Influence of the Quality of Root Canal Treatment and Crown Restoration on the Prevalence of Apical Periodontitis

Original Article

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Abstract

Introdouction:

The high prevalence of apical periodontitis (AP) of endodontic origin raises an important public health problem. Root canal treatment (RCT) and crown restoration (CR) have an effect on its prevalence. This cross-sectional study was performed to assess the effect of RCT and CR on the prevalence of AP.

Materials and methods:

Two observers assessed 608 teeth with RCT belonging to patients who were referred to the radiology ward of the dental school at the Shahid Sadoughi University of Medical Sciences, Yazd, Iran, in 2011–2012 in the form of 152 panoramic radiographs. The quality of RCT, including length/density of root restoration, and crown restoration and the prevalence of AP were recorded from patients' medical files. Data were analyzed by chi-square test, one-way ANOVA, and logistic regression model using SPSS (ver. 19).

Results:

The frequency of AP in teeth with RCT was 50.5%. Appropriate CR and RCT was observed in 348 (57.2%) and 168 (30.6%) of teeth, respectively. Furthermore, 36.8% of teeth with appropriate and 68.8% with inappropriate crown restoration showed AP, and the difference was significant ($p < 0.001$). Prevalence of AP was significantly lower in teeth with acceptable RCT than in those with unacceptable RCT ($p < 0.001$). Teeth with unacceptable RCT/CR showed AP 6 times more frequently than teeth with acceptable RCT/CR.

Conclusion:

The findings showed that a considerable number of teeth in Yazd had RCT/CR with unacceptable results and that the quality of both RCT and CR may affect the prevalence of AP. Therefore, considerable efforts are required to improve endodontic and restorative treatment standards.

Key words:

•Root Canal Therapy •Tooth Crown •Periapical Periodontitis •Radiology

Introduction

Apical periodontitis (AP) is a multi-factorial disease mostly caused by bacteria.[1] The disease results from the reaction of periapical tissue to mild irritations, such as pulp necrosis or inappropriate root canal treatment (RCT).[2] RCT is done to prevent AP and to create an appropriate condition for apex healing [3-5], although some RCTs may not be successful because of technical errors or difficulty in applying cleaning devices to the root canal.[6, 7] The prevalence of AP in teeth with RCT is about 24.5%–65.8% [5, 7-9]; however, its prevalence in teeth without RCT is about 4–9%.[9-12]

Panoramic radiography has been used in some studies because of its high validity and low patient exposure.[13-17] Various indices are used for radiographic assessment of the quality of root canal and crown restorations and the condition of teeth apices.[18-20] The periapical index (PAI) is one of the indices used as a reference for the assessment of AP.[20]Some studies have assessed the role of coronal sealing on apex healing.[9, 11, 16] Penetration of saliva from the crown to the interior of the tooth that has received RCT creates a damp environment that is suitable for the growth of bacteria.[8, 21, 22]

Considering the importance of crown and root canal treatment and its association with AP, this study was designed to assess the prevalence of AP and its association with the quality of root and crown restorations in patients referred to the oromaxillofacial radiology ward of dental schools.

Materials and Methods

A total of 608 teeth with RCT in 152 digital panoramic radiographs, obtained in 2011–2012, were randomly selected. The subjects, who were referred to the dental school for the first time, were included in the study and those younger than 18 years old, possessing lesser than 10 teeth, and having had an RCT in the last year were excluded from the study. Additional exclusion criteria were systemic disease, pulp stone, teeth with post and core, and extreme premolar overlap in the radiography. Anterior teeth were not included in our study because of vertebra column superimposition in panoramic view on the anterior site. Differentiation between scar and apical periodontitis was obtained from the patients' history. The study was approved by the ethics committee of the Shahid Sadoughi University of Medical Sciences (ethical code 138846). Radiographs were obtained by a digital device (Proline XC, Planmeca, Helsinki, Finland) under the following exposure parameters: exposure: 66–70 KVP, intensity: 8–10 mA, and duration: 10–12 s). Images were observed on a computer by Romexis 2.9.2 Planmeca software. The monitor size was 17 inches with 1024-pixel resolution. The contrast and brightness of the monitor was set by the observers, who were an oromaxillofacial radiologist and an endodontist. For consistency, 30 panoramic radiographs were reviewed and reported upon by both observers separately. Then, all radiographs were interpreted by the shared opinion of both observers. Teeth in which the root or pulp chamber were radiopaque were considered as being RCT. Length and density of root treatment, the overall quality of root treatment according to length/density, the quality of crown restoration, presence of AP, and its score (Table 1) were also assessed. The periapical situation of teeth was scored with the PAI index and the teeth were divided into 5 groups [25]. A score of 3 or higher was considered to be AP. Because this study was conducted according to the radiographic findings, leakage was not assessed.

Data were analyzed with SPSS using the chi-square test, Fisher's exact test, and logistic regression model. Level of significance was set at $p < 0.05$.

Results

This study was conducted on 3936 teeth from 152 subjects. 608 teeth (15.41%) had RCT. Table 2 shows the frequency distribution of subjects in different age groups. RCT teeth with AP were less frequent in males (30.2% vs. 69.7%). The oral hygiene of the selected population and the number of remaining and lost teeth are shown. Table 3 shows the frequency of RCT teeth and RCT teeth with AP. Table 4 shows the condition of the tooth restorations in terms of length and density. We found a significant association between the frequency of AP and length/density of canal in RCT teeth ($p < 0.001$) (Table 5).

Table 6 shows the multiple logistic regression analysis for the effect of two independent var-

iables (i.e., appropriate length and density) on periapical condition. Teeth that had acceptable RCT with adequate length/density were tested against any other combination of unacceptable RCTs (Table 5). Both length and density were found to be adequate in 186 teeth; 29.6% of these teeth had AP that was significantly lesser than any other combination of parameters ($p < 0.001$). In cases of unacceptable RCT, AP was present in 59.7% of teeth. Furthermore, the association between quality of CR and AP is presented in Table 5. Apical periodontitis was significantly less present in properly treated teeth, compared with teeth that had been treated improperly ($p < 0.001$).

The parameters for the combined quality of CR and RCT are also shown in Table 5. Both of these variables were adequate in only 19.9% of the teeth studied, and approximately one-sixth of these teeth (19%) had AP. When tested against other combinations of the quality parameters, RCT/CR was significantly less than acceptable ($p < 0.001$). Table 7 shows the multiple logistic regression analysis for the effect of two independent variables (RCT and CR quality) on periapical condition. The odds of AP/normal periodontal status in cases with both unacceptable RCT and CR was more than 6 times greater compared with cases with acceptable RCT/CR.

Table 1. Radiographic variables and diagnostic categories

Parameters	Registration and codes
Apical periodontitis[20]	1 = Absence (Normal periapical structures (score 1); or small changes in bone structure (score 2)
	2 = Presence (Changes in bone structure with some mineral loss (score 3); apical periodontitis with a well-defined radiolucent area (score 4); or extensive/severe periodontitis with exacerbating features (score 5)
Length of root filling[10]	1 = Adequate (<2 mm from, or flush with, the radiographic apex)
	2 = Inadequate (>2 mm from the radiographic apex or overextended)
Density of root filling[24]	1 = Adequate (Uniform density and adaptation of the filling to the root canal walls)
	2 = Inadequate (visible canal space laterally along the filling; voids within the filling mass; or identifiable untreated canal)
Coronal restorations[21]	1 = Adequate (radiographically intact restoration with no signs of leakage)
	2 = Inadequate (radiographic sings of overhangs, open margins/ recurrent decay, or no coronal restoration)

[a] if a multirooted tooth presented with different periapical statuses at different roots, the root canal with the most severe periapical condition was categorized.

[b] In cases of multirooted teeth, not all root canal fillings of such teeth were assessed separately; only the canal with the worst technical obturation quality was evaluated.

Table 2. Frequency distribution of remaining and lost teeth in different age groups

			Percent						
	Age group	Number	5	10	25	50	75	90	95
Remaining teeth	≥20	3	28.0	28.0	28.0	28.0	28.0	28.0	28.0
	21–30	50	23.0	26.0	27.0	28.0	28.0	28.0	28.0
	31–40	60	21.0	24.0	26.0	28.0	28.0	28.0	28.0
	41–50	22	16.3	18.3	20.75	24.0	25.0	28.0	28.0
	51–60	15	17.0	17.0	18.0	24.0	25.0	27.4	28.0
	<60	2	21.0	21.0	21.0	24.5	28.0	28.0	28.0
Lost teeth	≥20	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	21–30	50	0.0	0.0	0.0	0.0	1.0	2.0	5.0
	31–40	60	0.0	0.0	0.0	0.0	2.0	4.0	6.9
	41–50	22	0.0	0.0	3.0	4.0	7.25	9.7	11.7
	51–60	15	0.0	0.6	3.0	4.0	10.0	11.0	11.0
	<60	2	0.0	0.0	0.0	3.5	7.0	7.0	7.0

Table 3. Frequency distribution of treated teeth and treated teeth with AP regarding gender and type of tooth

	Tooth type	Treated teeth			Treated teeth with AP		
		Total (%)	Male (%)	Female (%)	Total (%)	Male (%)	Female (%)
Maxilla	Molar	43.9	36.8	63.2	48.0	39.1	60.9
	Premolar	56.1	29.2	70.8	52.0	22.5	77.5
	Total	100.0	32.6	67.4	100	61.6	138.4
Mandible	Molar	60.6	34.4	65.5	69.9	27.1	72.9
	Premolar	39.4	35.5	64.5	30.1	36.9	63.1
	Total	100	34.5	65.5	100	60.0	136.0

Table 4. Frequency distribution of the study variables

Variable	Situation	Number	Percent
Length of restoration	Appropriate	361	59.4
	Inappropriate	247	40.6
Density of restoration	Appropriate	247	40.6
	Inappropriate	361	59.4
Quality of RCT	Acceptable	186	30.6
	Unacceptable	422	69.4
AP	Presence	307	50.5
	Lack	301	49.5
AP score	3	214	35.2
	4	89	14.6
	5	4	7.0
Quality of CT	Appropriate	348	57.2
	Inappropriate	260	42.8

Table 5. Frequency distribution of AP in RCT teeth regarding the quality of RCT and CT

Parameter	Total		Apical periodontitis		p-value
	Number	Percent	Number	Percent	
RCT teeth	608	100	307	50.5	-
Sufficient length/density of restoration (acceptable)	186	30.6	55	29.6	<0.001
Sufficient length/insufficient density of restoration (unacceptable)	175	28.8	96	55.9	<0.001
Insufficient length/sufficient density of restoration (unacceptable)	61	10.0	32	52.4	<0.001
Insufficient length/insufficient density of restoration (unacceptable)	186	30.6	124	66.7	<0.001
Unacceptable RCT	422	69.4	252	59.7	-
Acceptable CR	348	57.2	128	36.8	<0.005
Unacceptable CR	260	42.8	179	68.8	<0.005
Acceptable RCT/acceptable CR	121	19.9	23	19.0	<0.001
Acceptable RCT/unacceptable CR	227	37.3	105	46.2	<0.001
Unacceptable RCT/acceptable CR	65	10.7	32	49.2	<0.001
Unacceptable RCT/unacceptable CR	195	32.1	147	70.4	<0.001

Table 6. Multiple logistic regression for evaluation of the effect of two independent variables (length and density of restoration) on the dependent variable (AP)

	B	SE	Wald	df	Sig	Exp	95% CI for OR (odds ratio)	
							Minimum	Maximum
Length of restoration	0.659	0.177	13.853	1	0.00	19.33	1.366	2.734
Density of restoration	0.899	0.177	25.800	1	0.00	2.458	1.737	3.478
Constant	0.776	0.143	29.474	1	0.16	-	-	-

Table 7. Multiple logistic regression for evaluation of the effect of two independent variables (quality of RCT and CR) on the dependent variable (AP)

	B	SE	Wald	df	Sig	Exp	95% CI for OR (odds ratio)	
							Minimum	Maximum
Quality of RCT	1.312	0.181	52.744	1	0.00	3.713	2.606	5.290
Quality of CR	1.233	0.198	38.758	1	0.00	3.433	2.328	5.062
Constant	−3.3945	0.447	77.812	1	0.00	-	-	-

Discussion

The main objective of RCT is prevention or treatment of AP lesions. According to studies in controlled situations, the success rate of RCT is more than 90%, but some cross-sectional studies on human populations have shown a success rate of 35%–60% for this treatment [23, 25]. RCT and post-treatment factors (e.g., length and density of root restoration and quality of crown restoration) are the main factors in the success rate of RCT (presence or lack of AP).[26]

In this study, panoramic radiography was used to assess the condition of AP and the quality of root canal or crown treatments. Length and density of restoration were used as the indices of acceptable root treatment, although panoramic radiography underestimates the real frequency of AP; however, because of a high correlation between intra-oral and panoramic radiographies and overestimation of panoramic radiography in comparison to intra-oral radiography [27-29], it seems that recording the prevalence of periodontitis using panoramic radiography is a satisfactory method [26]. Because of the study limitations, canal length was classified as acceptable and unacceptable.

The direct association between the quality of RCT and the prevalence of AP has been seen in previous studies as well.[2, 26] Asgary et al. found AP in 29.1% of RCT teeth, consistent with the results of the current study [26]; however, in Kakehashi's study, the prevalence of AP in teeth with acceptable RCT was 16.5%, which is probably because of the higher quality of treatment in this study.[2]

When we assessed the quality of root restorations according to the length and density separately, it was determined that the length and density of restorations were appropriate in 59.4% and 40.6% of cases, respectively. Thus, it was shown that both factors play an important role in the quality of RCT and the prevalence of AP. Asgary et al. [26], Deamkashan et al. [23], and Kirkevang et al. [8] found similar results.

In the current study, teeth that received RCT in the last year were included; since the majority of healing takes place in the first six months after treatment, size of AP is affected by the treatment procedure. In this study, prevalence of AP in all teeth was 50.5%, but this measure in different studies ranged from 20% to 65%.[28-31] This difference is probably because of the patient's level of oral health and the skill of the dentists.

