Original Article

General dentists' awareness of orthodontic treatment needs of patients and their referral practices

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ABSTRACT

Background: Since general dentists (GDs) usually act as the primary referral source for the patients in need of orthodontic treatments, having the proper knowledge and understanding of the accurate diagnosis of clinical situations is very important. The aim of this study was to assess GDs about the identification of orthodontic treatment needs and their referral practices.

Materials and Methods: This descriptive and analytical cross-sectional study was carried out in Iran 2020. A questionnaire consisting of three main parts was designed and distributed electronically among GDs. The first section included 11 image and scenario-based questions meant to assess the ability of GDs to correctly diagnose the orthodontic treatment needs of the patients. The next two parts were to assess the dentists' knowledge of the necessity of referral to an orthodontist with 11 questions, and the proper timing of orthodontic treatments with 8 questions. Data were analyzed using SPSS 26, by conducting Mann–Whitney, Kruskal–Wallis, and correlation tests $\alpha = 0.05$.

Results: Among 384 participated dentists, 50.3% (193) were female. The mean score of knowledge was 17.3 ± 3.5 out of 30. The highest percentage of good knowledge (70% of range) was related to the diagnosis of orthodontic problems, while the lowest one belonged to the referring pattern. There was a weak positive correlation between the working experience and the proper timing of referral ($R = 0.15$, $P = 0.004$ (. Kruskal–Wallis test also showed a significant difference between the total knowledge scores ($P = 0.04$) and the knowledge of the proper timing of treatment ($P = 0.04$) based on the age groups of participants. Eighty-seven percentage ($n = 334$) reported that they would refer the patients in need of orthodontic treatment.

Conclusion: The knowledge level of orthodontic treatment needs among GDs was moderate, thus emphasizing the importance of planning more educational courses for them to improve their knowledge, thus reducing the possible detriments of postponed or inaccurate treatments.

Key Words: Dentists, index of orthodontic treatment need, knowledge, orthodontics, referrals

INTRODUCTION

The ultimate purpose of dental care including orthodontic treatments is improving oral health and consequently, the patients' related quality of life.[1] Having aligned teeth and a beautiful smile usually leads to improved self-esteem in social relationships.[2] This

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fact, in addition to the increase in the prevalence of malocclusion, could justify the recently growing number of patients seeking orthodontic treatments.[3] Based on a meta-analysis, the prevalence of normal occlusion, Class I, II and III malocclusions in the Iranian adult population is 13.3% (confidence interval [CI] 95%: 7.8–21.7(, 50.7% (CI 95%: 42.9–58.4), 21% (CI 95%: 17.5–25.1(and 5.5% (CI 95%: 3–10(, respectively.[4]

The majority of orthodontic treatments are traditionally provided by specialists;[5] however, a substantial number of general dentists (GDs) appear to provide some type of orthodontic service.[6] GDs usually act as the primary referral source for the patients in need of orthodontic treatments; therefore, having the proper knowledge and understanding regarding the accurate diagnosis of clinical situations requiring timely treatment, as well as necessary referral to specialists, can be of paramount importance.[7-9]

American Association of Orthodontists states that graduated dentists should be able to design and adjust a space maintainer device; they should also have the ability to diagnose and manage space-related problems, as well as being familiar with single tooth movement or moving part of the dental arch by using functional orthodontic appliances. It is also stated that in orthodontic treatments, understanding the proper timing of the treatment is a key factor in achieving the optimum results and reducing the time and cost of postponed treatments.[10]

Referral to the orthodontist by a GD usually occurs when diagnosis and treatments are out of their ability or when during the orthodontic treatment, for various reasons including the complexity of the treatment or prolongation of treatment time, patients prefer to continue the treatment under the supervision of an orthodontist.[6,8] In a study of the orthodontic referral behavior of dentists, it was reported that only a small number of them were able to correctly identify the appropriate timing of referral.[11]

Unfortunately, there are limited studies evaluating dentists' knowledge of orthodontic treatments and referrals to specialists in Iran. The present study, thus, aimed to assess the GDs knowledge regarding the diagnosis of the necessity of orthodontic treatment and their referral practice.

MATERIALS AND METHODS

This descriptive cross-sectional study was carried out among 466 GDs in Isfahan, Iran, in 2020. The study was designed in accordance with the Ethical Declaration of Helsinki on medical protocol. In addition, the Regional Ethical Review Board of Isfahan University of Medical Sciences approved the study with the ethical code "IR.MUI.RESEARCH. REC.1399.831." Informed consent was obtained from all participants and their information was kept confidential.

The sample size was calculated to be 460 by using the formula: $n = \dfrac{Nz^2 p1 - p}{N - 1d^2 + Z^2 p1 - p}$, Where N is the number of target statistical population (GD); it was considered as 1500 based on the Medical Council reports. In a similar study done by Jackson *et al*. in 2009,[11] only 20% (*p*) of GDs had an acceptable knowledge of the necessity of referral to an orthodontist. A minimum difference of 3% (d) was considered statistically significant and the CI was set as 95%. Inclusion criteria included GDs working in Isfahan province for at least 1 year. The exclusion criteria were those questionnaires that about two third of the questions were not filled out. Considering the COVID-19 pandemic, we used the convenience sampling method (the participation was voluntary and the sampling was continued until reaching the proposed sample number). Therefore, an electronic questionnaire was designed and its link was distributed in the social virtual groups (Telegram) of GDs' societies such as the Isfahan General Dental Association and Isfahan Dental School graduation group. The permissions to access and distribute questionnaires were gained from the admins of these virtual groups. The sampling period with weekly reminders took 3 months.

