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Pattern of Dental Caries Experience in Turkish Young Adults in Different Risk Groups

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Abstract
Background: *Detailed knowledge of caries pattern is important since specific patterns of attack might indicate a distinct etiology and it is a useful source of reference for dental administrators in deciding which preventive strategies to use*
Objective: *The aim of the present study was to investigate in detail the distribution of caries lesions among tooth types and surfaces in the permanent dentition a young Turkish adult population with different risk levels.*
Materials and methods: *This study was carried out on 600 young adults (18-24 years old) of both genders between April 2012 and September 2013. Examinations were performed with dental mirrors and blunt, sickle-shaped explorers under a dental chair light, according to WHO recommendations. Caries experience was assessed at patient, tooth and surface levels. The subjects were categorized into three groups: low caries experience (LC), moderate caries experiences (MC) and high caries experience (HC) according to DFS index of persons. The range of DFS scores 0–3, 4-7 and ≥8 for the LC, MC and HC groups respectively. Caries experience is reported as decayed and filled teeth (DFT) at tooth level. Chi-square test was used for statistical analyze.*
Results: *Caries prevalence was 83.7% in subjects, 15.7% in teeth and 4.2% in all surfaces. The mean DFT was 4.4 and the mean DFS was 6.1 in this population. The number of subjects was 191, 198 and 211 for LC, MC and HC groups respectively. Females showed a higher incidence of caries than males (p <0.05). Caries distribution was higher in maxilla (54%) than in mandible (46%). The highest caries rate was found in posterior teeth (94%) in both jaws. The most commonly affected teeth were first molars an all risk groups. The most commonly affected surface was occlusal in total.*
Conclusions: *Occlusal surfaces of molar teeth are highly suspected for dental caries in this young adult population. The preventive strategies should focus on prevention of plaque accumulation due to anatomic liability*
Keywords: *Dental Caries, DMFT, Turkish Young Adults, Caries Prevalence, Oral Epidemiology*

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I. Background

The need for specific population-based oral epidemiological studies has long been advocated to determine the oral health needs of a population, set targets for the future, and to plan oral health services appropriately. In spite of the limitations of our ability to accurately detect all carious lesions, we must use the best evidence to classify the caries risk of individual patients and offer the most beneficial treatment tailored to a given level of current risk and probable future risk. It has been well established that information regarding a subject's caries pattern may provide insight on the etiology of dental caries (1). Detailed knowledge of caries pattern is important since specific patterns of attack might indicate a distinct etiology and it is a useful source of reference for dental administrators in deciding which preventive strategies to use (2). Up to now, literature has focused mainly on differences in the pattern of caries distribution in the permanent dentition between different age groups within the population (3, 4). Changes in disease pattern in the same population after a follow-up period have been studied as well (5,6).

However, the dental caries situation among adults is generally disappointing, as it tends to be in the worldwide population. The susceptibility of different tooth surfaces to dental caries is markedly different, with the pit and fissure (occlusal) surfaces the most susceptible and the smooth (labial and lingual) surfaces the least susceptible. (7,2). The most frequent sites of attack are the occlusal surfaces of the first and second permanent molars (2). In a longitudinal study of young adults 14–25 years of age, it was found that occlusal surfaces on

molars and premolars accounted for 60% of the total DMFS score. (8). Berman and Slack (1972) found that occlusal caries was a problem in the initial years after tooth eruption, and that aproximal caries became more prevalent than occlusal caries after 14 years of age (6).

Due to the complete lack of oral health information on young adults, it is impossible to understand the dramatic changes in oral health status from childhood to adulthood (9). Therefore, it is of great importance to collect oral health information on young adults. Although some studies have been conducted among young adults such as 18 year-olds in Brazil, China and Iran which these studies mostly have reported dental caries, periodontal disease and malocclusion. (9-11). More epidemiological studies are still necessary to evaluate the caries status (such as prevalence or surface distribution of dental caries) in especially young adult population and to establish preventive measures and treatment planning. No study has been published regarding caries pattern in different risk groups of young adults.

II. Objectives

Therefore the aim of the present study was to investigate in detail the distribution of caries lesions among persons, tooth types and tooth surfaces in the permanent dentition of young Turkish adults with different risk levels.