In the current study, 69.7% of AP cases were given a score of 3, which agrees with the findings of Asgary et al. [26] With increasing score, the size of lesion and its effect on the surrounding tissue will increase. The size of lesion may also affect the decision for treatment [32], but the size does not affect the patient's improvement. Large lesions only need a longer time to be cured [33]. The

frequency of all RCT teeth and treated teeth with acceptable RCT quality in the present study was 15.4% and 30.6%, respectively, while the same measures were 3.5% and 42.3% in the study conducted by Asgary et al. [26], which may show that the index of oral and tooth health in Yazd is lower than the Iranian average. Nonetheless, other studies have shown a frequency of 8.6 to 26% for RCT.[34-40]

The current study emphasized the importance of the quality of root and crown treatments on the prevalence of AP. The results showed that AP occurred in 29.6% of teeth with acceptable RCT, 59.7% of teeth with unacceptable RCT, 41.82% of teeth with appropriate restoration length, and 35% of teeth with appropriate restoration density. In similar studies in European countries, it was demonstrated that AP occurred in 10%–46% of teeth with appropriate restoration length.[27, 28] For instance, in a study in Denmark [19], 44.3% and 26.92% of teeth with appropriate restoration density exhibited AP. Therefore, it can be concluded that both length and density of restoration affect the quality of treatment and the prevalence of AP.

This study showed that, in spite of appropriate RCT quality, AP occurred in 46.2% of cases. Therefore, the quality of RCT is not the only factor that affects AP; appropriate crown restoration can also serve as a barrier to the penetration of liquids and bacteria from the oral cavity to the root space.[8]In the present study, crown restoration was acceptable in 57.2% of RCT teeth, which was similar to the results of Asgary et al. [26] It seems that the prevalence of AP in cases with unacceptable RCT and acceptable CR is almost similar to cases with acceptable RCT and unacceptable CR, consistent with the results of Sidaravicius et al. [39]; but, in a study by Roy and Trop, CR was more important than RCT. [41] Considering the prevalence of 15.4% for RCT and 50.5% for AP in RCT teeth in the study population, combined with the emphasis of this and similar studies on the effect of RCT and CR on the prevalence of AP, attention should be paid to all stages of the treatment of a tooth with pulp disease.

Conclusion

The findings of this study confirmed the results of past studies about the effect of the quality of RCT and CR on the occurrence of AP. Therefore, in order to cure teeth with pulp disease, all stages of treatment should be performed with caution. It is recommended that additional studies be conducted to clinically assess crown sealing conditions using both intra-oral and panoramic radiography.

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Refrences

1.Siqueira JF Jr, Rôças IN. Bacterial pathogenesis and mediators in apical periodontitis. Braz Dent J 2007; 18(4):267-80.
2.Kakehashi S, Stanley H, Fitzgerald R. The effects of surgical exposures of dental pulps in germ-free and conventional laboratory rats. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1965; 20(3):340-9.
3.Kirkevang LL, Væth M, Hörsted-Bindslev P, et al. Risk factors for developing apical periodontitis in a general population. Int Endod J 2007; 40(4):290-9.
4.Al-Omari MA, Hazaa A, Haddad F. Frequency and distribution of root filled teeth and apical periodontitis in a Jordanian subpopulation. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2011; 111(1):e59-e65.
5.Kabak Y, Abbott P. Prevalence of apical periodontitis and the quality of endodontic treatment in an adult Belarusian population. Int Endod J 2005; 38(4):238-45.
6.Abbott PV. The periapical space--A dynamic interface. Aust Endod J 2002; 28(3):96-107.
7.Nair P. Pathogenesis of apical periodontitis and the causes of endodontic failures. Crit Rev Oral Biol Med 2004; 15(6):348-81.
8.Kirkevang LL, Ørstavik D, Hörsted-Bindslev P, Wenzel A. Periapical status and quality of root fillings and coronal restorations in a Danish population. Int Endod J 2000; 33(6):509-15.
9.Marques M, Moreira B, Eriksen H. Prevalence of apical periodontitis and results of endodontic treatment in an adult, Portuguese population. Int Endod J 1998; 31(3):161-5.
10.De Moor R, Hommez G, De Boever J, et al. Periapical health related to the quality of root canal treatment in a Belgian population. Int Endod J 2000; 33(2):113-20.

11.Buckley M, Spangberg LS. The prevalence and technical quality of endodontic treatment in an American subpopulation. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1995; 79(1):92-100.
12.Tsuneishi M, Yamamoto T, Yamanaka R, et al. Radiographic evaluation of periapical status and prevalence of endodontic treatment in an adult Japanese population. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2005; 100(5):631-5.
13.Matijević J, Čižmeković Dadić T, Prpić Mehičić G, et al. Prevalence of apical periodontitis and quality of root canal fillings in population of Zagreb, Croatia: a crosssectional study. Croat Med J 2011; 52(6):679-87.
14.Kamberi B, Hoxha V, Stavileci M, et al. Prevalence of apical periodontitis and endodontic treatment in a Kosovar adult population. BMC Oral Health 2011; 11(1):32.
15.Kalender A, Orhan K, Aksoy U, et al. Influence of the quality of endodontic treatment and coronal restorations on the prevalence of apical periodontitis in a Turkish Cypriot population. Med Princ Pract 2012; 22(2):173-7.
16.Ahlqwist M, Halling A, Hollender L. Rotational panoramic radiography in epidemiological studies of dental health. Comparison between panoramic radiographs and intraoral full mouth surveys. Swed Dent J 1986; 10(1-2):73-84.
17.Molander B, Ahlqwist M, Gröndahl H, Hollender L. Comparison of panoramic and intraoral radiography for the diagnosis of caries and periapical pathology. Dentomaxillofac Radiol 1993; 22(1):28-32.
18.Hessari H, Vehkalahti MM, Eghbal MJ, Murtomaa HT. Oral health among 35- to 44-year-old Iranians. Med Princ Pract 2007; 16(4):280-5.
19.Gündüz K, Avsever H, Orhan K, Demirkaya K. Cross-sectional evaluation of the periapical status as related to quality of root canal fillings and coronal restorations in a rural adult male population of Turkey. BMC Oral Health 2011; 11(1):11-20.
20.Ørstavik D, Kerekes K, Eriksen HM. The periapical index: A scoring system for radiographic assessment of apical periodontitis. Endod Dent Traumatol 1986; 2(1):20-34.
21.Siqueira JF, Rôças IN, Alves FR, Campos LC. Periradicular status related to the quality of coronal restorations and root canal fillings in a Brazilian population. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2005; 100(3):369-74.
22.Tronstad L, Asbjørnsen K, Døving L, et al. Influence of coronal restorations on the periapical health of endodontically treated teeth. Endod Dent Traumatol 2000; 16(5):218-21.
23.Kashan SAD, Abu-bakr NH, Ibrahim YE. Pilot study on relation of the periapical status and quality of endodontic treatment in an adult Sudanese population. Arch Orofac Sci 2011; 6(1):3-8.
24.Segura Egea J, Jiménez Pinzón A, Poyato Ferrera M, et al. Periapical status and quality of root fillings and coronal restorations in an adult Spanish population. Int Endod J 2004; 37(8):525-30.
25.Asgary S, Shadman B, Ghalamkarpour Z, et al. Periapical status and quality of root canal fillings and coronal restorations in Iranian population. Iran Endod J 2010; 5(2):74-82.
26.Cleen MD, Schuurs A, Wesselink P, Wu MK. Periapical status and prevalence of endodontic treatment in an adult Dutch population. Int Endod J 1993; 26(2):112-9.
27.Eriksen H, Berset G, Hansen B, Bjertness E. Changes in endodontic status 1973–1993 among 35□year□olds in Oslo, Norway. Int Endod J 1995; 28(3):129-32.
28.Muhammed AH, Manson-Hing L. A comparison of panoramic and intraoral radiographic surveys in evaluating a dental clinic population. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1982; 54(1):108-17.
29.Estrela C, Leles CR, Hollanda ACB, et al. Prevalence and risk factors of apical periodontitis in endodontically treated teeth in a selected population of Brazilian adults. Braz Dent J 2008; 19(1):34-9.
30.Allard U, Palmqvist S. A radiographic survey of periapical conditions in elderly people in a Swedish county population. Endod Dent Traumatol 1986; 2(3):103-8.
31.Reit C, Gröndahl H. Management of periapical lesions in endodontically treated teeth. A study on clinical decision making. Swed Dent J 1983; 8(1):1-7.
32.Ng Y, Mann V, Rahbaran S, et al. Outcome of primary root canal treatment: systematic review of the literature–Part 2. Influence of clinical factors. Int Endod J 2008; 41(1):6-31.
33.Boucher Y, Matossian L, Rilliard F, Machtou P. Radiographic evaluation of the prevalence and technical quality of root canal treatment in a French subpopulation. Int Endod J 2002; 35(3):229-38.
34.Ödesjö B, Helldén L, Salonen L, Langeland K. Prevalence of previous endodontic treatment, technical standard and occurrence of periapical lesions in a randomly selected adult, general population. Endod Dent Traumatol 1990; 6(6):265-72.
35.Imfeld TN. Prevalence and quality of endodontic treatment in an elderly urban population of Switzerland. J Endod 1991; 17(12):604-7.
36.Lupi Pegurier L, Bertrand MF, Muller□Bolla M, et al. Periapical status, prevalence and quality of endodontic treatment in an adult French population. Int Endod J 2002; 35(8):690-7.
37.Petersson K, Pamenius M, Eliasson A, et al. 20-year follow-up of patients receiving high-cost dental care within the Swedish Dental Insurance System: 1977–1978 to 1998–2000. Swed Dent J 2006; 30(2):77.
38.Sidaravicius B, Aleksejuniene J, Eriksen H. Endodontic treatment and prevalence of apical periodontitis in an adult population of Vilnius, Lithuania. Endod Dent Traumatol 1999; 15(5):210-5.
39.Soikkonen K. Endodontically treated teeth and periapical findings in the elderly. Int Endod J 1995; 28(4):200-2003.
40.Ray H, Trope M. Periapical status of endodontically treated teeth in relation to the technical quality of the root filling and the coronal restoration. Int Endod J 1995; 28(1):12-8.

Prevalence of Head and Neck Sarcomas in the Main Health Centers in Yazd from 1994 to 2014

Original Article

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Abstract

Introduction:

Head and neck sarcomas involve a group of rare malignant diseases with a high histological variability involving various anatomical sites that can lead to under-reporting of the true incidence of these neoplasms. This study aimed to epidemiologically investigate the occurrence of sarcomas of the head and neck within the past 20 years in Yazd, Iran (1994– 2014).

Materials and methods:

In this descriptive, cross-sectional and retrospective study, 16114 patient's records with malignant tumors were examined via the census method, which were available in the archives of 8 main treatment centers in Yazd, Iran within a 20-year period. Age, sex, occupation, habitat, type of sarcoma, tumor location and grade, metastasis, recurrence, and history of head and neck irradiation were recorded. Data were analyzed in SPSS software version 17.

Results:

Among 586 cases of sarcomas, 59 cases (10.06%) were identified with head and neck sarcomas. The mean age of the patients was 32.22 ± 8.31 years, of which 26 (44.01%) patients were males and 33 (55.9%) were females. Soft tissue sarcomas were noted in 41 cases (69.5%); rhabdomyosarcoma was the most common (27.1%). Eighteen (30.5%) patients had hard tissue sarcomas; osteosarcoma (15.3%) was the most common. Soft tissues of the head and neck were the most (49.20%) involved sites. Most sarcomas were low grade. In 5 patients (8.5%), metastases occurred to the head and neck, and the tumor relapsed in 16 patients (27.1%).

Conclusion:

The findings of the current study were inagreement with those of other reports referred to in different studies. This suggests that the epidemiology of head and neck sarcomas in Yazd, Iran is similar to other geographical regions.

Key words:

•Head and Neck Neoplasms •Sarcoma •Yazd

Introduction

Sarcomas involve a rare and heterogeneous variety of malignant tumors of mesenchymal origin with a specific and distinct histopathology[1, 2].The mesenchymal cells can develop into tumors affecting the soft tissues of muscle, fat, and fibrous tissue. Bone and nerves can also be involved.[2] Occasionally, these tumors are associated with trauma, genetic syndromes as well as exposure to previous radiation, though there is mostly no apparent cause. Pathological classification is most valuable in the treatment and prognosis of head and neck sarcomas.[3]

The incidence of sarcoma is more prevalent in children than adults. Approximately 1% of all adult cancers[2-4] and 10%–20% of pediatric cancers are sarcomas[2]. About 5%–15%[2, 3] of adult sarcomas are in the head and neck region; 35%[3, 5] of children are diagnosed with head and neck sarcomas.he findings of different studies have revealed that the incidence of sarcoma is more in men than in women, which is about 50% to 60%.[6-11]

Common soft tissue sarcomas in order of frequency include liposarcoma, malignant fibrous histiocytoma, fibrosarcoma, rhabdomyosarcoma, leiomyosarcoma, synovial sarcoma, malignant peripheral nerve sheath tumors, angio-sarcoma and kaposi sarcoma, whereas hard tissue sarcomas in order of frequency entail osteosarcoma, chondrosarcoma, as well as Ewing's sarcoma[12]. The results of some studies conducted in Iran demonstrated that 60% of sarcomas occurred in males with a mean age of 36 years, that the most common sarcomas in adults were malignant fibrous histiocytoma and synovial sarcoma and osteosarcoma and in children, osteosarcoma, Ewing sarcoma, and rhabdomyosarcoma in the were the most common sarcomas.[11, 13]

The ratio of bone sarcoma to sarcoma of soft tissue was 3:1 in patients aged under 16 years and 1:3 among adults[13]. In a study conducted on the epidemiology of soft tissue sarcomas in Shahid Sadoughi hospital of Yazd in 2005, the most common sarcomas were synovial sarcoma and malignant fibrous histiocytoma respectively among males and females. The study findings indicated that the sarcoma incidence in Yazd was similar to that of Western countries.[11]

Epidemiological studies provide vital information that forms the basis of future research. Because investigating the prevalence of sarcomas in the head and neck has received scant attention in Iran, the present study is intended to provide the epidemiology of sarcomas of the head and neck over the past 20 years in Yazd, Iran (1994–2014) based on the histopathologic examinations.