The validity of the questionnaire was evaluated by a panel of experts including four orthodontists and one Dental Public Health specialist. To grade the relevancy of each question with the objectives of the study, the experts were asked to score the questions using a five-point Likert (1 = Very highly relevant – 5 = Very weakly relevant). Furthermore, the experts were asked to give their comments. Finally, questions with a mean score of 2 or above were modified or omitted and the questionnaire was re-evaluated for the final confirmation. Correct answers to the questions were determined based on orthodontic reference books and experts' personal opinions. The reliability of the questionnaire was confirmed using correlation coefficient (0.76, split Gottman test[14]) among 48 GDs of the pilot study.

The finalized questionnaire consisted of three main sections. The first section included 11 image and scenario-based questions meant to assess the ability of GDs to correctly diagnose the orthodontic treatment needs of the patients. Cases were selected based on the importance and prevalence of the problems[5] related to lip and palate cleft, anterior and posterior crossbite, bimaxillary protrusion, deep bite, thumb sucking open bite, crowding, midline displacement, space deficiency, dilaceration, tipping and spacing of anterior teeth.

The second part included 11 questions which were meant to evaluate the knowledge of determining the correct cases among the previous cases for referral to the orthodontist. In the final part, knowledge of the proper timing of the treatment was evaluated using eight questions focusing on different types of malocclusions.[5,11] Demographic data (age, sex, and work experience) and experience of attending continuing education or complementary orthodontic courses were also investigated at the end of the [Questionnaire].

Statistical analysis

Each question was scored as 0 (incorrect) or 1 (correct); accordingly, the total score of the questionnaire was between 0 and 30. We used the mean, standard deviation and frequency of answers to each part; on the other hand, *t*-test, ANOVA, or nonparametric equivalent tests were applied to present the data and evaluate the association between the age, work experience, and continuing education or complementary orthodontic courses and the total score of the questionnaire; this was done using SPSS (IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY, USA: IBM Corp) ($\alpha = 0.05$).

RESULTS

A total number of 384 completed questionnaires were returned (response rate = 83%). The demographic characteristics of the dentists are presented in Table 1. The mean age and work experience were 37.8 ± 8.7 (24–61) and 11.8 ± 8.4 (1–35 years), respectively. 50.3% (*n* = 193) of the participants were females and 19.5% (*n* = 75) had the experience of attending orthodontic complementary courses. 36.7% (*n* = 140) claimed that they had self-studies in the field of orthodontic treatments. Also, 87% (*n* = 334) reported that they would refer the patients in need of orthodontic treatment if they

Table 1: Working experience and demographic characteristics of the participated general dentists

Variable	Frequency (%)
Age groups (years old)	
24–34	154 (40.1)
35–45	152 (39.6)
46–62	78 (20.3)
Gender	
Male	191 (49.7)
Female	193 (50.4)
Working experience (years)	
1–7	140 (36.6)
8–14	114 (29.8)
15–21	74 (19.3)
22–28	36 (9.4)
29–35	19 (5)
Experience in attending orthodontic courses and seminars	
Yes	75 (19.5)
Personal studies in the field of orthodontics	
Yes	141 (36.7)
Referral of patients in need of complex orthodontic treatments	
Yes	334 (87)

realized that the proper treatment was beyond their capabilities.

The mean score of knowledge was 17.3 ± 3.5 out of 30 (5–27). Regarding the proper timing of orthodontic treatment, this was 4.9 ± 1.7 out of 8 (0–8). The mean score related to the knowledge of identification of the orthodontic treatment need and the necessity of referral to an orthodontist was 1.8 ± 5.4 from 11 (1–9) and 6.8 ± 1.5 from 11 (2–11), respectively.

Considering the minimum score of 70% as good knowledge, total knowledge, knowledge of the proper timing of treatment, knowledge of the identification of the need for orthodontic treatment, and knowledge of the necessity of referral to the orthodontist were reported as qualitative variables [Figure 1]. The highest percentage of good knowledge was related to the diagnosis of treatment need, while the lowest one belonged to the proper timing of the treatment.