III. Patients And Methods

A cross-sectional study was conducted on Konya, Turkey. Ethical approve was obtained by ethical committee of Dentistry Faculty of Selcuk University (2012/8-19) and informed consent was obtained from all participants. The study was performed from April to September 2013. A total of 600 (352 female and 248 male) young adults 18-24 years old participated in this study. Selection of subjects for the study was done by simple random sampling method after obtaining a list of 18-24 years old residing in the city. The total number of young adults at the age of 18-24 years was 198.328 in Konya. To calculate the probability sample, we adopted a 95% confidence interval level, 20% accuracy and design effect of 2. We used the simple formula to determine the sample size as follows: $n = \frac{t^2_{\alpha/2} pq}{d^2}$. Although the formula gave us approximately 512 participants we decided to increase the sample size to increase the power of the study and to get more accurate results. On the other hand, sample size with considering 10-15 percent attrition is equal. Examinations performed in three different oral health centers. The exclusion criteria for patients were with: [1] systemic problem, [2] undergoing fixed orthodontic treatment, [3] missing teeth, [4] with extreme plaque accumulation and periodontal problem. The patient's systemic problem was identified at dental hospital recording system. We did not record the missing teeth for statistical evaluation, however, this was not considered to be a significant problem, because only 78 teeth (0.046%) were excluded as missing in the sample population of 16782 teeth, mostly molars.

The distribution of dental caries at patients, tooth and tooth surface levels were determined using clinical and radiographic examinations. Clinical examination was made using a plane mouth mirror and blunt, sickle probe with the aid of a dental chair light on dried teeth by one calibrated examiner (S.K), who had undergone training and calibration exercises. To gauge the validity and consistency of the study design, a pilot study was designed and carried out on 40 subjects before planning the final study. Examinations were performed according to the criteria of (12) World Health Organization (WHO). The sickle probe was used to remove debris, check restoration margins and detect cavitation. In clinical examination, diagnosis of caries was made only when there was clear evidence of loss of tooth substance. White or brown spots in enamel in the surfaces of which remained intact and glossy were not considered to be caries. Caries were recorded as present when a lesion in a pit or on a smooth tooth surface had a detectably softened floor, undermined enamel or softened wall. Stick and discolored fissures were accepted as caries only if there was clear evidence of cavitation beginning below the fissure (3).

The digital bitewing images were obtained using the same intraoral unit (Trophy CCX Digital periapical X-ray Machine, France) using number 2 Digora phosphor plates at 65 kV, 8 mA. After the plates were exposed, plates were processed by Sorodex Digora Optime, France. The clinical and radiographic data were recorded separately for each subject by the same examiner. All radiographs included mesial surface of the first premolar and the distal surfaces of the second molar and no artifacts, position or processing errors. All approximal surfaces can be observed clearly in bitewings. Dental caries was recorded from the radiographs at the enamel and dentine level for approximal surfaces, and at the dentine level for occlusal surfaces, using the following codes: 1, radiolucency in outer half of enamel; 2, radiolucency in inner half of enamel; 3, radiolucency just penetrating into dentine; 4, radiolucency in outer half of dentine; and 5, radiolucency in inner half of dentine (5). Radiographic caries is reported in this paper for codes 3, 4 and 5 (D3 threshold). To assess the reproducibility of the diagnostic criteria application, the intra-examiner calibration was performed. An intra-examiner test was conducted by re-examining 20 randomly selected subjects 2 weeks after the first examination.

The level of intra-examiner agreement was measured using Cohen's kappa statistics. Intra-examiner agreement for caries detection was good with a Kappa value of 90%.

Caries experience at patient level; Caries experience is reported as DFS to assess the patient's risk level, based on combined clinical and radiographic findings. They were allocated to three different groups, based on their caries experience. Subjects with a DFS score between 0 and 3 formed as LC; those with DFS-score between 4 and 7 formed the MC; and those with a DFS-score of at least 8 formed the HC groups.

Caries experience at tooth level; Teeth with carious lesions and teeth with restorations were accepted as decayed and filled teeth (DFT). The DFT index was calculated as the summation of the decayed and filled teeth. A maximum of 28 teeth were examined per subject for dental caries.