Materials and Methods

In this descriptive, cross-sectional, and retrospective study, 16114 patients records(case notes), diagnosed as malignant tumors were examined from the archive of the Shahid Sadooghi Dental School and several other hospitals (Shahid Sadoughi, Shahid Rahnemoon, Mojibiyan, Mortaz, ShohadayeKargar, Seyedoshohada and SavanehSookhtegi) over a 20-year period (1994–2014).

The records were obtained by proposing a research study from the Shahid Sadoughi medical university of Yazd (Ethical code: p.17.1.77710; date: 1393.4.22).

It should be noted that case records that were incomplete or cases in which the patients reported a written dissatisfaction were excluded from the study. In order to glean the study data, a checklist was devised consisting of the following variables: case record number, pathology department identification number, age, sex, occupation, place of residence, type of sarcoma, tumor location, tumor grade, the occurrence of metastasis, recurrence, history of head and neck irradiation. The patients' medical records as well as their pathology reports available in the mentioned health centers were collected and analyzed utilizing the SPSS software (Ver. 17) through descriptive statistics.

Results

Out of 16,114 cases examined in this study, 586 cases (3.65%) of patients were diagnosed with sarcomas, among which 59 patients (10.06%) suffered from sarcomas of the head and neck, the study cohort. The mean age of the patients was 32.22 ± 8.31 years with an age range of 1.5--83 years, of which 17 patients (28.8%) were <16 years of age, whereas 42 patients (71.2%) were > 16 years. A total of 26 patients (44.05%) were males and 33 (55.9%) were females More than half of patients (59.3 %) lived in Yazd (Table 1). As demonstrated in Table 2, 41 cases (69.5%) of

sarcomas belonged to soft tissue sarcomas. The most prevalent type of soft tissue sarcomas was rhabdomyosarcoma (27.1%).

Among the bone tissue sarcomas, affecting 18 patients (30.5%), osteosarcoma (15.3%) and chondrosarcoma (11.9%) were the most prevalent (Table 2).

Rhabdomyosarcoma was reported to be the most common sarcoma (13.5 %) in the both the age groups, as well as in men (10.2%) and women (16.9%). The lowest incidence was found to be Kaposi sarcoma, which was only observed in one man >16 years old (1.7 %) (Table 2).

The most areas commonly affected were soft tissues of the head and neck (49.2 %), jaw bones (35.6 %) as well as the head and skull bones (15.3%). With respect to tumor grading, most of the sarcomas were of the low grade (40.4%) followed by moderate (30.5%) and high (28.8%) grades, respectively. Metastases from other parts of the body to the head and neck occurred in 5 patients (8.5%), whereas, in 2 patients (3.4%) the sarcoma metastasized to other parts of the body from the head and neck. Out of the 59 examined patients, 16 cases (27.1%) were observed to have suffered from recurrence.

Table 1. Distribution of the head and neck sarcomas according to the demographic characteristics

Variable		Number	Percent
Age	≤16	17	28.8
	>16	42	71.2
Sex	Male	26	44.05
	Female	33	55.9
Habitat	Yazd	35	59.3
	Out of Yazd	24	40.7

Table 2: Distribution of the head and neck sarcomas according to demographic variables and frequency

Type of sarcoma	Name of sarcoma	N	%	Total	Sex				Age			
					Female		Male		16<		16≥	
					%	n	%	n	%	n	%	n
Soft tissue sarcomas	Rhabdomyosarcoma	16	27.1	(69.5%) 41	16.9	10	10.2	6	13.5	8	13.5	8
	Neurofibrosarcoma	5	8.5		6.8	4	1.7	1	6.8	4	1.7	1
	Fibrosarcoma	5	8.5		6.8	4	1.7	1	6.8	4	1.7	1
	Liposarcoma	3	5.1		1.7	1	3.4	2	5.1	3	0	0
	Malignant fibrous histiocytoma	3	5.1		1.7	1	3.4	2	3.4	2	1.7	1
	Synovial Sarcoma	3	5.1		1.7	1	3.4	2	0	0	5.1	3
	Angiosarcoma	3	5.1		3.4	2	1.7	1	5.1	3	0	0
	Leimyosarcoma	2	3.4		0	0	3.4	2	3.4	2	0	0
	Kaposi's Sarcoma	1	1.7		0	0	1.7	1	1.7	1	0	0
Hard tissue sarcomas	Osteosarcoma	9	15.3	(30.5%) 18	10.2	6	5.1	3	15.3	9	0	0
	Chondrosarcoma	7	11.9		6.8	4	5.1	3	8.5	5	3.4	2
	Ewing's sarcoma	2	3.4		0	0	3.4	2	1.7	1	1.7	1

Discussion

Sarcomas are rare and involve 1% of human cancers, among which currently 4%–10% occur in the head and neck.[14] In the present study, 59 cases (10.06%) of 586 sarcomas patients were observed to suffer from the head and neck sarcomas.

In this study, 12 types of sarcoma histopathology were observed, which in turn demonstrates the wide histological variety of these tumors.Pacheco et al.[16] in a study on 36 patients with the head and neck sarcomas, reported 12 types of sarcomas. Lajer et al. observed 15 histopathological types of sarcoma in a study consisting of 36 patients, which are in line with the findings of the present study.

Most of the head and neck sarcomas belong to the soft tissue category, and only 20% are bone sarcomas or have a cartilage source[17]. In this study, 59 sarcomas were investigated among which 41 (69.5 %) soft tissue sarcomas, and 18 cases (30.5%) were hard tissue sarcomas. In a similar study in the Canadian population, Aljabab et al. observed 80% of sarcomas in the hard tissue and 20% of sarcomas in the soft tissue.[18]

In the current study, the most prevalent type of sarcoma, rhabdomyosarcoma, involved 27.1% of the total tumors. Multiple reports[19-23] have noted that approximately half of rhabdomyosarcomas commonly occur in the head and neck areas. This is in concurrence with the findings of the current study. However, the incidence of head and neck rhabdomyosarcoma can vary. Few studies mention the incidence to be in the range of 8% to 16%[24-26], or higher(33.3%)[11]. This could be because of geographical and racial differences as well as the different sample size of the different studies. Various studies mention that no geographical preference can be taken into consideration for the occurrence of soft tissue sarcomas[36, 37]. The majority of the patients in our study[59.35] lived in Yazd, and the rest were from other cities traveled to Yazd for treatment. However, this might affect follow-up of patients in the study centers.

In this study, more than half of the involved patients with the head and neck sarcomas (56%) were females, which is in line with the findings by Bree et al.[27], although in several other studies[23, 28-31] men have been reported to be affected more than the women. Some of these studies have indicated the predilection of males for the disease is nearly twice as much than females[29, 31]. Due to the rarity of head and neck sarcomas, and limited sample size of most studies conducted in Iran and the world, drawing conclusions and comparisons is not very effective, yet; perhaps one of the reasons for the higher prevalence of females in this study was that women were referred to health centers more than men.

As was expected, sarcomas of the head and neck can occur in any age. In fact, studies have demonstrated that soft tissue sarcomas affects 80%–90% of adults and 10%–20% of children.[18, 32] The mean age of the patients involved in this study was 32.22 ± 8.31 years which supports the findings of the studies conducted by Pacheco et al.[16] and Dudhat et al.[30] who noted a similar average mean age of 39.7 ± 25.1. However, Epstein and Gorsky[33] reported the mean age of 40.4 years for this disease. Moreover, Mendenhall et al.[34] reviewed the literature published between 1972 and 2000, and indicated the mean age of 50–55 years for the head and neck sarcomas, though findings of some studies propose that generally sarcomas involving the head and neck affect younger people including children and teenagers compared to squamous cell carcinoma.[35]

In the present study, the anatomical distribution of most of the head and neck sarcomas included the jaw bone as well as the soft tissue of head and neck. Kraus et al.[32] also indicated these two areas as the most prevalent involved locations with the head and neck sarcomas. Tajudeen et al.[9] found the nasal cavity and sinuses as the most commonly involved locations in 22% of his patients. Penel et al.[28] reported a 39.3% involvement in the neck tissue that is consistent with the findings of the current study.

In the present study, 5 patients (8.5%) were found to have metastasis from other parts of the body to the head and neck. Breast is the most common site of tumor metastasis to the bone of the jaw, while the lungs involves the most frequent source for metastasis to the soft tissue of the mouth and teeth. In 30% of cases, metastasis in the mouth has been found to demonstrate the first sign of an undiscovered cancer in another part of the body.[38] Compared to other head and

neck neoplasms (e.g., squamous cell carcinoma), soft tissue sarcomas have a lower rate of regional metastasis.[39] In this study, only 2 cases (3.4%) had metastasis to other parts of the body, whereas in a study conducted by Tajudeen et al.[9] metastasis to lymph nodes was 6.5% and neural invasion was observed in 6.5% of the cases. Salcedo-Hernández et al.[5] reported 50% of soft tissue sarcomas of the head and neck involving metastasis.

Singh et al. [31] reported local recurrence in 42% of patients and 42% of metastatic disease development in the lungs. Probably in this study, one reason for the low figures of head and neck sarcoma metastasis to other parts of the body is the lack of follow-up of individual patients specifically from other provinces, who included a large portion of the study sample.

Recurrences of the sarcomas were observed in 27.1% of patients in this study.

Because the patients were not actively followed up in order to evaluate recurrence, in reality, the recurrence rate in this study might have been more than what is being reported here. It has been demonstrated that local recurrence in head and neck sarcomas is more than that of other organs[28, 40-43], which is probably due to the fact that reaching negative margins of tumor is more complex during sarcoma surgery of the head and neck.[44]

Regardless of the location and size of the tumor, one of the main factors for prognosis with sarcomas is the tumor histologic grade.[45, 46]

In this study, the majority (40.7%) of sarcomas were low-grade tumors, while 30.5% and 28.8% belonged to average and high grades respectively. However, Tajudeen et al.[9] reported 35% of their cases as high-grade sarcomas.

Conclusion

The head and neck sarcomas are rare tumors that demonstrate a high variability in histology. In the current study, soft tissue sarcomas were generally much more prevalent than hard tissue sarcomas, among which rhabdomyosarcoma was the most common soft tissue sarcoma and osteosarcoma was the most common hard tissue sarcoma. Moreover, the age and gender prevalence, as well as the involved anatomic location in the studied population was similar to those of most other studies. However, our results, for the first time, provide an insight into the prevalence of head and neck sarcomas in Yazd, Iran.

The weak points of this study were the incomplete medical and pathological evidence of the patient and the patients were referred to other treatment centers and IHC (ImmunoHistoChemistry) results were unavailable in some cases.

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References

1.Cardona AF, Zuluaga J, Carranza H, et al. Stem Cells in Cancer: Should We Believe or Not?: Springer; 2014. P. 245-61.

2.Ryan C, Meyer J. Clinical presentation, histopathology, diagnostic evualation, and staging of soft tissue sarcoma. Available from: http://www.uptodate.com/contents/clinical-presentation-histopathology-diagnostic-evaluation-and-staging-of-soft-tissue-sarcomaSturgis

3.Sturgis EM, Potter BO. Sarcomas of the head and neck region. Curr Opin Oncol 2003;15(3):239-52.

4.Pellitteri PK, Ferlito A, Bradley PJ, et al. Management of sarcomas of the head and neck in adults. Oral Oncol 2003;39(1):2-12.

5.Salcedo-Hernández RA, Lino-Silva LS, Mosqueda-Taylor A, Luna-Ortiz K. Soft tissue sarcomas of the head and neck. Clinical and pathological evaluation of 108 cases in Mexico. J Craniomaxillofac Surg 2014; 42(8):1566-71.

6.De Bree R, van der Waal I, de Bree E, René Leemans C. Management of adult soft tissue sarcomas of the head and neck. Oral Oncol 2010;46(11):786-90.

7.Eeles R, Fisher C, A'Hern R, et al. Head and neck sarcomas: prognostic factors and implications for treatment. Br J Cancer 1993;68(1):201-7.

8.Moretti G, Guimarães R, Oliveira KMd, Sanjar F, Voegels RL. Rhabdomyosarcoma of the head and neck: 24 cases and literature review. Braz J Otorhinolaryngol 2010;76(4):533-7.

9.Tajudeen BA, Fuller J, Lai C, et al. Head and neck sarcomas: the UCLA experience. Am J Otolaryngol 2014; 35(4):476-

81.

10.Levi F, Randimbison L, Maspoli-Conconi M, et al. Incidence of second sarcomas: a cancer registry-based study. Cancer Causes Control 2014; 25(4):473-7. doi: 10.1007/s10552-014-0349-7. Epub 2014.

11.Salari AA, Binesh F, Valizadeh S. Epidemiology of Soft Tissue Sarcomas in Shahid Sadoughi University of Medical Sciences of Yazd during 1994-2005. Iranian J Surge 2010; 18(4):39-44. Persian.

12.Neville BW, Damm DD, Allen CM, Bouquot JE. Oraland Maxillofacial Pathology. St Louis: Sanders; 2009.P.771-774.

13.Seddighi S, Rafat J. 1470 cases of sarcoma referring to Imam Khomeini hospital during an 11-year period. Med Sci J 2005; 15 (3):131-136 . Persian.

14.Huber GF, Matthews TW, Dort JC. Radiation-induced soft tissue sarcomas of the head and neck. J Otolaryngol 2007; 36(2):93-7.

15. Lahat G, Lazar A, Lev D. Sarcoma epidemiology and etiology: potentialenvironmental and genetic factors. Surg Clin North Am. 2008 ;;88(3):451-81,

16.Pacheco IA, Alves AP, Mota MR, et al. Clinicopathological study of patients with head and neck sarcomas. Braz J Otorhinolaryngol 2011; 77(3):385-90.