Based on the Kolmogorov–Smirnov test, the distribution of knowledge mean scores was not normal; therefore, nonparametric tests were used for the comparison of the groups and calculation of the possible effect sizes. Spearman coefficient showed a direct, weak and positive correlation between age and total knowledge ($R = 0.1$, $P = 0.04$), and between age and knowledge of the necessity of referral ($R = 0.16$, $P = 0.001$). A significant positive correlation was
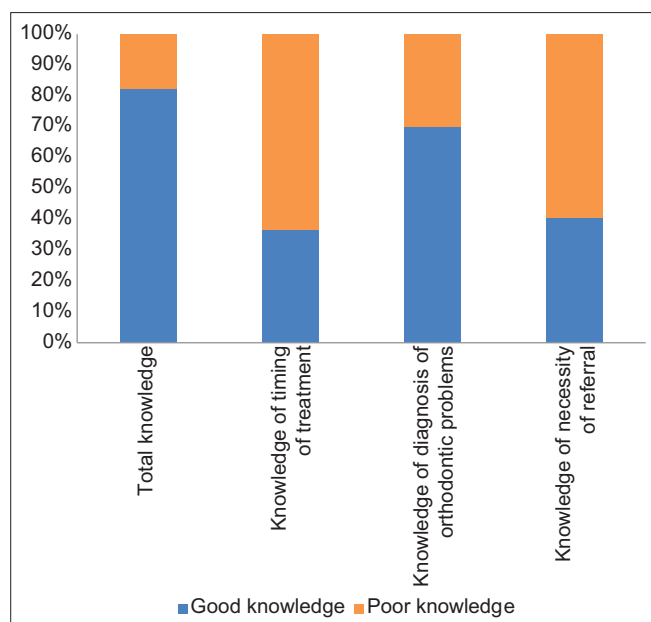
Figure 1: Level of total knowledge, knowledge of the timing of treatment, knowledge of diagnosis of orthodontic problems, and knowledge of the necessity of referral in GDs. GDs: General dentists.

also detected between the three subdomains of knowledge ($P < 0.001$, $R = 0.17$ for the correlation between timing and necessity of referral, $r = 0.27$ between diagnosis and timing, and $r = 0.24$ for the correlation between diagnosis and necessity of referral).

The work experience of the dentist had a significant positive and weak correlation only with the knowledge of the proper timing of treatment ($R = 0.15$, $P = 0.004$). Kruskal–Wallis test also showed a significant difference in the total knowledge score for different age groups ($P = 0.04$). The highest difference was between the 24 and 34 age group and others (16.6 ± 3.3, in comparison to 17.5 ± 3.5 in the 35–45 age group and 17.7 ± 4 in the 46–61 one). Furthermore, knowledge of the timing of treatment was significantly different among different age groups ($P = 0.04$); again, the highest difference was between the 24 and 34 age group and others (4.5 ± 1.7 in comparison to 5.2 ± 1.5 in the 35–45 age group and 5.3 ± 1.6 in the 46–61 one).

Mann–Whitney U test did not show a significant difference between the total knowledge score and three subdomains based on gender. There was no significant correlation between knowledge scores and the experience of attending the orthodontic related continuing education or complementary courses.

Besides this, no significant correlation was detected between knowledge scores and personal self-studies in orthodontics.

Table 2 demonstrates the percentage of correct answers to the questions. Regarding the need for orthodontic treatment, cleft lip and/or palate had the highest frequency of correct responses. Meanwhile, problems related to mandibular midline shift and tipping and spacing of the mandibular anterior teeth, which could lead to future crowding, received the lowest percentage of correct answers. Considering the necessity of referring the patient to the orthodontist, the highest rate of correct answers was related to cleft lip and/or palate problems; meanwhile, the lowest one was related to the patients with an anterior crossbite. Considering the correct answers to the level of need and the necessity of referring simultaneously, four categories for the selected cases were defined; cases whose treatment need and necessity of referral had been recognized by dentists correctly (>60 correct answers to both questions) were the cleft, deep bite and true crowding; those cases whose treatment need were correctly diagnosed but dentists thought they were needed to be referred included anterior crossbite and thumb sucking. Cases such as posterior crossbite, localized space loss and anterior mandibular tipping were not diagnosed and chosen to be referred correctly. The treatment needs of other cases including the bimaxillary protrusion, mandibular midline off and dilaceration were not correctly identified by dentists, but they mostly chose to be referred anyway.

Table 3 presents the percentage of correct answers regarding the proper orthodontic treatment timing. Ideal timing of the first orthodontic examination had the highest frequency of correct answers, while questions related to the proper timing of the treatment of skeletal class II problem (with deficient mandible) gained the lowest one.

DISCUSSION

In orthodontic treatments, proper timing and treatment planning are the key factors in achieving favorable outcomes and preventing unnecessary costs and the waste of time. Since GDs are usually the first referral source of orthodontic treatments, acquiring knowledge of accurate diagnosis and proper timing of orthodontic treatments would be necessary for them.[6,8,12,13] In the present study, the mean knowledge was 17.3 ± 3.5 out of 30, thus indicating a moderate level of knowledge.

Table 2: Percentage of correct answers to the questions based on the diagnosis of the orthodontic problem

Orthodontic problem	Question	Percentage
Cleft lip and/or palate	Necessity of treatment	94.8
	The necessity of referral to the orthodontist	99
Anterior crossbite	Necessity of treatment	59.4
	The necessity of referral to the orthodontist	22.4
Posterior crossbite	Necessity of treatment	47.7
	The necessity of referral to the orthodontist	44.8
Bimaxillary protrusion and mild crowding in the anterior mandible	Necessity of treatment	51.8
	The necessity of referral to the orthodontist	75.5
Open bite due to the thumb-sucking habit	Necessity of treatment	76.6
	The necessity of referral to the orthodontist	41.4
True crowding and no compensation by the jaws	Necessity of treatment	77.3
	The necessity of referral to the orthodontist	87.5
Deep bite	Necessity of treatment	59.9
	The necessity of referral to the orthodontist	81
Dilaceration and supernumerary teeth	Necessity of treatment	52.9
	The necessity of referral to the orthodontist	81.5
Mandibular midline shift	Necessity of treatment	12
	The necessity of referral to the orthodontist	71.4
Current tipping and spacing of the anterior mandibular teeth and future crowding	Necessity of treatment	12
	The necessity of referral to the orthodontist	39.8
Localized space loss due to mesial drift of first molar	Necessity of treatment	49.5
	The necessity of referral to the orthodontist	43.5