Caries experience at tooth surface level; Caries experience is reported as decayed and filled surfaces (DFS) only for existing teeth to assess the pattern of caries experience, as there is no way of assessing the distribution of surface susceptibility for missing teeth. The mean of DF surfaces was calculated from the number of surfaces available for examination for five surfaces for molars and premolars (distal, mesial, occlusal, buccal and lingual/palatinal), and four surfaces for canines and incisors (distal, mesial, buccal and lingual/palatinal). The third molars, congenitally missing or extracted teeth were excluded from data collection. Therefore, a maximum of 140 surfaces of teeth were examined per subject for dental caries. Descriptive Statistics was used in statistical analysis. Chi-Square test was used to compare;1) prevalence of outcome between male and female, 2)caries pattern of different risk groups. Mann-Whitney U test was used for evaluate differences of non-parametric means (SPSS 17.0 for Windows).

IV. Results

83910 teeth surfaces at 16782 teeth of 600 young adults were examined in total. The results of this study showed that the mean DFT score was 4.4 and the mean DFS score was 6.1 in this population. In Table 1, DFT and DFS values of both genders were presented. Of the 600 subjects examined, 502 (83.7%) had caries or filling, and only 16.3% of the subjects were both clinically and radiographically caries free. Of those subjects diagnosed with caries, 296 (59%) were female and 206 (41%) were male. There was statistical significant difference in the prevalence of caries between male and female groups (P=0.033). The distribution of subjects according to gender in different risk groups are shown in Table 1.

Caries prevalence at different tooth level according to different risk groups is presented in Fig 1. The prevalence of caries teeth was 15.7%. No significant differences were found between the left and right side of the dentition (P=0,987). The results of the present study showed that caries distribution was higher in maxilla (54%) than in mandible (46%). The highest caries rate was found in posterior teeth (94%) in both jaws. Caries lesions were not evenly distributed among different tooth types. The most commonly affected teeth were first molars, (45.7% of the overall sample). Regarding the distribution of caries within all teeth, the mandibular and maxillary first molars were most prone to caries at 24% and 21.7% respectively, while the mandibular canines were least prone teeth (0.05%). The distribution of caries teeth according to jaw is shown in Table 2.

Caries prevalence at the level of individual tooth types is presented in Fig 2 and 3. No significant differences was found between risk groups according to teeth surface pattern (P=0.356), but significant differences was found between risk groups according the number of teeth surface affected by dental caries (P=0.000). In total, occlusal surface was the most affected area in caries development (46.8%). According to the Figure 2, distal surface (37.5%) was more susceptible to the caries than mesial surface (32.2%) in maxillary anterior teeth. Nevertheless, mesial surface of maxillary lateral incisors was the most affected approximal area contrary to central incisors and canines. Palatinal surface of maxillary lateral incisors (21.6%) is also susceptible the caries development in anterior region of maxilla. In maxilla, the frequency of caries was the lowest in canines. Although distal surface (54.5%) was the most affected area in premolars, occlusal surface (56.1%) was the most commonly affected in molar teeth. Palatinal region of maxillary both molars (9.6%) was the more susceptible to the caries development than buccal surface as in anterior teeth. Previous data was effectual for all risk groups.

The results of the present study showed that mandibular central incisors were least like to be caries teeth, while maxillary and mandibular molars were the most likely. Even though distal surface was the most commonly affected area in premolars (63.2%), occlusal surface was the most susceptible (59.2%) surface in molars. Previous findings were similar with the findings of maxillary teeth. However distal surface was the more commonly affected approximal area in mandibular first molars (14.1%), caries number was higher in mesial surface in mandibular second molar teeth (17.8%). Contrary to the maxillary teeth, buccal surface (12.3%) was more susceptible to the caries than palatinal surface in mandibular teeth. Previous data was effectual for all risk groups. The pattern of dental caries was the same, independently risk groups. On the other hand, more occlusal and approximal caries lesions was formed when risk group is increased.