17.Rapidis AD. Sarcomas of the head and neck in adult patients: current concepts and future perspectives. Expert Rev Anticancer Ther 2008; 8(8):1271-97.

18.Aljabab AS, Nason RW, Kazi R, Pathak KA. Head and neck soft tissue sarcoma. Indian J Surg Oncol 2011 2(4):286-90.

19.Hagiwara A1, Inoue Y, Nakayama T, et al. The 'botryoid sign': a characteristic feature of rhabdomyosarcomas in the head and neck. Neuroradiology 2001; 43(4):331-5.

20.Lee JH, Lee MS, Lee BH, et al. Rhabdomyosarcoma of the head and neck in adults: MR and CT findings. AJNR Am J Neuroradiol 1996; 17(10):1923-8.

21.Lioyd C, McHugh K. The role of radiology in head and neck tumours in children. Cancer Imaging 2010 Mar 3;10:49-61. doi: 10.1102/1470-7330.2010.0003.

22.Franco T, La Boria A, Domanico R, et al. Rare adult masseteric rhabdomyosarcoma and a review of the literature. Case Rep Oncol 2013; 6(3):472-9.

23.Penel N, Van Haverbeke C, Lartigau E, et al. Head and neck soft tissue sarcomas of adult: prognostic value of surgery in multimodal therapeutic approach. Oral Oncol 2004; 40(9):890-7.

24.Bentz BG, Singh B, Woodruff J, et al. Head and neck soft tissue sarcoma: a multivariate analysis of outcome. Ann Surg Oncol 2005; 11(6):619-28.

25.Chen AS, Morris CG, Andur RJ, et al. Adult head and neck soft tissue sarcomas. Am J Clin Oncol 2005; 28(3):259-63.

26.Yamaguchi S, Nagasawa H, Suzuki T, et al. Sarcomas of the oral and maxillofacial region: a review of 32 cases in 25 years. Clin Oral Invest 2004; 8(2):52-5.

27.Bree R, Valk P, Kuik DJ, et al. Prognosis factors in adult soft tissue sarcomas of the head and neck: a single centre experience. Oral Oncol 2006; 42(7):703-9.

28.Penel N, Mallet Y, Robin YM, et al. Prognostic factors for adult sarcomas of head and neck. Int J Oral Maxillofac Surg 2008; 37(5):428-32.

29.Le QT, Fu KK, Kroll S, et al. Prognostic factors in adult soft tissue sarcoma of the head and neck. Int J Radiat Oncol Biol Phys1997; 37:975-84.

30.Dudhat SB, Mistry RC, Varughese T, et al. Prognostic factors in head and neck soft tissue sarcomas. Cancer 2000; 89(4):868-72.

31.Singh RP, Grimer RJ, Bhujel N, et al. Adult head and neck soft tissue sarcomas: treatment and outcome. Sarcoma 2008;2008:654987. doi: 10.1155/2008/654987.

32.Kraus DH, Dubner S, Harrison LB, et al. Prognostic factors for recurrence and survival in head and neck soft tissue sarcomas. Cancer 1994; 74(2):697-702.

33.Gorsky M, Epstein JB. Craniofacial osseous and chondromatous sarcomas in British Columbia - a review of 34 cases. Oral Oncol 2000; 36(1):27-31.

34.Mendenhall WM, Mendenhall CM, Werning JW, et al. Adult head and neck soft tissue sarcomas. Head Neck 2005; 27(10):916-22.

35.Patel SG, Shaha AR, Shah JP. Soft tissue sarcomas of the head and neck: an update. Am J Otolaryngol 2001;22(1):2-18.

36.Vincent T. Devita Jr. Samuel Hellman, et al, Sarcoma of the Soft tissue and bone, cancer principles and practice of oncology. USA: Lipincott Williams & Wilkins; 2001.p. 1841-44.

37.Weiss SW, Goldblum JR. Enzinger and Weiss's Soft Tissue Tumor. 4th ed. St. Louis: Mosby; 2001.p. 1-17.

38.Hirshberg A, Buchner A. Metastatic tumours to the oral region. An overview. Eur J Cancer B Oral Oncol 1995;31B(6):355-60.

39.Srivastava A, Ghosh A, Saha S, et al. Sarcomas of head and neck - A 10 yrs experience. Indian J Otolaryngol Head Neck Surg 2007;59(4):322-6.

40.Gullane P, Kraus D, Weber R. Soft tissue sarcoma. Head Neck 2002; 24(3):296-300.

41.Borden EC, Baker LH, Bell RS, et al. Soft tissue sarcomas of adults: state of the translation science. Clin Cancer Res 2003; 9(6):1941-56

42.Wunder JS, O Nielsen T, Maki RG, et al. Opportunities for improving the therapeutic ratio for patients with sarcoma. Lancet Oncol 2007;8(6):513-24.

43.Shellenberger TD, Sturgis EM. Sarcomas of the head and neck region. Curr Oncol Rep 2009; 11(2):135-42.

44.Piñeiro Aguín Z, León Vintró X, García Lorenzo J, et al. [Head and neck sarcomas. Our experience]. Acta Otorrinolaringol Esp 2011 Nov-Dec;62(6):436-42. doi: 10.1016/j.otorri.2011.05.005. Epub 2011 Aug 5. Spanish.

45.Tran LM, Mark R, Meier R, et al. Sarcomas of the head and neck. Prognostic factors and treatment strategies. Cancer 1992;70(1):169-77.

46.Stojadinovic A, Leung DH, Hoos A, et al. Analysis of the prognostic significance of microscopic margins in 2,084 localized primary adult soft tissue sarcomas. Ann Surg 2002; 235(3):424-34.

Evaluation of Changing Serum Blood Glucose Levels after Local Anesthetic Injection during Tooth Extraction

Original Article

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Abstract

Introdouction:

Injection of local anesthesia during dental procedures can induce metabolic changes. The purpose of this study was to evaluate the changes in the serum blood glucose levels after the injection of lidocaine with a vasoconstrictor during tooth extraction.

Materials and methods:

In this clinical trial study, we enrolled 60 patients. We extracted mandibular teeth by using inferior alveolar nerve block. We took a finger blood sample test from each enrolled patient immediately before and 10 min after local anesthesia administration. The anesthetic solution (1.8 mL carpule) contained lidocaine and 1:80,000 epinephrine. It was injected through the inferior alveolar nerve after negative aspiration. Only one carpule was injected into each patient. This study is approved by the ethics committee of the research center of Azad University of Medical Sciences.

Results:

The mean age of the patients in our study was 39.54 ± 15 years. Thirty-five patients were male, and 25 were female. The serum blood glucose level was 111.6 ± 25.47 mg/dL before local anesthesia and 115.3 ± 24.39 mg/dL after tooth extraction (P = 0.418). Eleven female patients and four male patients had a reduction in the blood glucose levels after injection. There was a significant difference between these groups (P = 0.01).

Conclusion:

According to our findings and previous reports, using local anesthesia during tooth extraction does not induce hypoglycemia and could increase the serum blood glucose level in individuals.

Key words:

•Anesthesia •Local •Epinephrine •Glucose •Lidocaine •Tooth Extraction

Introduction

Tooth extraction is one of the most common and frequent dental procedures, which is considered a stressful and painful intervention.[1, 2] If patients' pain can be soothed, therapeutic procedures will be carried out in a more acceptable situation and patients' pain threshold will increase.[3]

Lidocaine is the most common local anesthetic material in dentistry. Lidocaine was introduced by Nils Lofgren in 1943 and used for the first time as a local anesthetic material in 1948. One of the most important concerns about local anesthetic injection is its systemic effects.[4]

The most common complications after lidocaine injection are vasovagal shock, hyperventilation syndrome, tachycardia, shivering, and the loss of consciousness. Injection procedures cause pain and induce secretion of endogenous catecholamine, which could have a synergism effect with the vasoconstrictors in the local anesthetic material, leading to some side effects.[5, 6] Using epinephrine along with local anesthesia can also induce metabolic changes.[7]

During anesthetic material injection, some individuals experience some unpleasant situations, such as paleness and losing consciousness, and one of the supportive medications in these cases is using glucose.[8] Activation of the sympathetic system by stress and epinephrine injection can increase the blood glucose level in patients who undergo dental procedures, such as tooth extraction. Dental surgery with local anesthetic injection can increase catecholamine release, blood glucose, and insulin.[9]

The aim of this study is to evaluate the serum blood glucose level changes after local anesthesia by using local anesthetic in tooth extractions.

Materials and Methods

In this clinical trial study, we evaluated the effect of local anesthetic, by using lidocaine and epinephrine, on the blood glucose concentration in patients who underwent teeth extractions. This study was conducted at the Department of Oral and Maxillofacial Surgery in the dental college, and it was approved by the ethics committee of the research center of Azad University of Medical Sciences. This trial is registered with RCT ID: AEARCTR-0000445.

This study was performed between February and May 2014.

We used a convenient, time-based sequential sampling method. Informed consent was given by all patients. We included all adult individuals who were referred to our department for mandibular tooth extractions, and we excluded patients who underwent tooth extractions both in mandible and maxilla or had known histories of diabetes, infection, or any contraindications for using epinephrine.

Our local anesthesia solution (1.8 mL carpule) contained lidocaine and 1:80,000 epinephrine. It was injected in 1 min through the inferior alveolar nerve after negative aspiration. Only one carpule was injected in each patient.

We took a finger blood samples immediately before and 10 min after the administration of local anesthesia. We used a glucometer (Accu Check Active, model GC, Germany) to measure blood glucose in our samples.

Statistical analyses were performed by using Statistical Program for Social Sciences software (SPSS) version 18. Paired t-test and chi-square test were used for data analyses. The significance level (P) was set at 0.05.

Results

In this study, we had evaluated 60 individuals. Thirty-five (58.3%) were male, and 25 (41.7%) were female. The mean age in our study was 39.54 ± 15 years. Most patients underwent molar tooth extraction. In two patients (3.3%), we extracted their first tooth; only in one participant tooth number four was extracted, and in nine patients (15%), we extracted tooth number five. Forty-eight patients underwent molar tooth extraction (16 patient for each tooth). Before injection, the mean blood glucose level in patients was 111.6 ± 25.47 mg/dL, and 10 min after lidocaine injection, the mean blood glucose was 115.3 ± 24.39 mg/dL. Paired t-test showed that there was no significant difference in blood glucose levels in patients before and after injection (P = 0.418). Before local anesthesia, in 42 patients, the blood glucose level was higher than 100 mg/dL, and after lidocaine injection, in 51 participants, the blood glucose level was higher than 100 mg/dL. Chi-square test showed that there was a significant change in the number of patients who had

blood glucose levels higher than 100 mg/dL after lidocaine injection (P = 0.03). Nine patients had blood glucose levels lower than 100 mg/dL, and 41 participants had blood glucose levels higher than 100 mg/dL both before and after tooth extraction. After anesthesia injection, in 45 patients (75%), blood glucose levels were increased, and in 15 patients (25%), it was decreased. Among female participants, in 11 patients, blood glucose levels were decreased; in contrast, among male participants, in only four patients, blood glucose levels were decreased. Chi-square tests showed there was a significant difference between groups (P = 0.01).

We also divide patients in to two groups: molar and non-molar tooth extraction. Forty-eight patients underwent molar and 12 underwent non-molar tooth extraction. The blood glucose level of 13 patients in the molar group and two patients in the non-molar group was decreased. Figure 1 summarizes the distribution of blood glucose levels in patients before and after local anesthesia administration.

During our study, vasovagal shock occurred in one patient. The blood glucose level was 94 mg/dL before and 98 mg/dL during his shock, and it was 102 mg/dL when he was stabilized.

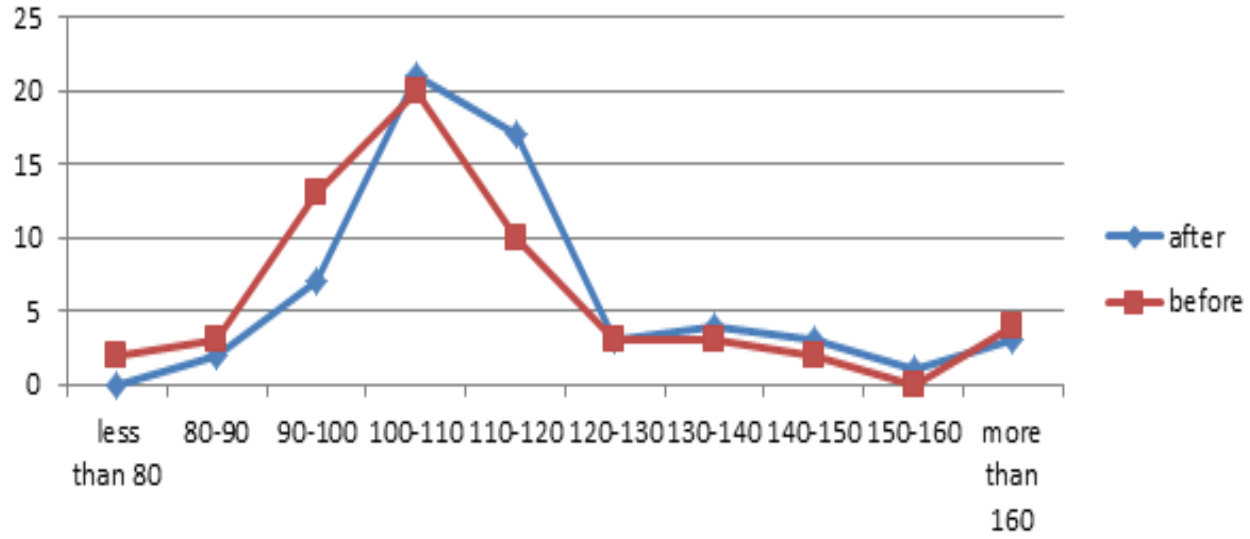

Figure 1. Distribution of 60 patients before and after local anesthesia based on their blood glucose levels.