Table 3: Percentage of correct answers to the questions about the identification of proper timing of orthodontic treatments

Question	Percentage
Ideal timing for the first orthodontic examination	71.6
Proper timing of the extraction of primary canine tooth in case of absence of eruption of the permanent canine tooth	57
Ideal timing of treatment of class III skeletal problem deficient maxilla	64.3
Ideal timing of treatment of class II skeletal problem excess maxilla	58.3
Ideal timing of treatment of class II skeletal problem deficient mandible	54.7
Ideal timing of treatment of class III skeletal problem excess mandible with the increased mandibular plane inclination	55.2
Ideal timing of treatment of supernumerary teeth	68.8
Possibility of compensation of the vertical changes of the face caused by maxillary excess by providing treatment in older ages	64.8

Similarly, in a study done by Kapoor *et al.*,[8] it was shown that the understanding and knowledge among GDs and specialists other than orthodontists of the principles of orthodontic diagnosis and timely treatments was moderate and unsatisfactory.

A study conducted in Saudi Arabia also indicated the GDs' knowledge of the identification of orthodontic treatment needs as unacceptable, reporting that most of the participants responded to less than half of the questions correctly.[14] Omrani *et al.* also reported that the knowledge of the proper timing of orthodontic treatments among GDs was about 14.77 out of 24.[13] However, their population was limited to 100 dental practitioners and the questions were multiple choice questions, not scenario-based ones. In contrast to the prior studies, other studies have shown that GDs have a sound knowledge and attitude toward orthodontic treatments.[15,16]

The results of the present study, thus, revealed a direct albeit weak positive correlation between age and the total knowledge and knowledge of the proper timing of referral. Thus, it seems that with the rise of age and work experience, the acquired knowledge would be increased, which could be partly justified by the GDs' more encounters with the patients in need of orthodontic treatments. In another similar study, a significant correlation was also reported between the knowledge of orthodontic treatments of GDs and age, working experience, and the possibility of attending orthodontic courses.[17]

In our study, about 40% of the participants claimed that they had personal studies in the field of orthodontics; also, one fifth had the experience of attending orthodontic courses. However, no significant correlation was detected between knowledge scores

and the continuing education in orthodontics and personal studies in the field of orthodontics. A study done by Zarif Najafi *et al*.[10] in Shiraz also showed that most of the participants considered university education the most important source of learning orthodontic skills. Further, Lee *et al*.[18] confirmed the results of the previous study. It seems, therefore, that allocating more hours of education in the dental schools' curriculum can be beneficial for improving the GDs' knowledge of the orthodontic treatments.

In general, our study showed that the considered GDs had a good level of knowledge in regard to the diagnosis of orthodontic treatment needs, but their knowledge of the proper timing and the necessity of referral to specialists was moderate only 36.5% of the participants had good knowledge in this regard. Similarly, in a study done by Jackson *et al*. in the United Kingdom, only 20% of GDs had a good knowledge of proper timing.[11] Kisely *et al*. also reported that almost 26% of referrals to orthodontists had improper timings.[19] While only 40.6% of our participants were capable of identifying the necessity of referral correctly, this rate was 52% in the Jackson's study.[11] Studies have also reported that besides having the knowledge of referral to orthodontists in a specific orthodontic problem, having access to orthodontists also plays an important role in making a decision for referring the patient to the specialist.[6,20-22] However, we did not explore the barriers to the referral practice in our study.

The higher rate of correct answers belonged to the necessity of orthodontic treatment and the referral of a patient with cleft lip and palate to an orthodontist (above 90%). This condition is the most common syndrome in the head-and-neck region;[23] accordingly, it is almost completely covered by some educational courses in undergraduates' curriculum other than orthodontics, such as maxillofacial surgery and prosthodontics; therefore, knowledge of GDs was quite high in this area.[23,24] Based on the results of a meta-analysis, the prevalence of lip and palatal cleft was about one in every 1000 births in Iran.[25]

Among questions with the photographs of malocclusion, the second-highest rate of correct responding was related to true crowding without lip compensation (77.4% correct responses to the question addressing the necessity of treatment and 87.5% correct answers to the question in relation to the necessity of referral). It, thus, seems that dentists'

good knowledge in this regard can be justified by the fact that crowding is the most common malocclusion, especially among adolescents,[26] and dental students might have a higher chance to have the experience of treating this problem during their academic education. In a recently published systematic review, crowding, with a prevalence of about 40%, was reported as the most common occlusion problem.[27]

In regard to the question about deep bite patients, a good level of knowledge was observed. It was estimated that about 60% of Iranian adolescents had normal overbite; also, about 34.5% and 2.2% had increased overbite and deep bite, respectively.[26]