V. Discussion

Reports about caries distribution in young adults (18 to 24 years old) are rare (5). There were two studies in the literature which include a wide age range (3, 4). However, in these studies, different risk groups in special age group were not assessed. Therefore present investigation is unique that evaluate caries pattern in different risk groups in the literature. The results of the present study showed that the overall prevalence of dental caries amongst young subjects is relatively high in this young adult population. However, exact comparison with other studies was limited because no data were reported about detailed caries distribution in this age range in both genders with different risk groups.

A 83.7% overall caries prevalence was observed in this report. The caries prevalence in present study was similar to the findings of investigations on Turkish (87% for 15-18 years old) (13) and Brazilian (81% for 18 ages) populations (14). The caries prevalence of our sample was higher than the findings of Kelly et al. (2000). They indicated that caries prevalence was 51% among UK people with 16 to 24 years age (15). Among the young adults, the variation in caries prevalence in different population can be resulted from the differences in diet, using topical fluorides, preventative strategies, brushing habits, demographic and socioeconomic status and behavior and attitudes concerning oral health.

In agreement with most studies, it was found in our study that the experience of caries was higher in females than males (16, 17). This is in contrast to other report which performed in Istanbul, Turkey in 2001 (13). García-Cortés (2009) et al reported more caries experience for Mexican young females (16). In many cultures historically, females have been the family member with the responsibility of food preparation. This would allow easier access to foods and snacks outside of mealtime, which provide bacteria in their oral flora with more substrate for caries development. Evidences has been provided to demonstrate that caries risk factors for females include a different salivary composition and flow rate, hormonal fluctuations, dietary habits, genetic variations, and particular social roles among their family. (18).

The mean DFT index found (4.4) in the present study is in to the range for young adults. Caries experience is reported as decayed and filled surfaces (DF) only for existing teeth to assess the pattern of caries experience, as there is no way of assessing the distribution of surface susceptibility for missing teeth (4). The World Health Organization (WHO) defined the acceptable dental health status in terms of DMFT index for adults as 4 for age 18 years old. It was reported that DMFT index of 2766 Turkish male recruits with the age of 20 was 5.97 (19). It was reported that DMFT index were 3.59 and 4.63 for 17-20 years old and 21-25 years old Australian populations respectively (20). The mean DMFT in 16-24 year old United Kingdom young adults was reported 10.8 at 1998 (15). Differences in DMFT score between studies may be explained by the differences in diagnostic criteria used, as well as varying socio-economic, cultural and geographical factors, brushing and nutrition habits of populations.

The results of the present study showed that mandibular central incisors were least like to be caries teeth, while maxillary and mandibular molars were the most likely. Caries are also more prevalent in maxillary teeth than in mandibular teeth (3, 21). The results of our study showed that caries was also more prevalent in maxillary teeth than in mandibular teeth (Table 2). These results are also in accordance with other studies (3). According to results of present study the most affected teeth were mandibular molar and the least affected teeth were mandibular canines and these results are comparable with those obtained by other authors (21, 22). According to this finding, although the caries is a multifactorial disease, anatomical structure may be considered as the dominant etiological factor in caries development process. The mandibular anterior teeth are probably more resistant to caries because of their close proximity to the secretions of the submandibular salivary glands. On the other hand, easiness of brushing of mandibular anterior teeth can be protective factors to development of caries lesions (23, 24).

The first molar tooth was the most susceptible to dental caries in the present study for all risk groups. The finding of this study is accordance with the literature (5). According to this finding, the effect of first molars is great in increasing of DMFT values of subjects. This mean that even tough, the cultural, economic, dietary and brushing habits are dissimilar for different populations, first molars are the most affected teeth in dentition for populations. The reasons for the high caries prevalence in the first molar teeth could be due to various reasons such as the deep pits and fissures on the occlusal surface, the large-sized crown which leads to accumulation of acid produced by bacteria, and the early eruption of the tooth.