Discussion

In this clinical trial study, we evaluated glucose levels in 60 patients before and after tooth extraction. There was no significant difference before and after our procedure in patients' blood glucose levels. Between male and female participants, blood glucose level in female patients was significantly reduced after injection (P = 0.01). Only in one individual was vasovagal shock observed. No hypoglycemic state was detected in this patient. This could be due to catecholamine release and cortisol secretion following anxiety, fear, and pain during injection in this case.

Tily et al. evaluated 30 diabetic and 30 healthy individuals in 2007. They used local dental anesthesia (1.8 mL carpule each) containing 1:80,000 epinephrine and evaluated patients before and 10 min post-extraction. They showed that there was no significant difference in blood glucose concentrations before injection and 10 min after extraction in healthy people compared with diabetic patients. There was no correlation between blood glucose changes and the number of carpules injected, number of teeth extracted, and the gender of the patients; however, there was a significant difference between their diabetic patients who used and who did not use their medications.[10] Our results agree with their findings.

In some other studies, it has been shown that local anesthetic administration can increase norepinephrine in plasma but there is a subtle increase related to the severity and extension of the dental procedure. The blood glucose concentration is related to the epinephrine plasma

concentration and is different from norepinephrine secreted by the sympathetic system.[11-13] An increased blood glucose level is observed in the presence of epinephrine in local anesthetic materials. Epinephrine has gluconeogenic hormonal activity. After epinephrine infusion, blood glucose concentration increased rapidly during 15 min and returned to the baseline after 2 h.[14, 15] Bortoluzzi et al. included 37 Brazilian individuals in their study to evaluate hemodynamic and glucose measurement changes in patients who received a local anesthetic and a vasoconstrictor (LAVA; 2% mepivacaine with adrenaline 1100,000). They reported that their evaluated parameters, including systolic blood pressure, diastolic blood pressure, heart rate, and glucose levels, have no significant changes in healthy individuals.[16] Our results are consistent with their report. In both studies, there was no significant difference before and after dental procedures in glucose levels.

In local anesthetic materials, epinephrine can penetrate to blood circulation and lead to glucose level increase after injection. This change happens after injection and before dental extraction. It is important to know changes in the hemodynamic state and blood glucose after local anesthetic injection to manage some emergent conditions that may occur immediately after injection.

As it was mentioned in the results section, there was a patient with vasovagal shock in our study. According to his different blood glucose levels, there was no hypoglycemic state in this patient. This situation can be explained by catecholamine release and cortisol secretion following anxiety, fear, and pain during injection in this patient.

Conclusion

In many situations during dental procedures, after anesthetic injection, the clinicians encounter emergencies, such as dizziness or loss of consciousness. In these situations, many clinicians begin to administer intravenous fluids with glucose to treat hypoglycemia; however, according to our results and previous studies, blood glucose levels not only decrease after local anesthetic injection but also increase due to injection, pain, and emotional stress.

Acknowledgments

Authors declare that they have no conflicts of interest.

References

1. Yusa H, Onizawa K, Hori M, et al. Anxiety measurements in university students undergoing third molar extraction. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2004 ;98(1):23-7.

2. López-Jornet P, Camacho-Alonso F, Sanchez-Siles M. Assessment of general pre and postoperative anxiety in patients undergoing tooth extraction: A prospective study. Br J Oral Maxillofac Surg 2014;52(1):18-23. doi: 10.1016/j.bjoms.2013.01.004. Epub 2013.

3. Abdeshahi SK, Hashemipour MA, Mesgarzadeh V, et al. Effect of hypnosis on induction of local anaesthesia, pain perception, control of haemorrhage and anxiety during extraction of third molars: a case-control study.. J Craniomaxillofac Surg 2013;41(4):310-5. doi: 10.1016/j.jcms.2012.10.009. Epub 2012.

4. Gordh T, Gordh TE, Lindqvist K. Lidocaine: the origin of a modern local anesthetic. Anesthesiology 2010;113(6):1433-7. doi: 10.1097/ALN.0b013e3181fcef48.

5. Kämmerer PW, Palarie V, Daubländer M, et al. Comparison of 4% articaine with epinephrine (1: 100,000) and without epinephrine in inferior alveolar block for tooth extraction: double-blind randomized clinical trial of anesthetic efficacy. Oral Surg Oral Med Oral Pathol Oral Radiol 2012;113(4):495-9. doi: 10.1016/j.tripleo.2011.04.037. Epub 2011.

6. Bronzo AL1, Cardoso CG Jr, Ortega KC, Mion D Jr.. Felypressin increases blood pressure during dental procedures in hypertensive patients. Arq Bras Cardiol 2012;99(2):724-31. Epub 2012.

7. Kalra P, Rana A, Peravali RK, et al. Comparative evaluation of local anaesthesia with adrenaline and without adrenaline on blood glucose concentration in patients undergoing tooth extractions.. J Maxillofac Oral Surg 2011;10(3):230-5. doi: 10.1007/s12663-011-0239-4. Epub 2011.

8. Cholewa M, Sobaniec S, Sobaniec P, et al. Sudden episodes of loss of consciousness in dental practice. Neurologia Dziecięca. 2012;21(43):71-8.

9. Hansen O, Johansson BW, Nilsson-Ehle P. Metabolic, electrocardiographic, and hemodynamic responses to increased circulating adrenaline: effects of selective and nonselective beta adrenoceptor blockade. Angiology 1990;41(3):175-88.

10. Tily FE, Ajman ST. Glycemic effect of administration of epinephrine-containing local anaesthesia in patients undergoing dental extraction, a comparison between healthy and diabetic patients.. Int Dent J 2007;57(2):77-83.

11. Kämmerer P, Seeling J, Alshihri A, Daubländer M. Comparative clinical evaluation of different epinephrine concentrations in 4% articaine for dental local infiltration anesthesia. Clin Oral Investig 2014;18(2):415-21. doi: 10.1007/

s00784-013-1010-7. Epub 2013.
12. Chernow B, Balestrieri F, Ferguson CD, et al. Local dental anesthesia with epinephrine: minimal effects on the sympathetic nervous system or on hemodynamic variables. Arch Intern Med 1983;143(11):2141-3.
13. Bader JD, Bonito AJ, Shugars DA. A systematic review of cardiovascular effects of epinephrine on hypertensive dental patients. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2002;93(6):647-53..
14. Cherrington A, Fuchs H, Stevenson R, et al. Effect of epinephrine on glycogenolysis and gluconeogenesis in conscious overnight-fasted dogs. Am J Physiol 1984;247(2 Pt 1):E137-44. 15. Meechan JG. The effects of dental local anesthetics on blood glucose concentration in healthy volunteers and in patients having third molar surgery. Br Dent J 1991; 170: 373-375.
16. Bortoluzzi MC, Manfro R, Nardi A. Glucose levels and hemodynamic changes in patients submitted to routine dental treatment with and without local anesthesia. Clinics (Sao Paulo) 2010;65(10):975-8.

Evaluating the relationship between Orthodontic Treatment need and Oral Health-Related Quality of life Among students aged 15-18 year in Shiraz

Original Article

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Abstract

Introdouction:
The major demand for orthodontic treatment is associated with esthetic complaints rather than with the severity of occlusal irregularities. This study evaluated the relationship between orthodontic treatment need based on index of complexity, outcome, and need (ICON) and orthodontic-specific quality of life (QOL) among high school students in Shiraz.

Materials and methods:
Based on the correlation between ICON and QOL score (r = 0.254) with α = 0.05 and an estimated power of 80%, 118 high school students (49 girls and 69 boys) aged 15-18 years were selected for this analytical cross-sectional study. The students were randomly selected. The need for orthodontic treatment was determined according to ICON and was compared with QOL, which was assessed using Cunningham's questionnaire. Data analysis was performed by SPSS-21 using Spearman's correlation coefficient and Mann-Whitney tests. ($p<0.05$)

Results:
Analysis based on Spearman's correlation coefficient, showed no significant association between QOL score and ICON (r=0.95, p=0.282), Mann-Whitney test did not show a significant difference between boys and girls. QOL score was considerably higher in boys (median = 18.50, mean ± SD = 14.82 ± 18.5) compared with girls (median = 9.00, mean ± SD = 14.3 ± 15.02) (p = 0.58).

Conclusion:
No significant difference among boys and girls in relation to orthodontic treatment need was observed, although girls had a significantly lower QOL score than boys. Correlation between orthodontic treatment need and its impact on QOL was also not significant. Therefore, dental esthetics has a greater impact on social acceptance and self-concept among girls.

Key words:
•Index of Orthodontic Treatment Need •Quality of Life •Students

Introduction

Malocclusion, more than being a disease, is considered as a deviation from social esthetic norms. The primary expectation from treatment is improvement in oral function and patient's appearance. Such a treatment leads to improved psychosocial status, increased self-esteem, and less anxiety and stress while interacting with social groups.[1] The major demand for orthodontic treatment is associated with esthetic complaints rather than with severity of the occlusal irregularities and the subsequent negative effects on dental health.[2]

Quality of life (QOL) is an ambiguous and general term, used in a wide range of contexts.[3] The World Health Organization (WHO), defines QOL as the individual's perception of their position in life in the context of culture and value systems in which they live and in relation to their goals, expectations, standards, and concerns.[4] Oral health-related QOL is a more specific term that concerns the impact of oral and dental health status on an individual's QOL. Oral and dental health is defined as a set of standards that enables an individual to eat, speak, and socialize without active disease, discomfort, or embarrassment. Oral health has a direct effect on psychological and functional status. Therefore, it profoundly affects enhancement of the overall sense of well-being.[5] In this context, orthodontic treatment could serve as an aid in improving function, and esthetics and, as a result, enhance oral health-related QOL.[6]

In the past 50 years, numerous indices have been developed to evaluate the need for orthodontic treatment.[7] These occlussal indices have been developed based on the type of malocclusion and its negative effects on oral health to assess orthodontic treatment need.[8] Among these indices, the index of complexity, outcome, and need (ICON) is worth mentioning.[9]

One of the QOL assessment tools, associated with orthodontic status, is a questionnaire designed by Cunningham in 2001. Cunningham developed this assessment tool to evaluate orthodontic-specific QOL in orthodontic patients with dento-facial deformities, and also showed its validity and reliability in his studies; He introduced this questionnaire as a useful assessment tool for evaluating oral health-related QOL in clinical studies.[10]

Several studies have shown a significant correlation between QOL and oral and orthodontic status [10, 11]; however few other investigations reported contrasting results.[12, 13]

Thus due to such contradictory results, the latest establishment of ICON, the lack of sufficient regional studies on this subject, and the effect of regional, social, and cultural factors on QOL, the present study aimed at evaluating the relationship between orthodontic treatment need based on ICON and orthodontic-specific QOL among high school students in Shiraz.

Materials and Methods

This analytical cross-sectional study was conducted on a sample of 118 high school students (49 girls and 69 boys) aged 15-18 years, which was based on the correlation between ICON and QOL score ($r = 0.254$) with $\alpha = 0.05$ and an estimated power of 80%.

The subjects were randomly selected from four high schools (two boys' and two girls' high schools). Because the examination of the students was possible only through permission from Shiraz education office, high schools located in four different regions were selected by an educationalist. Each student was numbered in the educational system. By using the table of random numbers, 118 students were randomly selected for the present study. The list of selected students was checked with school authorities to exclude students with depression, bipolar and body dysmorphic disorders.

Other exclusion criteria were: history of orthodontic treatment and currently under treatment. Individuals who needed orthodontic treatment or were currently under treatment because of a diagnosed psychological disorder were also excluded.

Furthermore, before the start of the study, a letter was given to the parents/ guardians of the students to seek consent for their cooperation to participate in the study. This letter also served to inform the parents/ guardians about the examination procedure and to assure them of the confidentiality of any information collected. Only positive consent was accepted.

Measuring the QOL index:

Cunningham's questionnaire was used to

assess QOl. The validity of the questionnaire was checked and confirmed by a group of orthodontists, and subsequently the required changes were applied. Cronbach's α (α = 0.82) was adopted for determining the reliability. The questionnaire was also further checked and edited by a sociologist.

Before completing the questionnaire, necessary instructions were given to the students. They were asked to fill the questionnaire according to their personal opinion.

Determining the need for orthodontic treatment using ICON:

In order to obtain accuracy in the use of ICON, four orthodontic residents underwent training and calibration exercise. Inter-examiner reliability was assessed under the supervision of a board- certified orthodontist, and intra-examiner reliability was evaluated within 2 weeks. The inter- and intra- examiner reliability values were 89% and 90%, respectively.

For measuring ICON, oral examination was performed using a mouth mirror. Dental esthetics, crowding, and spacing in the upper arch, cross-bite, overbite, and molar relationships were evaluated. Each subject was given a grade from 1 to 10 according to the standard form of esthetics. Based on the severity of crowding and spacing in the upper arch, each subject was given a grade from 0 to 5. Subjects were given a score of 1 in the case of posterior cross-bite, and 0 if no posterior cross-bite. Incisor bite was scored 1-3, and occlusion was graded 0-2.[9]

Data from the questionnaire were classified. QOL was measured according to these data and was compared with the average treatment need diagnosed by the dentist according to the ICON. After data collection and classification, statistical analysis was performed using SPSS 21. Spearman' correlation coefficient and Mann-Whitney tests were used for data analysis. ($p<0.05$)

Results

Analysis based on Spearman's correlation coefficient, showed no significant association between QOL score and ICON ($r = 0.95$, $p = 0.282$).

There was also no significant difference between QOL score and ICON among the two genders in the study (Table1), based on Mann-Whitney test. However, QOL score was considerably higher in boys (median = 18.50, mean ± SD = 14.82 ± 18.5) compared with girls (median = 9.00, mean ± SD = 14.3 ± 15.02) ($p = 0.58$) (Table2).

Table 1. Relationship between ICON and quality of life among the students (n = 118)

	Quality of life			
	P		R	
ICON	Boys	Girls	Boys	Girls
	0.653	0.327	0.116	0.061

Table 2. Relationship between ICON and quality of life among the students according to gender (n = 118).