Questions about anterior and posterior crossbites, bimaxillary protrusion, open bite related to thumb-sucking habit, the simultaneous occurrence of a supernumerary tooth with dilaceration, and localized space loss showed a moderate level of knowledge. Open bite, with a frequency of 1.6% in Iran,[26] can arise from different reasons including the normal transition of primary to permanent teeth, thumb sucking, teeth displacement by soft tissue pressures or skeletal problems.[5] Most of the problems arising by transitional or habitual reasons would be resolved over time or by habits broken. For example, the side effects of thumb sucking in occlusion, except for posterior cross-bite, would be solved automatically if the habit were broken before the eruption of permanent teeth.[5] However, it seems that dentists in our study had underestimated their ability to provide care to these patients, preferring to refer them.

Questions about midline shift (12% correct diagnosis of the necessity of orthodontic treatment, but 71.4% correct identification of the necessity of referral), and spacing and tipping, which lead to future crowding (12% correct diagnosis of the necessity of orthodontic treatment and 39.8% correct identification of the necessity of referral to an orthodontist), had the lowest correct answer rate that could be explained by the complexity of the treatment, the need for full-scale assessment, and the lower prevalence. In the triage of orthodontic problems, the 4th step is to evaluate and manage the space-related problems. Based on the study conducted by Pedersen *et al*.,[28] about half of the children have experienced the early extraction of primary teeth due to dental caries which might lead to difficulties such as crossbite, midline shift and increased overjet/bite. However, despite the low ability of dentists to recognize the treatment need

level of space-related problems, the rate of the correct choice of referring cases with mandibular midline shift was higher. This could highlight the fact that diagnosing midline shift has been easier for dentists and they might have not even diagnosed the cases of anterior tipping or mesial drift of the first mandibular.

In the proper timing section, the highest frequency of correct responses belonged to the proper timing of orthodontic examination (71%), which is the 7-year age, as mentioned multiple times in different theoretical orthodontic and pediatric courses in the dental education curriculum.[24] Timing of the treatment for supernumerary teeth was in the second place, with 68% of correct responses, as also discussed in Oral and maxilla facial pathology and surgery courses. The prevalence of supernumerary teeth has been reported to be 1.5%–3.5%,[29] which is detectable both in primary (0.1%–3.8%) and permanent 0.3%–0.8% teeth.[30] In Iran, the frequency of such a problem is about 0.74%; it is mostly seen in the patients with malocclusion problems.[31] Timely extraction of these teeth before disturbing the dental arch is usually the only recommended treatment.[5]

Studies have emphasized the importance of accurate and timely diagnosis of the treatment needs in achieving high-quality and successful treatment goals. However, it should be noted that this is attained only when a good education is provided for GDs in dental schools.[6,8,11,12] Burden also showed that by providing an orthodontic educational package, treatment planning decisions and timely referral, the practice of GDs was improved dramatically and the mild malocclusions were easily and appropriately managed.[32] These findings, thus, indicate the necessity of developing more educational courses and referral guidelines that could briefly demonstrate when and which cases should be referred to a specialist and when and in which cases, GDs are capable of providing orthodontic treatments.

CONCLUSION

The results of the present study, thus, revealed a moderate level of knowledge of orthodontic treatments among GDs, thus highlighting the importance of considering continuing educational courses for GDs and increasing the educational hours in the dental curriculum to improve the knowledge of orthodontic treatment needs for the diagnosis and management.

Limitations of the study
Refusal of the dentists to fill out the questionnaire and limited similar studies to get help for designing the structure of our study and discussing the results are among the most important limitations of our study. Besides these, given the economic and social discrepancy in different parts of the country, this study could be implemented on a larger scale to compare the results with a higher degree of confidence.

Conflicts of interest
The authors of this manuscript declare that they have no conflicts of interest, real or perceived, financial or non-financial in this article.

REFERENCES

1. Mandall NA, McCord JF, Blinkhorn AS, Worthington HV, O'Brien KD. Perceived aesthetic impact of malocclusion and oral self-perceptions in 14-15-year-old Asian and Caucasian children in greater Manchester. Eur J Orthod 2000;22:175-83.
2. Amnaie A, Nasari M, Adib M, Shirvani A. Relationship between self-concept and satisfaction with tooth alignment and demand for orthodontic treatment and demand for orthodontic treatment and professionally determined orthodontics needs. Dent Res J (Isfahan) 2012;7:656-61. [Persian].
3. de Oliveira CM, Sheiham A. The relationship between normative orthodontic treatment need and oral health-related quality of life. Community Dent Oral Epidemiol 2003;31:426-36.
4. Eslamipour F, Afshari Z, Najimi A. Prevalence of malocclusion in permanent dentition of Iranian population: A review article. Iran J Public Health 2018;47:178-87.
5. Ireland AJ, Willmot D, Hunt NP. An introduction to dento-legal issues and risks in orthodontics. Br Dent J 2015;218:197-201.
6. de Bondt B, Aartman IH, Zentner A. Referral patterns of Dutch general dental practitioners to orthodontic specialists. Eur J Orthod 2010;32:548-54.
7. Ngan P, Fields H. Orthodontic diagnosis and treatment planning in the primary dentition. ASDC J Dent Child 1995;62:25-33.
8. Kapoor D, Bhatia S, Garg D. Assessment of the attitude and knowledge of the principles and practices of orthodontic treatment among the non-orthodontic specialists and general practitioner dentists. JNMA J Nepal Med Assoc 2018;56:766-9.
9. Christensen GJ. Orthodontics and the general practitioner. J Am Dent Assoc 2002;133:369-71.
10. Zarif Najafi H, Oshagh M, Pakshir HR, Mohebbi M. Orthodontic treatments provided by general dentists in Shiraz, Iran. J Mashhad Dent Sch 2014;38:375-86.
11. Jackson OA, Cunningham SJ, Moles DR, Clark JR. Orthodontic referral behaviour of West Sussex dentists. Br Dent J 2009;207:E18.