In this study, it was found the occlusal surface was the most commonly affected area in total. Earlier studies was also reported the same finding (2-5). In addition, it was also reported that distal surfaces were the most susceptible surfaces in all premolar teeth. The results are also in accordance with the literature (3,7). It was reported that not all interproximal surfaces were equally susceptible, and in particular, distal surfaces of both maxillary and mandibular second premolars were at least three times more likely to decay than other premolar interproximal surfaces (7). In maxillary anterior teeth, although approximal caries lesions tend to be located in distally in total, approximal lesions were higher in mesial surface in maxillary lateral incisors in present sample. The results of the present study were comparable to those of other studies with respect to approximal caries (3,

7). It was also shown in another study that distal surfaces of the first molar were more prone to caries than mesial surfaces of the second molar in young adults (25, 26). It was reported that neighboring approximal tooth surfaces differed in caries susceptibility, implying that one surface may show obvious radiographic signs of caries, while the neighboring surface does not (2, 3). Even though palatinal surface of maxillary first molars was commonly affected buccal surface of mandibular first molars was more susceptible to the caries. This is in accordance with the findings of Demirci et al. (3).

According to these findings, the characteristics of specific age groups at surface level should be taken into consideration in detection and prevention of caries lesions. In young adults, distal surface of premolars, mesial surface of maxillary molars, palatinal surface of maxillary first molars, buccal surface of mandibular first molars are prone to caries frequently. Mesial surface of maxillary lateral incisors and distal surface of mandibular first molars require a special attention in diagnostic and preventive procedures because of the different characteristic of caries location.

The one of aim of this investigation was determine whether the distribution of caries at tooth and surface levels showed any differences. As a result, the treatment and preventive strategies could be specialized according to these differences. In this study, DFS index was used to compose of different risk groups for caries development in young adults. DFS index is based on numeric values of carious and filled tooth surface. It was found that there was no difference among the risk groups about the distribution characteristics of caries at surface and tooth levels. On the other hand, more occlusal and approximal lesion was observed in high risk groups.

VI. Conclusion

Mandibular central incisors are least likely to experience caries, while maxillary and mandibular molars demonstrate the highest caries rates. Furthermore, maxillary teeth are more susceptible to caries than mandibular teeth. On the other hand, occlusal surfaces in molars show the highest caries rates. The role of anatomic characteristics of tooth may be more important in caries etiology. The preventive strategies should focus on prevention of plaque accumulation due to anatomic liability.

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[27]. Figure legends

[28]. **Figure 1:** Caries distribution of maxillary and mandibular teeth according to different risk groups (Number of affected surface is presented for figures)
[29]. **Figure 2:** Caries pattern according to tooth surface for each tooth in maxilla. (Number of affected surface is presented for figures)
[30]. **Figure 3:** Caries pattern according to tooth surface for each tooth in mandible. (Number of affected surface is presented for figures)
[31]. **Table legends**
[32]. **Table-1:** The presentation of caries, mean DFT and risk groups in relation to gender.
[33]. **Table-2:** Number and percentage of teeth that affected caries according to the jaw. Teeth on left and right sites have been combined in the table.