	Gender		P
	Girls	Boys	
ICON	4.00	3.00	
(mean ± SD)	1.98± 4.09	2.51± 4.01	0.58
Quality of life	9.00	18.50	
(mean ± SD)	15.02 ±14.3	18.5 ±14.82	0.022

Discussion

Among the different age groups, adolescents are more concerned about their physical appearance; consequently, they become sensitive about their dental appearance and esthetics. This could play a significant role in their psychosocial well-being.This study evaluated the relationship between orthodontic treatment need as perceived by a dentist and its impact on oral health-related QOL, among high school students aged 15-18 years.

Among the different indices, the ICON was selected in this study to determine the need for orthodontic treatment. This index places more emphasis on anterior teeth instead of the whole arch. Moreover, it is simple to use on dental casts and thus could be easily applied in clinical settings. This index was also shown to demonstrate better agreement with the perception of orthodontists regarding the need for orthodontic treatment in comparison with IOTN and PAR indices.[14]

In the current study, the correlation between need for orthodontic treatment and its impact on QOL was not significant, which is consistent with the results of earlier studies.[12, 13] However, significant association was also reported by some other studies.[6, 8, 11]The reason for these contradictory results could be attributed to age, ethical, cultural, and social differences; and variation in subjective perception of QOL. These factors could not be fully considered in the questionnaire.

Nevertheless in order to make a comparison, it should be taken into account that earlier studies that reported a significant association had used IOTN, whereas we used ICON to assess the need for orthodontic treatment.

We also assessed the gender differences among the study subjects in terms of QOL. The results indicated that QOL is significantly lower among girls. This finding could be attributed to the fact that dental esthetics has a greater impact on social acceptance and self-concept among girls. In general, with the same severity of malocclusion, girls feel more shy in social contexts and their body self-concept is negatively affected, whereas the same malocclusion might be perceived differently by boys.They might be indifferent or even satisfied, whereas girls usually get concerned about minor irregularities.[15]Regarding orthodontic treatment need among the study subjects, we found no significant gender difference, which is in accordance with the study by Daniela et al. [15] This finding indicates a similar prevalence of malocclusion among both boys and girls.[15]The lower QOL among girls compared with boys despite the same orthodontic treatment need could be attributed to the fact that QOL is measured subjectively based on each person's self-perception, whereas orthodontic treatment need is objectively determined using specific criteria.One of the primary limitations of this study was the lack of complete cooperation on behalf of the school authorities during filling the questionnaires. Therefore, it is recommended that a more comprehensive study be conducted in a broader context.

Conclusion

No significant difference among boys and girls in relation to orthodontic treatment need was observed, although girls had a significantly lower QOL score than boys. Correlation between orthodontic treatment need and its impact on QOL was also not significant. Therefore, dental esthetics has a greater impact on social acceptance and self-concept among girls.

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References

1. Cunningham S J, O'Brien C. Quality of Life and Orthodontics. Seminars in Orthodontics. 2007;13 (2): 96–103.
2. Mohlin B, al-Saadi E, Andrup L, Ekblom K. Orthodontics in 12-year old children. Demand, treatment motivating factors and treatment decisions. Swed Dent J 2002;26(2):89-98.
3. Bowling, A. Measuring Health: A Review of Quality of Life Measurement Scales. 3rd ed. Maidenhead, Berkshire, England: Open University Press. 2005; 1–7.
4. World Health Organization. Measuring quality of life: the development of the World Health Organization Quality of Life Instrument (WHOQOL). Geneva: World Health Organization; 1993.
5. Locker D. Concepts of Oral Health, Disease and the Quality of Life. Measuring Oral Health and Quality of Life. Chapel Hill: University of North Carolina, Department of Dental Ecology; 1997. 11-24.
6. de Oliveira CM, Sheiham A. Orthodontic treatment and its impact on oral health-related quality of life in Brazilian adolescents. J Orthod. 2004; 31(1):20-7; discussion 15.
7. Firestone AR, Beck FM, Beglin FM, Vig KW Validity of the Index of Complexity, Outcome, and Need (ICON) in determining orthodontic treatment need. Angle Orthod 2002;72(1):15-20.
8. Liu Z, McGrath C, Hägg U. The impact of malocclusion/orthodontic treatment need on the quality of life. A systematic review. Angle Orthod 2009;79(3):585-91. doi: 10.2319/042108-224.1.
9. Daniels C, Richmond S. The development of the index of complexity, outcome and need (ICON). J Orthod 2000;27(2):149-62.
10. Cunningham SJ, Hunt N P. Quality of life and its importance in orthodontics. J Orthod 2001;28(2):152-158.
11. Heravi F, Farzanegan F, Tabatabaee M, Sadeghi M. Do malocclusions affect the oral health-related quality of life? Oral Health Prev Dent 2011;9(3):229-33.
12. Taylor KR, Kiyak A, Huang GJ, et al. Effects of malocclusion and its treatment on the quality of life of adolescents. Am J Orthod Dentofacial Orthop 2009;136(3):382-92. doi: 10.1016/j.ajodo.2008.04.022.
13. Caglayan F, Altun O, Miloglu O, et al. Correlation between oral health-related quality of life (OHQoL) and oral disorders in a Turkish patient population. Med Oral Patol Oral Cir Bucal 2009;14(11):e573-8.
14. Fox NA, Daniels C, Gilgrass T. comparison of the index of complexity outcome and need (ICON) with the peer assessment rating (PAR) and the index of orthodontic treatment need (IOTN). Br Dent J 2002;193(4):225-30.
15. Feu D, de Oliveira BH, de Oliveira Almeida MA, et al. Oral health-related quality of life and orthodontic treatment seeking. Am J Orthod Dentofacial Orthop 2010;138(2):152-9. doi: 10.1016/j.ajodo.2008.09.033.

Assessment of Dentists' knowledge of Peri-Implant Inflammatory Diseases and Their Related Treatment in Rasht

Original Article

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Abstract

Introdouction:
Implants are considered to be a useful treatment for the replacement of lost teeth. Although the success rate and durability of implants are high, the prevalence of peri-implantitis is high as well. The purpose of this study was to analyze the knowledge of general practitioners in the city of Rasht in Northern Iran regarding peri-implantitis and its treatment.

Materials and methods:
This descriptive, cross-sectional research was conducted among general practitioners working in the city of Rasht. They were asked to fill out a questionnaire, which included two parts of personal information; and their knowledge about the peri-implantitis disease.

Results:
Of 100 general practitioners who filled out the questionnaires, between 23-88 % answered correctly with a mean of 54.1%. The knowledge of 6% of dentists was poor, 74% average, and 20% good. There was no meaningful connection between age, sex, and job experience of the dentists and their knowledge of peri-implantitis diseases.

Conclusion:
The rate of dentists' knowledge in the city of Rasht regarding peri-implantitis diseases and their knowledge of treatment were average. Thus, continuous training sessions and workshops regarding peri-implantitis diseases are suggested for their improvement.

Key words:
•peri-implantitis disease •peri-implantitis •peri-implant mucositis •dentist knowledge

Introduction

An inflammatory change of the implant's surrounding tissue is called peri-implantitis.[1] This lesion is the most common complication in dental implants.[1] Implant failures include primary and secondary failures. Surgical trauma, lack of primary stability, and bacterial infection are primary failures.

Secondary failures result from prosthesis placement, bacterial infection, and mechanical overload. Peri-implantitis is the secondary failure of dental implants.[2]Based on the tissue involvement, the severity of peri-implantitis is divided into two categories: peri-implant mucositis and peri-implantitis.[3] Peri-implant mucositis is a reversible inflammation of the surrounding tissues of functional implants and dose not result in any bone loss.[4,5,6,7] Bleeding on probing, pus excretion, and 4-5 mm pocket depth are the clinical signs of this disease.[4,5,6,7]

While, peri-implantitis is a multi-factorial disease that is affected by microbial pathogens and the host's inflammatory response, biomechanical factors associated with additional forces can affect the implant as well.[8] This increase in microbial activity disrupts the host response balance, precipitating an inflammatory reaction in the tissue surrounding implant leading to bone loss.[4,5,6,7] There for, continuation of stimulation, causes to periodontal or peri-implant tissue destruction.[4,5,6,7] Increased pocket depth (>5 mm), bleeding, pus excretion on probing, peri-implant tissue bone loss, and circumferential crater are clinical signs of the disease.[7]

Microorganisms have an important role in the development of peri-implantitis.[8] There is a high proportion of pathogens, which are involved in periodontal disease, particularly gram-negative anaerobic bacteria such as P. gingivalis, Tanerella forsythia, and Troponema denticola.[8] Given that there are not clear microbiological differences between moderate and severe peri-implant mucositis and peri-implantitis, we can suggest that in most cases, peri-implant mucositis gradually turns to peri-implantitis.[8]

Other factors affecting peri-implantitis are patient-related factors such as previous periodontitis history, diabetes mellitus, genetic factors, poor oral hygiene, smoking and alcohol consumption6. Implant-related factors include: lack of keratinized tissue around implant, mechanical overload, deeply positioned implant, excessive cement retained, restoration-abutment poor insertion, over contoured restoration, improper implant position and implant surface properties.[6] Recent research on the long term success of implants has indicated the high incidence of peri-implant mucositis and peri-implantitis.[9] Infections caused by anaerobic bacteria are the primary inflammatory cause of peri-implants.[10] In the 6th European Periodontal Workshop11 the incidence rate of peri-implant mucositis (12-40% in implant sites) was 28 to 56 %.[11]

In the present, more people are keeping their natural teeth for more years.[12,13] however, people demand improvement in function and beauty and thus in the quality of life , moreover than oral health care.[12,13] In the past, dental implants were performed in specialized centers, but today the number of treatments performed by general practitioners is rapidly increasing.[14]

Accurate diagnosis of peri-implantitis disease is essential for its proper control: most studies have focused on dentists' knowledge of dental implants. No studies regarding peri-implantitis diseases were found to have been conducted be done, therefore, in this study, dentists' knowledge of peri-implantitis and its related treatment was assessed. It was a descriptive, cross-sectional study to provide appropriate educational content.

Materials and Methods

This descriptive, cross-sectional study was done among general practitioners working in the city of Rasht in 2014. The study population included all general practitioners in private practice or employed in clinics in the city of Rasht.

The list of names and addresses of all active general practitioners in the city of Rasht (capital to the province of Guilan) were taken from the Dental School of Medical Council. The sampling method for this study was "convenience sample size" and 96 dentists were included.

The information in this research was obtained from the assessment of dentists' knowledge, by the researcher-developed questionnaire.

The questionnaire did not ask about their names or addresses and had 2 parts: In part 1, personal information about age, sex, job experience, and history of attendance in implant workshops

or symposiums was questioned. In part 2, they were asked about etiology (questions 1- 4), clinical diagnosis (questions 5-8) and peri-implantitis disease treatment (questions 9-17). For each correct and wrong, a score of 1 and 0 were given respectively. The results varied from 100% (for all correct) to 0% (for no correct answer), and the result was considered to be representative of the dentists' level of knowledge.

To confirm the questionnaire's validity, we ask dental school professors of Guilan University of Medical Sciences (GUMS) opinioin's , and, we confirmed the questionnaire's reliability, by using the Cronbach's alpha-1 coefficient in a preliminary study.

The project manager herself conducted the general dentist's offices (or clinics) and provided explanations about the objectives of the study for data collection, after which the questionnaire was given to the dentists. As much as was possible, the questionnaires were filled out in the researcher's presence; otherwise, after dentists were given a thorough explanation of the study, they were asked to carefully fill out the questionnaire for collect later.

Finally, all 100 questionnaires were collected, and the information went through statistical analysis using SPSS v-19.The relationship between knowledge, age, and job experience was assessed using the Pearson correlation coefficient and the relationship between knowledge, gender, and re-education was analyzed using the Spearman correlation coefficient (statistical significance level $P < 0.05$). To calculate the correct answer to questions in relation with items, the Chi-Square test with 95% confidence intervals was used, and to determine the factors affecting the account ability logestic regression was used.

Results

After the assessment, mean general knowledge of dentists in the city of Rasht was found to be 54.1%. From 100 participants, 69% were male (n=69) and 31% females (n=31). Independent Sample test showed no meaningful differences between the average knowledge of both sexes. (p=0.404).

Regarding background, 53% of the dentists had over 10 years of job experience and 47% had fewer than 10 years of job experience, with 77% having had a history of participation in dental implant workshops or symposiums (23% no history). Using the Independent Sample test there was no significant difference between knowledge and job experience (P=0.179).

Dentists' distribution based on the field of focus was as follows: 21% prosthetics, 7% surgery, 36% prosthetics and surgery, and 36% none of the above. Using one way ANOVA test, there was a significant statistical relation between the knowledge and field of focus ($P = 0.019$) with prosthetics in the lead (44.62 %); however, it was not statistically significant.

In Table 2, the number of people who correctly answered less than 33% of the questions, received a poor rating; those answering between 33% and 67% were average; and those with more than 67% were considered good. According to the table in terms of etiology, 25%, 37%, and 38% had poor, average, and good knowledge, respectively. In the field of treatment, 27% , 63%, and 10% had a poor, average, and good knowledge, respectively. In the field of diagnosis, 12%, 37% , and 51% had poor, average, and good knowledge, respectively. Finally, 6% of the dentists had poor, 74% had average, and 20% had good knowledge. The range of correct answers was between 4 and 15: The highest and lowest correct answers were 15 (2% of people) and 4 (3% people) respectively. The mean number of correct answers was 10, with 12 people answering (12% of dentists).

Discussion

Despite the high success rate of implants, the increasing rate of peri-implantitis disease has been reported in the literatuer[11], hence it can be concluded that general practitioners have to increase their knowledge on prevention, diagnosis, and treatment of those diseases. Therefore, continued learning is essential to their professions.