12. Jain M, Dhakar N. Timing of orthodontic treatment. J Orthod Res 2013;1:99-102.
13. Omrani A, Zabihi F, Sadeghi M. General dentists' knowledge about appropriate timing of orthodontic treatments in Isfahan. Dent Res J (Isfahan) 2018;14:187-98.
14. Alnusayri MO, Alnezi KK, Patil SR, Aeleni KR, Rao KA. Knowledge and attitude regarding principles and practices of orthodontic treatment among general dental practitioners and nonorthodontic specialists of Saudi Arabia: A preliminary study. J Res Med Dent Sci 2017;5:59-62.
15. Barzilay V, Ratson T, Sadan N, Dagon N, Shpack N. Orthodontic knowledge and referral patterns: A survey of paediatric specialists and general dental practitioners. Australas Orthod J 2020;36:55-61.
16. Niveda S, Saravana D. A survey of the knowledge, attitude and awareness of principles and practices in orthodontics among general dentists and non-orthodontic specialists. IOSR J Dent Med Sci 2014;13:44-6.
17. Nemati R, Anoush K, Soleimani AH. Study in Knowledge of General Dentists in Preventive Orthodontic Treatment in Ardabil City in 2019. General Dentistry Thesis. Available from: https://lib.arums.ac.ir. [Last accessed on 2021 May 08].
18. Lee DS, Sulkowski T, Bocklage C, Frazier-Bowers SA, Wiesen C, Mihas P, *et al.* Identifying factors that impact general dentists' referrals to orthodontists. Am J Orthod Dentofacial Orthop 2022;161:e147-71.
19. Kisely S, Howell K, Green J. Pathways to orthodontic care. J Public Health Med 1997;19:148-55.
20. Galbreath RN, Hilgers KK, Silveira AM, Scheetz JP. Orthodontic treatment provided by general dentists who have achieved master's level in the Academy of General Dentistry. Am J Orthod Dentofacial Orthop 2006;129:678-86.
21. Aldawood S, Ampuan SN, Medara N, Thomson WM. Orthodontic treatment provision and referral preferences among New Zealand general dental practitioners. Aust Orthod J 2011;27:145-54.
22. McComb J, Wright J, O'Brien K. Dentists' perceptions of orthodontic services. Br Dent J 1995;178:461-4.
23. Conderman CP. Cleft lip and palate. In: Facial Plastic and Reconstructive Surgery. Cham: Springer; 2016. p. 167-87.
24. General Dental Education Curriculum. Available from: https://www.dnt.mui.ac.ir. [Last accessed on 2021 May 08].
25. Khazaei S, Shirani AM, Khazaei M, Najafi F. Incidence of cleft lip and palate in Iran. A meta-analysis. Saudi Med J 2011;32:390-3.
26. Borzabadi-Farahani A, Borzabadi-Farahani A, Eslamipour F. Malocclusion and occlusal traits in an urban Iranian population. An epidemiological study of 11- to 14-year-old children. Eur J Orthod 2009;31:477-84.
27. Lombardo G, Vena F, Negri P, Pagano S, Barilotti C, Paglia L, *et al.* Worldwide prevalence of malocclusion in the different stages of dentition: A systematic review and meta-analysis. Eur J Paediatr Dent 2020;21:115-22.
28. Pedersen J, Stensgaard K, Melsen B. Prevalence of malocclusion in relation to premature loss of primary teeth. Community Dent Oral Epidemiol 1978;6:204-9.
29. Tetay-Salgado S, Arriola-Guillén LE, Ruíz-Mora GA, Aliaga-Del Castillo A, Rodríguez-Cárdenas YA. Prevalence of impacted teeth and supernumerary teeth by radiographic evaluation in three Latin American countries: A cross-sectional study. J Clin Exp Dent 2021;13:e363-8.
30. Rajab LD, Hamdan MA. Supernumerary teeth: Review of the literature and a survey of 152 cases. Int J Paediatr Dent 2002;12:244-54.
31. Vahid-Dastjerdi E, Borzabadi-Farahani A, Mahdian M, Amini N. Supernumerary teeth amongst Iranian orthodontic patients. A retrospective radiographic and clinical survey. Acta Odontol Scand 2011;69:125-8.
32. Burden DJ. An investigation of the association between overjet size, lip coverage, and traumatic injury to maxillary incisors. Eur J Orthod 1995;17:513-7.