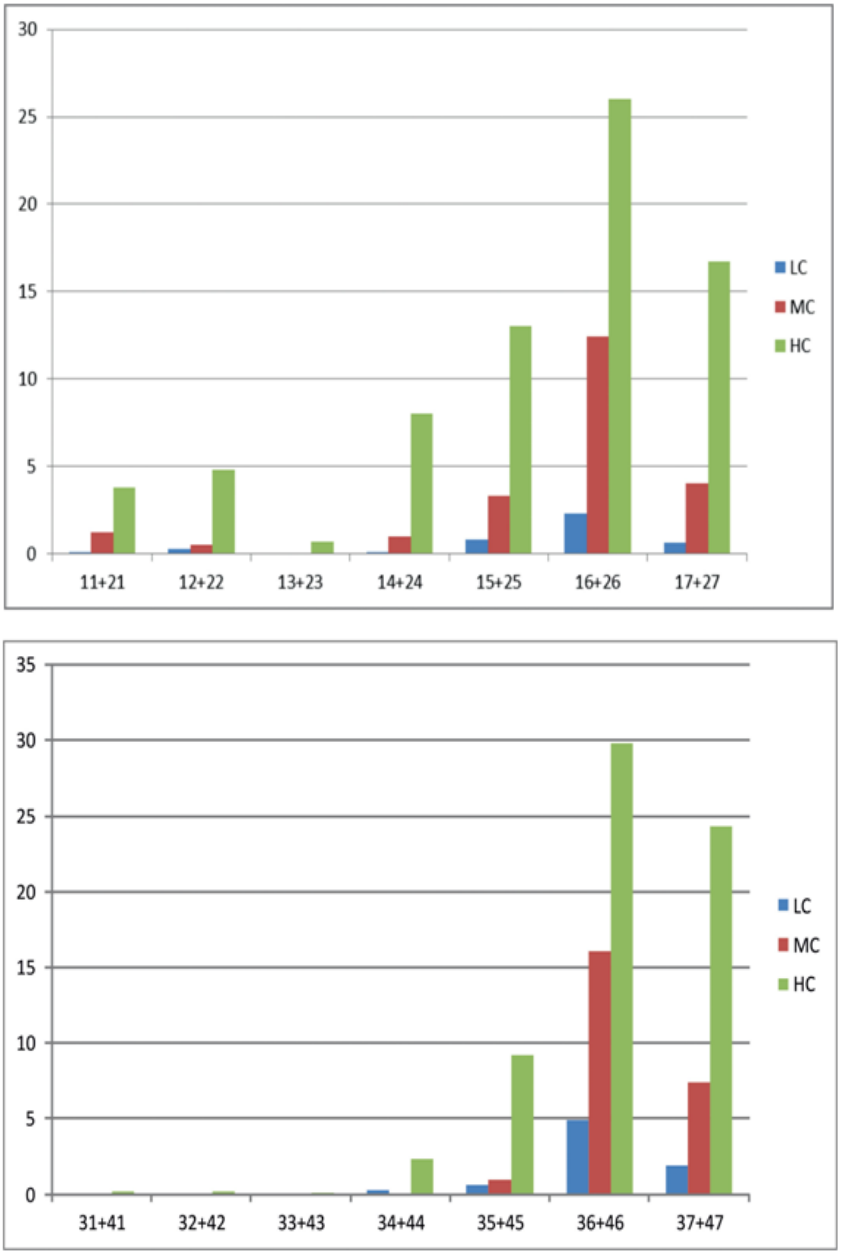
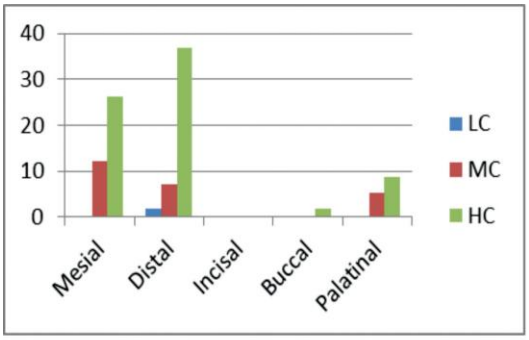
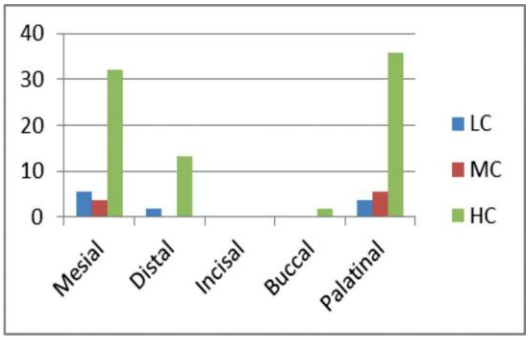