In a 2002 study by Heubener in the United States, the pattern of using implant education in dentistry graduates of Creight University over a period of 10 years (1988 - 1997) was assessed. Results showed that those who passed the implant training in laboratories and workshops had a greater knowledge about implants, , did additional implant therapy in their offices and also spent more time on implant education than those who did not

Table 1. Distribution of the questions with their percentages

questions	Answer	percentage
Peri-implantitis is an inflammatory reaction of hard and soft tissue around implants.	incorrect	35%
	correct	65%
Prevalence of peri-implantitis is about 30–60% .	incorrect	76%
	correct	24%
Bacterial plaque is the main factor of peri-implantitis development.	incorrect	26%
	correct	74%
Factors such as history of periodontitis, diabetes mellitus, oral health, smoking, and alcohol can increase the incidence of peri-implantitis.	incorrect	43%
	correct	57%
Probing around implants compared to the teeth required less than normal force.	incorrect	53%
	correct	47%
Bone loss is not a symptom of peri-implantitis.	incorrect	33%
	correct	67%
1.5 mm Bone loss at first year of implant insertion is not a symptom of peri-implantitis.	incorrect	12%
	correct	88%
loosening of the implant is not useful for early detection of diseases.	incorrect	58%
	correct	42%
Non-surgical treatment (debridement and plaque control) is the only necessary treatment for peri-implantitis mucositis, and this method can be used in the initial phase of peri-implantitis.	incorrect	39%
	correct	61%
To remove plaques from the surface of titanium implants, titanium curettes, plastic brushes, hydrogen peroxide and chlorhexidine can be used.	incorrect	62%
	correct	38%
Bleeding on probing with a probing depth of 6 mm and bone loss in consecutive meetings requires surgical treatment of inflammatory diseases.	incorrect	32%
	correct	68%
The type of the lesion is an important factor in choosing the type of surgery for peri-implantitis treatment.	incorrect	35%
	correct	65%
Loosening of the implant is a definitive indication for implant removal.	incorrect	50%
	correct	50%
Appropriate Recall period for patients receiving the implant after insertion of the prosthesis is every 3 to 4 months in the first year.	incorrect	28%
	correct	72%
Removal of plaque and calculus and oral health instruction (OHI) is the best treatment for a patient with BOP, pus excretion, and 3 to 4 mm probing depth around the implant.	incorrect	82%
	correct	18%
The first treatment for a patient with BOP, pus excretion, and 6 mm probing depth around the implant is supragingival and subgingival debridement and OHI	incorrect	52%
	correct	48%
Metronidazole is a systemic antibiotic prescribed for the treatment of diseases around the implant.	incorrect	64%
	correct	36%

According to Table 1, the average knowledge of general dentists was 54.1% (total number of correct answers divided by 17).

Table 2. Frequency distribution of knowledge in the fields' of etiology, diagnosis, and treatment

Fields	Answers	Poor	Average	Good
etiology	number	25	37	38
	percent	25%	37%	38%
treatment	number	27	63	10
	percent	27%	63%	10%
diagnosis	number	12	37	51
	percent	12%	37%	51%
total	number	6	74	20
	percent	6%	74%	20%

pass such courses. These findings indicate that, "scientific and practical implant workshops can substantially improve their practical implementation".[15]

Most et al. (2013) studied the impact of a dental implant training program to improve knowledge of dental students. In this study, a training program consisting of 200 hour of dental implant training and practice, over a period of 3 years, for a group of students was presented. For another group of students a 3-day training program was held. Then both groups were asked to fill out a questionnaire about the following: basic information and implant materials, implant design, and soft tissue management. The results showed that scores of basic implant information and implant design in the 3-year group were higher than in the 3-day group. According to this study, academic training can improve students' knowledge of dental implants.[16]

Poorsamimi et al. (1390) studied general dentists' knowledge and practice about dental implants in the Qazvin province. Of 104 dentists who participated in that study, 60.8% of participants were male and 39.2% were female with an average age of 35 years, and 8 years of job experience. The average score of dentists' who had participated in implant re-training courses was 13.33%. According to this study there was no significant relationship between sex, age, job experience history, and dentists' knowledge; however, there was a significant relation between dentists' knowledge and their practice. This study reported that, despite adding implant training courses to the student curricula, there was no significant difference between younger and older dentists. This can be interpreted as dental schools and implant re-training courses not being successful in the field of implants.[17]

Haghighat et al. (2011) conducted a study in the city of Isfahan, to assess the knowledge of dentists to provide basic information of implant re-training workshops.

In this cross-sectional study, 300 dentists were evaluated by a questionnaire. The minimum score was 0, while the maximum was 60. The results showed that 67.7% of dentists did not participate in implant re-training courses. The mean total score for the all dentists was 28.33 ±16.9. The mean score of general practitioners was 27.87 ± 16 and the mean score of specialist dentists was 41±17.9, which was statistically significant (P = 0.03). The mean score of dentists who had participated in implant re-training courses was 38.72 ± 13.74, while that of dentists who had not participated in implant re-training courses was 23.4±16.2, with a statistically significant difference (P < 0.001). Based on the results of this study, general practitioners' and specialists' knowledge was found to be very far from the ideal. It is essential that the dental student curriculum would be planned and implant re-training courses be tailored accordingly.[18]

In this study, with a sample size of 100, general dentists' knowledge about peri-implant inflammatory disease and its treatment was assessed. According to this study, there was no significant relationship between age, sex, job experience, and general dentists' knowledge about peri-implant inflammatory diseases. On the other hand, there was a significant difference between field of focus (prosthetics, surgery, or both) and general dentists' knowledge; in other words, dentists with prosthetics experience had a higher knowledge score.

The questionnaire was divided into 3 part: etiology, clinical diagnosis, and treatment of peri-implant inflammatory diseases. According to the results, in the field of etiology, 38%, 37% and 25% had good, average, and poor knowledge respectively. "Only 10% of dentists had good knowledge of treatment, and, 90% had an average or poor knowledge" . This suggests that the gap in the knowledge of the etiology related to reduced knowledge in the field of treatment. In terms of clinical diagnosis, 51% of the dentists had good knowledge. Greater knowledge of clinical diagnosis than etiology and treatment could indicate the need for higher levels of education

in this field.

On the other hand, studies have shown that, in most universities of developed countries, such as United States, Canada, and Western Europe, dental implant clinical training is included in the general dentistry schedule, while in the dental schools of Iran such kinds of studies are not present.[19]

The results of the present study, with a knowledge score of 10.8 for the dentists in the city of Rasht, indicate that implant re-training courses and workshops have not successful in recent years. It seems to be essential to hold re-training courses and conferences, and to distribute training brochures about dental issues to dentists to enhance their theoretical and practical skills of dentists: in particular, about implant and peri-implant diseases.

To provide more statistics and information in dentists' proficiency and a better and more accurate evaluation of this issue, further studies are needed in other cities of Iran to provide a more comprehensive means for raising dentists' knowledge levels in the future.

References

1. Sánchez-Gárces MA, Gay-Escoda C. Periimplantitis. Med Oral Patol Oral Cir Bucal 2004;9 Suppl:69-74; 63-9.

2. Esposito M, Hirsch JM, LekholmU, ThomsenP. Biological factors contributing to failures of osseointegrated oral implants.(II). Etiopathogenesis. Eur J Oral Sci 1998; 106:721-764.

3. Albrektsson T, Isidor F. Consensus report of session IV. In: Lang NP, Karring T, editors. Proceedings of the First European Workshop on Periodontology. London: Quintessence; 1994. 365–369.

4. Murata M, Tatsumi J, Kato Y, et al. Osteocalcin, deoxypyridinoline and inter-leukin 1-β in peri-implant crevicular fluid of patients with peri-implantitis. Clin. Oral Impl Res 2002; 13:637-643.

5. Heitz-Mayfield LJ. Peri-implant diseases: diagnosis and risk factors. J Clin Periodontol 2008;35(8 Suppl):292-304. doi: 10.1111/j.1600-051X.2008.01275.x.

6. Moghaddas O. Management and treatment of peri-implant conditions. Journal of Isfahan Dental School 2012; 8 (5): 480-490. Persian.

7. Heitz-Mayfield. Diagnosis and management of peri-implant disease. Aust Dent J 2008;53 :S43-8. doi: 10.1111/j.1834-7819.2008.00041.x.

8. Mombelli A, De caillet F. The characteristics of biofilm in peri-implant disease. J Clin Periodontal 2011; 38 (suppl. 11):203-213.

9. Nogueira-Filho G, Iacopino AM, Tenenbaum HC. Prognosis in implant dentistry: a system for classifying the degree of peri-implant mucosal inflammation. J Can Dent Assoc 2011; 77: b8.

10. Mombelli A, Lang NP. The diagnosis and treatment of periimplantitis. Periodontol 2000 1998;17:63-76.

11. Zitzmann NU, Berglundh T. Definition and prevalence of peri-implant diseases. J Clin Periodontal 2008;35(suppl.8):286-291.

12. Lang NP, Wetzel AS. Histologic probe penetration in healthy and inflamed peri implant tissues. Clin Oral Implants Res 1994;5(4):191-201.

13. Mattheos N, Ivanovski S, Sambrook P, Klineberg I. Implant dentistry in Australian undergraduate dental curricula: knowledge and competencies for the graduating dentist. Aust Dent J 2010; 55:333-8.

14. Vasak C, Fiederer R, Watzek G. Current state of training for implant dentistry in Europe: a questionnaire-based survey. Clin Oral Implants Res 2007; 18: following 668.

15. Huebner GR. Evaluation of preductoral implant curriculum: does such a program influence graduates practice patterns? Int J Oral Maxillofac Implants 2002; 17(4):543-9.

16. Möst T, Eitner S, Neukam FW, et al. I lect, a pre-graduate education model of implantology. Eur J Dent Educ 2013; 17: 106-13.

17. Poorsmimi J, moulavi . Assessment of knowledge and practice of general dentists in the city of Qazvin than implants (thesis). Qazvin dental school;1389.persian.

18. Haghighat A, Bonakdarchian M, Ghafari SM. Evaluation of Isfahan dental practitioners' awareness about dental implants. Journal of Isfahan Dental School 2011; 6(5) 1: 493-499.

19. Atash razm P, Valaei N, Rahnamania R, noorbakhsh M. Evaluation of implant training in the pre-doctorate courses in the worlds' dental colleges. Journal of Dental Research. 2010; 7(1) .persian.

Fascin Expression in Oral Squamous Cell Carcinoma using an Immunohistochemical Technique

Original Article

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Abstract

Introdouction:
Oral squamous cell carcinoma (OSCC), the most common form of oral cancer, requires early diagnosis and suitable treatments. Fascin is a protein involved in cell adhesion and is increased in expression in certain types of carcinomas. The present study was conducted to assess fascin expression in OSCC using an immunohistochemical technique.

Materials and methods:
In the present retrospective study, 25 paraffin blocks of OSCC samples were selected and immunohistochemically stained for detection of fascin expression. Fascin expression rate was calculated as the sum of stained cells (scores from 0 to 4) and staining intensity (scores from 0 to 3).

Results:
Samples collected from 18 men and 7 women, with a mean age of 57.42 years, were assessed, which showed that the most usually affected sites were the gingiva and the tongue. Fascin expression was positive for all the samples and had the highest possible score (24 cases with score 7 and 1 case with score 6). Fascin expression level was not found to have a significant relationship with age, gender, and tumor location ($P > 0.05$).

Conclusion:
Irrespective of the clinical parameters, fascin expression is possibly involved in the etiology of OSCC; target therapy medicines can therefore be used in the future to treat this malignancy.

Key words:
•Fascin •Mouth Neoplasms •Carcinoma, •Squamous Cell •Immunohistochemistry

Introduction

Oral squamous cell carcinoma (OSCC) is the most common form of oral cancer, accounting for approximately 91% of all oral malignancies.[1] The etiology of this carcinoma is multifactorial and both internal and external factors might affect its development. Despite using a combination of treatments including surgery, radiotherapy, and chemotherapy, the 5-year survival prospect is perceived in only approximately 40% of the patients and some die due to the secondary complications of cancer.[2]

Although surgery is still an appropriate treatment, it presents certain complications, such as chronic pain, dysphagia, dysphasia, and malformation.[3] Radiotherapy and chemotherapy also have antitumor effects, but they damage the normal tissue. A better understanding of the molecular mechanisms and identification of the potential of oncogenes in OSCC could lead to the introduction of new adjunctive methods of treatment (molecular targeted therapy) for patients with oral cancer, which would result in fewer complications compared with other methods of treatment.[4] Local tumor invasion and metastasis account for 90% of treatment failures. This aggressive behavior arises due to multiple phases that lead to the loss of cell adhesion. Fascin is a 55-kDa protein from the family of actin-bundling proteins that contributes a great share to the properties of cell junctions and their increased motility. In recent years, several studies have been conducted on this marker in normal and pathological tissues and several different roles have been attributed to it in the incidence of diseases such as neoplasms.[5,6]

Given the role of fascin in cell adhesion, this protein may be used as a target for the treatment of OSCC and also as a marker for identifying aggressive malignant cell behaviors. As only a few studies have examined the role of fascin in OSCC [7-12], the present study was therefore conducted to evaluate the expression levels of fascin in OSCC to gain more knowledge about fascin and OSCC and to also pave way for predicting tumor behavior and for finding a suitable treatment. Furthermore, given that, in many cases, non-smoking young individuals are diagnosed with tongue carcinoma, the present study assessed the relationship between this marker and age, gender, and tumor location.

Materials and Methods

The present study was retrospective and cross-sectional in design. Archived samples at the pathology laboratory of Taleghani Hospital and a private laboratory were examined and samples with an OSCC diagnosis were selected. Clinical and demoghraphic data such as age, gender, and tumor location were extracted from the patients' records. Cases with sufficient data on the surveyed variables as well as the corresponding paraffin blocks with complete fixation and adequate tissue and with microscopic features of squamous cell carcinoma were finally selected.

