth in the mouth for maintaining the integrity of the dental arches and therefore they need special attention during dental examination. The earlier the child visits the dentist, and adopts preventive strategies including fissure sealant, topical fluoride applications, and meticulous home care greater his or her chance exists of being free of caries. Restorative and preventive regimens for teeth must be based on frequent recall examinations of not more than 6 monthly intervals to reduce dental decay and further caries progress in the FPMs among children. Oral health education should be raised in the community through oral health campaigns. Adequate access to public preventive and restorative dental programs and services should be ensured for all the children

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Dr.Elizabeth Prabha James, et. al. "Prevalence of caries in mandibular first molar and treatment needs in 15 -17 year old students in Calicut district, Kerala, India." *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, 19(5), 2020, pp. 13-20.