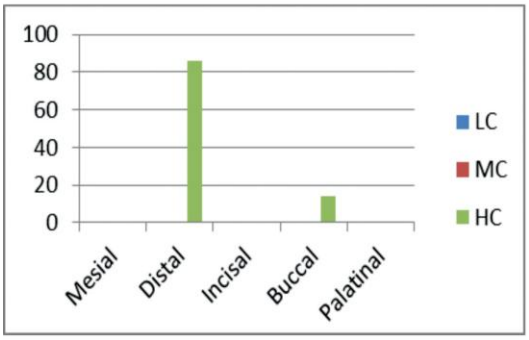
Fig: 1



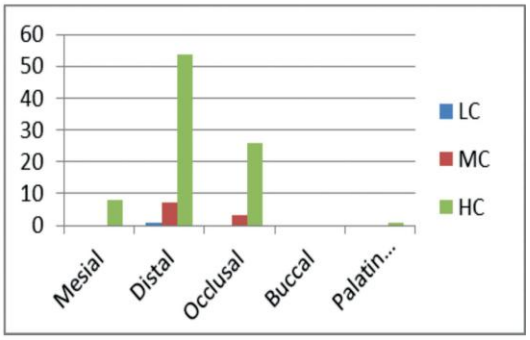
Upper central incisors



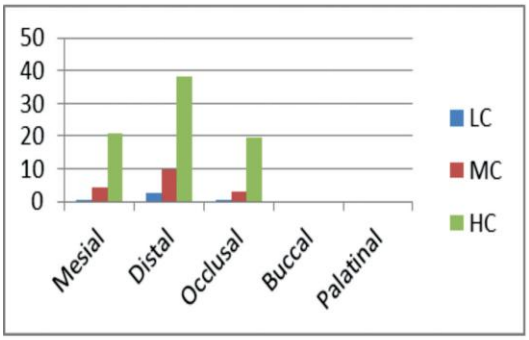
Upper lateral incisors



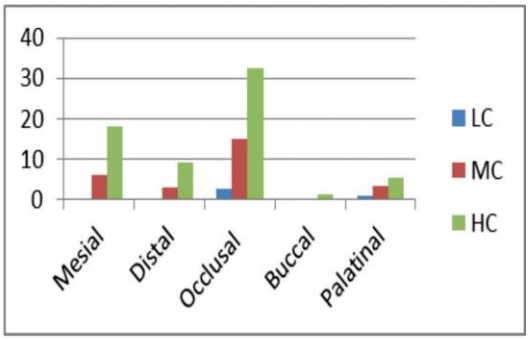
Upper canines



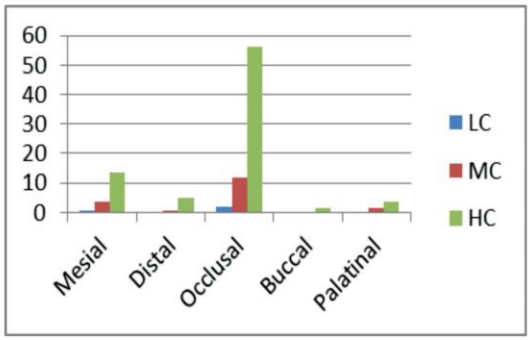
Upper first premolars



Upper second premolars

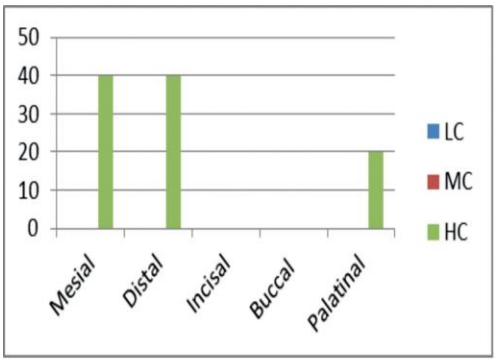


Upper first molars

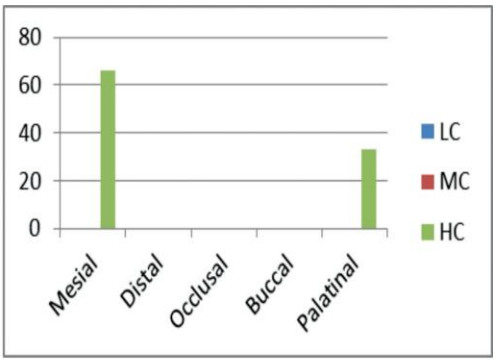


Upper second molars

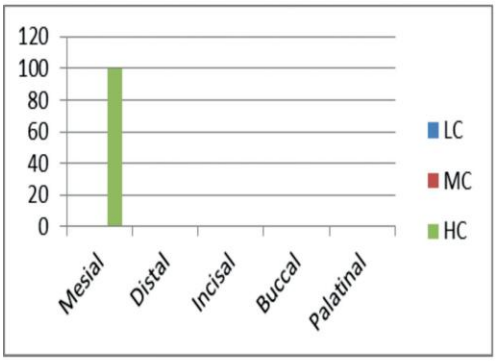
Fig 2



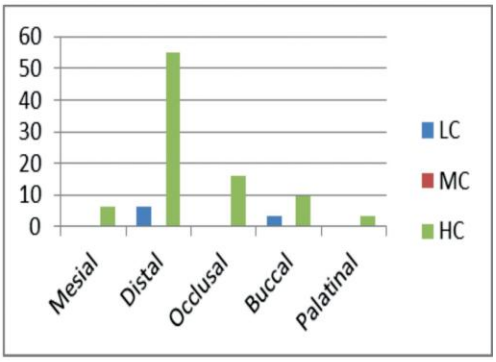
Lower central incisors



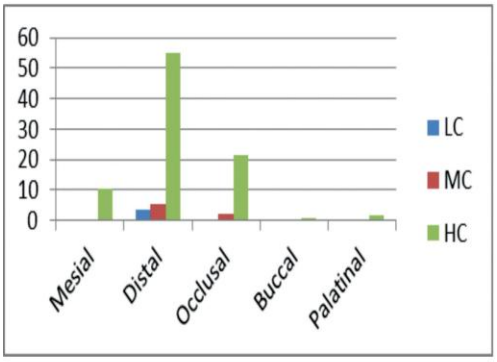
Lower lateral incisors



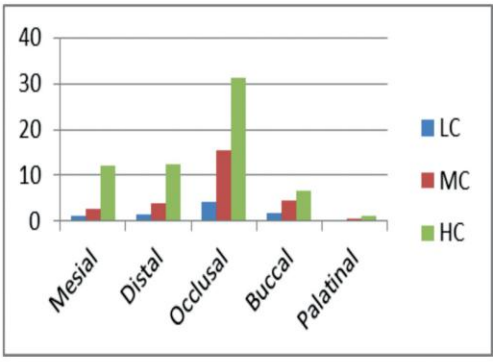
Lower canines



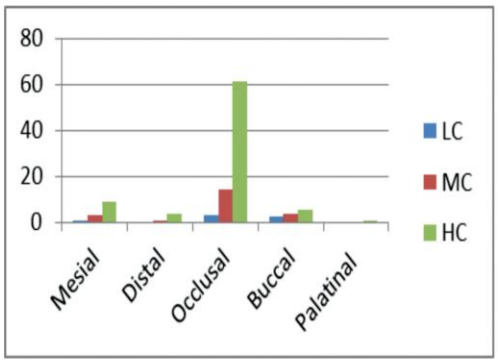
Lower first premolars



Lower second premolars



Lower first molars



Lower second molars

Fig 3

		Number and percentage % of subjects		Mean±SD		Risk groups		