Immunohistochemical (IHC) staining of paraffin blocks

The streptavidin-biotin method was used for staining. All samples were first fixed in 10% buffered formalin and then embedded in paraffin. Sections were prepared with a diameter of 4 mm and then deparaffinized and dehumidified by xylene and alcohol and washed with phosphate-buffered saline (PBS) and then placed in DAKO cytomation (PH = 9) in a microwave for 20 min for fixing the antigens. Internal oxidation was inhibited by addition of 3% hydrogen peroxidase. The slides were then incubated with monoclonal antibody (Dako, Denmark, clone55k-2, Code M3567) for 30 min according to the manufacturer's recommendations for examining fascin expression. After washing the slides with PBS for 5 min, they were immersed in Zymed streptavidin and incubated for 10 min. In the next step, the slides were exposed to 3,3′-Diaminobenzidine (DAB) hydrochloride as a chromogenic reagent, which produced a brown reaction product. The samples were then counterstained by hematoxylin and a coverslip was placed on them after dewatering.

A sample of Hodgkin's lymphoma was used as the positive control and the negative control was examined after the elimination of the primary antibody. Vascular endothelium was also taken as an internal positive control.

Method of interpreting the slides

Staining was assumed positive when the cytoplasm of the tumor cells was visibly stained. Fascin expression was determined based on the following items:

1. Percentage score (PS): According to the study conducted by Lee et al. [10], the number of stained cells was determined based on the DAB staining under an optical microscope, which were then divided into four groups. Score 1: less than 10% stained; score 2: 11-50% stained; score 3: 51-80% stained, and score 4: more than 81% stained.
2. Intensity score (IS): Score 0: no staining; score 1 (poor): staining is visible but with some difficulty; score 2 (medium): pale brown (oak); and score 3 (extreme): dark brown. To calculate the final score, PS was added to IS (0-7).

Results

The present study was conducted on OSCC samples of 25 patients with a mean age of 57.42 years (range: 27–90 years), of which 18 patients (72%) were males with a mean age of 59.41 years and 7 (28%) were females with a mean age of 52.57 years. The OSCC samples were mostly collected from the gingiva (10 cases or 40%) and the tongue (8 cases or 32%). In addition, four samples (16%) were collected from the buccal mucosa, two (8%) from the palate, and one (4%) from the lip. Fascin expression was analyzed in the OSCC samples using IHC staining. Fascin staining was cytoplasmic and fascin expression was confirmed in all the samples examined with a high score. All the samples obtained score 3 for their percentage score. For the intensity score, 24 samples obtained score 3 and 1 sample obtained score 2 (Figures 1 and 2).

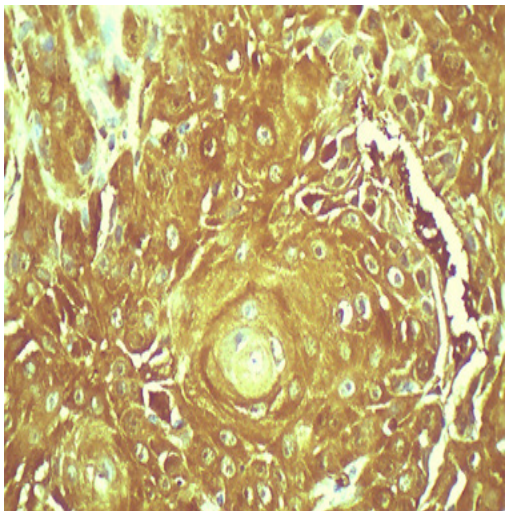

Figure 1. Cytoplasmic fascin expression in OSCC in malignant squamous cells with score 6 (× 400)

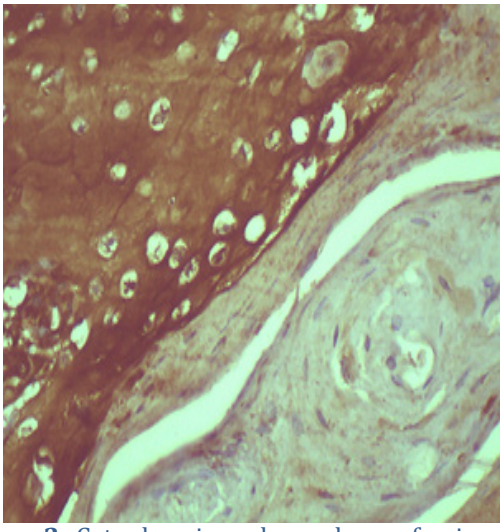

Figure 2. Cytoplasmic and membrane fascin expression in OSCC in the keratin pearl island with score 7 (× 400)

The assumption in this study was that independent variables, particularly tumor location, were capable of affecting fascin expression. Given that all the samples had high scores in terms of their fascin expression levels (score 7 and, in one case, score 6), it was observed that fascin expression was not related to the patients' age and gender and tumor location. As the biopsy samples were mostly incisional, with few excisional cases, grading them was not possible. However, the tissues surveyed were primarily differentiated and the majority contained keratin pearls, and no poorly differentiated states were observed under the microscope. Malignant squamous cell islands were fascin-positive with or without the presence of keratin pearls.

Table 1. Fascin expression scores in OSCC by patients' demographic characteristics

		No of Samples	Percentage Score	Intensity Score	Total
Age (years)	< 40	4	4	3	7
	41–55	12	4	3	7
	41–55	1	4	2	6
	56–70	4	4	3	7
	>70	3	4	3	7
Location	Gingiva	9	4	3	7
	Gingiva	1	4	2	7
	Tongue	8	4	3	7
	Palate	2	4	3	7
	Buccal Mucosa	4	4	3	7
	Lip	1	4	3	7
Gender	Male	17	4	3	7
	Male	1	4	2	6
	Female	7	4	3	7

Discussion

The present study showed overexpression of fascin in OSCC. Fascin expression level was not found to have a significant relationship with the patients' age and gender and tumor location. These results are consistent with the results of many other studies conducted on fascin expression and its relationship with gender, age, and tumor location.[7, 9, 10, 11,12]

Similarly, Chen et al. [9] did not find fascin expression intensity to have a relationship with age, gender, and tumor location and fascin expression percentage to have a relationship with the patients' age and gender. Although the majority of buccal mucosa samples expressed less than 55% fascin, the tongue samples of OSCC mostly expressed more than 55% fascin, which was statistically significant. Lee et al. [10] also did not find fascin expression intensity to have a relationship with the patients' age and gender. Similar to the present study, they also reported that this protein was expressed in 91.3% of the samples. In the present study, the majority of samples were well differentiated under the microscope and contained keratin pearls (although their microscopic grade could not be determined). All the islands, with or without keratin pearls, overexpressed fascin. Consistent with our findings, Shimamura et al. [11] noticed fascin expression in epithelial dysplasia, carcinoma in situ, and also in OSCC, unlike in benign tumors such as papilloma. Therefore, it is quite natural for all of our samples to also overexpress this marker. It was suggested that fascin could be a useful tool for the accurate diagnosis of dysplasia and carcinoma in situ.[11] Fascin might therefore be involved in the early stages of carcinogenesis.

In contrast to the results obtained in our study on fascin expression, Alam et al.[7] did not detect this protein in 25.19% of the cases and found that it had a poor expression in 41.98% of the samples and was overexpressed only in 32.28% of the cases.[13] They also did not find fascin expression in the well-differentiated keratin-pearl-containing cases of OSCC. Moreover, unlike Chen and Alam [7,9], other researchers [10,12] did not find a relationship between grade, microscopic stage, and fascin expression; however, they found that a relationship was established when lymph nodes were involved. The possible reasons for the disparity of results might be technical errors and the different steps of performing IHC staining, visual counting, using the computer, and the sample size examined. As in previous studies [9,11], in the OSCC samples examined in the present study, fascin was primarily cytoplasmic-stained; however, due to its overexpression, the cell membrane was also stained in some cases. Nevertheless, Alam et al. also showed fascin expression in cell membranes in addition to that in the cytoplasm.[7] Previous studies showed that fascin is either not expressed in normal oral epithelium or is expressed very poorly.[11] An interesting point, however, was that in the study conducted by Papaspyrou et al., 7 cases out of the 19 surveyed cases of normal epithelium showed score 2.[12]

The justification for this finding might be that the epithelia might have been derived from the vicinity of the tumor and might have therefore had the same environmental and pathological conditions, thus overexpressing the marker. The epithelia might be normal in macroscopic terms and under an optical microscope and might have experienced structural changes at the molecular level, and our slides also showed epithelia in some cases. However, the epithelium was not the subject for examination as it was in the vicinity of the tumor and hence will not be considered environmentally natural. Alam et al. [7] found no relationship between fascin expression and invasion around the nerves. They also stated that fascin overexpression was observed in 17% of the N0 cases, and these patients should therefore be followed up to determine in the future whether fascin can act as a prognostic factor of occult metastasis or not. Papaspyrou et al.[12] also concluded that fascin can be used to predict regional lymph node metastasis, and, in contrast to several studies [7, 8 ,10], fascin expression was not associated with the reduced survival in their study.

To better explain the role of this protein, several studies have investigated its function, including a study conducted by Chen [8], who examined the function of fascin from the WNT signaling pathway through the stabilization of β-catenin mutation or the inactivation of APC gene and suggested that it increases the expression of this protein in cancer cells. In addition, Lee et al. [10] stated that fascin expression is associated with the loss or reduction of E-cadherin, which is a

significant component of tumor cell invasion, and leads to the loss of cell–cell contact. Alam et al. [7] stated that fascin can disrupt the cell–cell contact and is involved in the formation and progression of primary OSCC tumor. Furthermore, fascin increases MMPs [2,9], which are proteolytic enzymes that digest the basement membrane content and facilitate metastasis.

They also found a strong relationship between fascin expression and lymph node involvement, confirming that the marker might facilitate the movement of tumor cells from the primary location to the lymph nodes. In the present study, the IHC staining method was used to examine fascin expression. Other methods can also be used to confirm the IHC staining results; for instance, the RT-PCR for analyzing fascin expression and the Western Blot for assessing fascin levels.[10] However, further tests could not be conducted in the present study due to their high costs and the use of fixed samples. Alam et al.[7]

found actin components such as microspikes to be thicker and longer and showed the formation of more filopodia and lamellipodia, demonstrating a visibly increased cell motility in OSCC cell culture. Similarly, in another study on two OSCC cell lines, Chen et al.[8] also concluded that fascin expression might have an essential role in the regulation and development of OSCC that acts through epithelial-mesenchymal transition (EMT) and changes in E-cadherin and β-catenin. Chen et al. [13]

tested migrastatin on breast cancer cells and found that this drug prevents cell migration, invasion, and metastasis by blocking fascin activity. The above-reviewed studies investigated the relationship between fascin expression levels and the clinical and histological conditions of OSCC and showed that increased fascin expression is associated with more invasive malignant cells and poorer prognosis. In the present study, all the samples showed the same score of fascin expression. i.e, [6,7] Data on the stage of the disease and patients' survival rates were not examined due to the incomplete pathological records. As a result, the effect of fascin expression levels and clinicopathological factors could not be investigated in this study.

Conclusion

Given the limitations of the present study, the results showed that fascin is overexpressed in OSCC samples, but its level is not associated with gender, age, and tumor location. Regardless of the clinical parameters, fascin expression is possibly involved in the etiology of OSCC, and target therapy medicines can therefore be used in the future for treating this malignancy.

References

1.Silverberg E, Boring CC, Squires TS. Cancer statistics, 1990. CA Cancer J Clin. 1990;40: 9-26.

2.Day G, Blot WJ. Second primary tumors in patients with oral cancer. Cancer. 1992 1;70:14-9.

3.Telfer MR, Shepherd JP. Psychological distress in patients attending an oncology clinic after definitive treatment for maxillofacial malignant neoplasia. Int J Oral Maxillofac Surg. 1993;22:347-9.

4.Le Tourneau C, Siu LL. Molecular-targeted therapies in the treatment of squamous cell carcinomas of the head and neck. Curr Opin Oncol. 2008;20:256-63.

5.Alaeddini M, Fouladdel S, Etemad-Moghadam S, Azizi E. Expression of Fascin and mRNA in the KB carcinoma cell line following treatment with doxorubicin. J Cancer Res Ther. 2011;7:427-32.

6.Tong GX, Yee H, Chiriboga L, Hernandez O, Waisman J. Fascin-1 expression in papillary and invasive urothelial carcinomas of the urinary bladder. Hum Pathol. 2005;36:741-6.

7.Alam H, Bhate AV, Gangadaran P, Sawant SS, Salot S, Sehgal L et al. Ascin overexpression promotes neoplastic progression in OSCC. BMC Cancer 2012 20: 12-32.

8.Chen SF, Lin CY, Chang YC, Li JW, Fu E, Chang FN, et al. Effects of small interfering RNAs targeting Fascin on gene expression in oral cancer cells. J Oral Pathol Med. 2009;38:722-30.

9.Chen SF, Yang SF, Li JW, Nieh PC, Lin SY, Fu E, et al. Expression of fascin in oral and oropharyngeal squamous cell carcinomas has prognostic significance - a tissue microarray study of 129 cases. Histopathology. 2007;51:173-83.

10. Lee TK, Poon RT, Man K, Guan XY, Ma S, Liu XB, et al. Fascin over-expression is associated with aggressiveness of OSCC. Cancer Lett. 2007 8;254:308-15.

11-Shimamura Y, Abe T, Nakahira M, Yoda T, Murata S, Sugasawa M. Immunohistochemical analysis of oral dysplasia: diagnostic assessment by fascin and podoplanin expression. Acta Histochem Cytochem. 2011 28;44:239-45.

12- Papaspyrou K, Brochhausen C, Schmidtmann I, Fruth K, Gouveris H, Kirckpatrick J et al. Fascin upregulation in primary head and neck squamous cell carcinoma is associated with lymphatic metastasis. Oncol Lett. 2014;7:2041-46.

13-Chen L, Yang S, Jakoncic J, Zhang JJ, Huang XY. Migrastatin analogues target fascin to block tumor metastasis. Nature. 2010 15;464:1062-6.