به نام خدا

دندانپزشک محترم این پرسشنامه بدون درج نام و صرفا به منظور انجام یک کار تحقیقاتی تحت عنوان بررسی میزان آگاهی دندانپزشکان عمومی شاغل در شهر اصفهان درتشخیص نیازهای درمانی ارتودنسی بیماران و ارجاع آنها به متخصص ارتودنسی در سال 1399 تهیه و تنظیم شده است.لذا خواهشمند است با نهایت دقت و توجه و با هدف ارج نهادن به تحقیقات علمی جامعه دندانپزشکی سوالات زیر را بررسی فرمایید. محتویات پرسشنامه پرشده محرمانه خواهد ماند و نتایج تنها به صورت کلی ، گروهی و بدون نام منتشر خواهد شد. به شما اطمینان داده می شود که در صورت تمایل نتایج پژوهش در اختیار شما قرار خواهد گرفت.پیشاپیش از همکاری شما صمیمانه سپاسگزاریم.

سن: جنس: سابقه کاری:.....سال

1- آیا در دوره ها و سمینارهای بازآموزی ارتودنسی شرکت کرده اید؟

الف)بله   ب)خیر

2- آیا مطالعات شخصی در حیطه درمانهای ارتودنسی دارید؟

الف)بله   ب)خیر

3- اگر بیمار نیاز به ارجاع داشته باشد اما در حیطه توانایی شما باشد آیا بیمار را جهت تشخیص نهایی و درمان به متخصص ارتودنسی ارجاع میدهید؟

الف)بله   ب)خیر

تصویر شماره یک

لطفا با توجه به تصویر شماره یک به سوالات 4 و 5 پاسخ بدهید. (بیمار مبتلا به سندرم شکاف کام و لب است)

4-میزان نیاز این بیمار به درمان ارتودنسی را چگونه ارزیابی میکنید؟

الف)عدم نیاز یا نیاز کم به درمان   ب) نیاز متوسط (حد مرزی نیازمند درمان)
ج)نیاز شدید یا ضروری به درمان

5- آیا درمان این بیمار نیاز به ارجاع به متخصص ارتودنسی دارد ؟

الف)بله   ب)خیر

تصویر شماره دو

لطفا با توجه به تصویر شماره دو به سوالات 6 و 7 پاسخ بدهید.

6-میزان نیاز این بیمار به درمان ارتودنسی را چگونه ارزیابی میکنید؟

الف)عدم نیاز یا نیاز کم به درمان   ب) نیاز متوسط (حد مرزی نیازمند درمان)   ج)نیاز شدید یا ضروری به درمان

7- آیا درمان این بیمار نیاز به ارجاع به متخصص ارتودنسی دارد ؟

الف)بله   ب)خیر

لطفا با توجه به تصویر شماره سه به سوالات 8 و 9 پاسخ بدهید.

8-میزان نیاز این بیمار به درمان ارتودنسی را چگونه ارزیابی میکنید؟

الف)عدم نیاز یا نیاز کم به درمان   ب) نیاز متوسط (حد مرزی نیازمند درمان)   ج)نیاز شدید یا ضروری به درمان

9- آیا درمان این بیمار نیاز به ارجاع به متخصص ارتودنسی دارد ؟

الف)بله   ب)خیر

تصویر شماره سه

لطفا با توجه به تصاویر شماره چهار به سوالات 10 و 11 پاسخ بدهید.

10-میزان نیاز این بیمار به درمان ارتودنسی را چگونه ارزیابی میکنید؟

الف)عدم نیاز یا نیاز کم به درمان   ب) نیاز متوسط (حد مرزی نیازمند درمان)   ج)نیاز شدید یا ضروری به درمان

11- آیا درمان این بیمار نیاز به ارجاع به متخصص ارتودنسی دارد ؟

الف)بله   ب)خیر

تصویر شماره چهار

تصویر شماره پنج

لطفا با توجه به تصویر شماره پنج به سوالات 12 و 13 پاسخ بدهید.

(بیمار عادت انگشت مکیدن دارد و مشکل وی دنتال است)

12-میزان نیاز این بیمار به درمان ارتودنسی را چگونه ارزیابی میکنید؟

الف)عدم نیاز یا نیاز کم به درمان   ب) نیاز متوسط (حد مرزی نیازمند درمان)
ج)نیازشدید یا ضروری به درمان

13- آیا درمان این بیمار نیاز به ارجاع به متخصص ارتودنسی دارد ؟

الف)بله   ب)خیر

لطفا با توجه به تصاویر شماره شش،هفت و هشت به سوالات 14 و 15 پاسخ بدهید.

(دندان بیمار دچار dilaceration شده است (زاویه یا خمیدگی غیر طبیعی ریشه یا تاج دندان)

تصویر شماره هشت

تصویر شماره هفت

تصویر

14-میزان نیاز این بیمار به درمان ارتودنسی را چگونه ارزیابی میکنید؟

الف)عدم نیاز یا نیاز کم به درمان
ب) نیاز متوسط (حد مرزی نیازمند درمان)   ج)نیاز شدید یا ضروری به درمان

15- آیا درمان این بیمار نیاز به ارجاع به متخصص ارتودنسی دارد ؟

الف)بله   ب)خیر

تصویر شماره نه

لطفا با توجه به تصویر شماره نه به سوالات 16 و 17 پاسخ بدهید.