		Caries free	**Caries or Filling**	**DFT**	**DFS**	**LC**	**MC**	**HC**
Gender	***Male***	42 (42.8%)	206 (41%)	4.21±3.72	5.98±5.06	82 (42.9%)	85 (42.7%)	81 (38.2%)
	Female	56 (57.2%)	296 (59%)	4.54±4.13	6.15±6.94	109 (57.1%)	113 (57.3%)	130 (61.8%)
	Total	**98 (16,3%)**	**502 (83,7%)**	**4.4±4.02**	**6.10±6.43**	**191**	**198**	**211**

Table 1

Teeth Type	Jaws	
	Maxilla (%)	**Mandible (%)**
Central incisors	74 (2.7)	3 (0.1)
Lateral incisors	75 (2.8)	3 (0.1)
Canines	11 (0.3)	2 (0.05)
First premolars	132 (4.9)	31 (1.2)
Second premolars	248 (9.2)	147 (5.6)
First molars	576 (21.7)	628 (24)
Second molars	305 (11.4)	405 (15.7)
Total	**1421 (54)**	**1219 (46)**

table 2

*Said Karabekiroglu. "Pattern of Dental Caries Experience in Turkish Young Adults in Different Risk Groups." IOSR Journal of Dental and Medical Sciences (IOSR-JDMS) 16.9 (2017): 89-97