16-میزان نیاز این بیمار به درمان ارتودنسی را چگونه ارزیابی میکنید؟

الف)عدم نیاز یا نیاز کم به درمان   ب) نیاز متوسط (حد مرزی نیازمند درمان)   ج)نیاز شدید یا ضروری به درمان

17- آیا درمان این بیمار نیاز به ارجاع به متخصص ارتودنسی دارد ؟

الف)بله   ب)خیر

تصویر شماره ده

لطفا با توجه به تصویر شماره ده به سوالات 18 و 19پاسخ بدهید.

18-میزان نیاز این بیمار به درمان ارتودنسی را چگونه ارزیابی میکنید؟

الف)عدم نیاز یا نیاز کم به درمان   ب) نیاز متوسط (حد مرزی نیازمند درمان)   ج)نیاز شدید یا ضروری به درمان

19- آیا درمان این بیمار نیاز به ارجاع به متخصص ارتودنسی دارد ؟

الف)بله   ب)خیر

لطفا با توجه به تصویر شماره یازده به سوالات 20 و 21 پاسخ بدهید.(midline فک پایین در این بیمار به دلیل از دست رفتن زودهنگام دندان کانین شیری به سمت راست به صورت bodily جابه جا شده است.)

تصویر شماره یازده

20-میزان نیاز این بیمار به درمان ارتودنسی را چگونه ارزیابی میکنید؟

الف)عدم نیاز یا نیاز کم به درمان   ب) نیاز متوسط (حد مرزی نیازمند درمان)   ج)نیاز زیاد یا ضروری به درمان

21- آیا درمان این بیمار نیاز به ارجاع به متخصص ارتودنسی دارد ؟

الف)بله   ب)خیر

لطفا با توجه به تصویر شماره دوازده به سوالات 22 و 23 پاسخ بدهید.

(دندانهای قدامی پایین بیمار به صورت لینگوالی دچار tipping شده اند همچنین دارای فاصله هستند.)

تصویر شماره دوازده

22-میزان نیاز این بیمار به درمان ارتودنسی را چگونه ارزیابی میکنید؟

الف)عدم نیاز یا نیاز کم به درمان   ب) نیاز متوسط (حد مرزی نیازمند درمان)   ج)نیاز شدید یا ضروری به درمان

23- آیا درمان این بیمار نیاز به ارجاع به متخصص ارتودنسی دارد ؟

الف)بله   ب)خیر

لطفا با توجه به تصویر شماره سیزده به سوالات 24 و 25 پاسخ بدهید. (از دست دادن زودرس مولر دوم شیری منجر به mesial drift و چرخش مولر اول دائمی شده است و میزان از دست رفتن فضا کمتر از 3 میلی متر است.)

تصویر شماره سیزده

24-میزان نیاز این بیمار به درمان ارتودنسی را چگونه ارزیابی میکنید؟

الف)عدم نیاز یا نیاز کم به درمان   ب) نیاز متوسط (حد مرزی نیازمند درمان)   ج)نیاز شدید یا ضروری به درمان

25- آیا درمان این بیمار نیاز به ارجاع به متخصص ارتودنسی دارد ؟

الف)بله   ب)خیر

26-بهترین زمان برای اولین معاینه ارتودنسی چه زمانی است؟

الف)حدود 4 سالگی   ب)حدود 7 سالگی   ج) حدود 12 سالگی

27- در چه سنی با مشاهده عدم رویش دندان کانین دائمی باید اقدام به خارج کردن دندان کانین شیری نمود؟

الف)8 سالگی   ب)10 سالگی   ج)16 سالگی

28-در بیماری با مشکل Class III (اسکلتال) بهترین زمان درمان چه سنی است؟(مشکل از فک بالا است)

الف)7-5 سالگی   ب)10-8 سالگی   ج)16-14 سالگی

29- در بیماری با مشکل Class II (اسکلتال) بهترین زمان درمان چه سنی است؟(مشکل از فک بالا است)

الف)به محض مراجعه   ب)نزدیک به سن بلوغ   ج)بعد از سن بلوغ

30- در بیماری با Class II (اسکلتال)بهترین زمان درمان چه سنی است؟(مشکل از فک پایین است)

الف)به محض مراجعه   ب)نزدیک به سن بلوغ   ج)بعد از سن بلوغ

31- در بیماری با مشکل Class III(اسکلتال)بهترین زمان درمان چه سنی است؟(مشکل از فک پایین است و شیب فک پایین به طور قابل توجهی افزایش یافته است)

الف)به محض مراجعه   ب)نزدیک به سن بلوغ   ج)بعد از سن بلوغ

32- در بیماری با مشکل داشتن supernumerary teeth (دندان اضافه) بهترین زمان درمان چه سنی است؟

الف)به محض مراجعه   ب)نزدیک به سن بلوغ   ج)بعد از سن بلوغ

33-امکان جبران تغییرات عمودی صورت ناشی از گسترش ماگزیلا با انجام درمان در سنین بالاتر ...

الف)کاهش میابد   ب)افزایش میابد   ج)تغییری نمیکند