Original Article

Assessment of Orthodontic Services Provided by Pediatric Dentists in Iran: Evaluation of Treatment Modalities, and Factors Influencing Patient Referral

Zahra Enshaei [1], Elahe Asnaashari [2], Faeze Eslamipour [3], Zahra Karimi [4]

[1] Department of Pediatrics, Dental Research Center, Dental Research Institute, School of Dentistry, Isfahan University of Medical Sciences, Isfahan, Iran
[2] Department of Pediatrics, School of Dentistry, Isfahan University of Medical Sciences, Isfahan, Iran
[3] Department of Oral Public Health, Dental Research Center, Dental Research Institute, School of Dentistry, Isfahan University of Medical Sciences, Isfahan, Iran
[4] Dental Students Research Committee, School of Dentistry, Isfahan University of Medical Sciences, Isfahan, Iran

Abstract

Background and Aim: This cross-sectional study aims to evaluate the frequency of orthodontic treatments provided by pediatric dentists in Iran and identify the factors influencing their referral of patients to orthodontists.

Materials and Methods: A questionnaire, previously developed and validated in similar studies, was administered electronically to 111 pediatric dentists in Iran. The questionnaire collected demographic data and information on orthodontic services provided, types of malocclusions treated, orthodontic treatment modalities used, methods of acquiring orthodontic treatment skills, appropriate strategies for teaching orthodontics, reasons for avoiding orthodontic treatment, and factors influencing patient referral. Descriptive and analytical statistics were used to analyze the collected data using SPSS software. Data were analyzed using Mann-Whitney, Kruskal-Wallis, and chi-squared tests.

Results: Among the participating pediatric dentists, 65.8% offered orthodontic services, with a predominant use of removable orthodontic appliances. The most commonly treated malocclusions included space maintenance (89.2%), oral habits (75.5%), and anterior crossbite (69.4%). The most frequently used treatments were removable spring plates (75.5%) and expansion screw plates (67.6%). The majority of dentists (64%) acquired their orthodontic treatment skills through academic education. Improving the academic education system was identified as the preferred solution for enhancing orthodontic education (77.5%). Personal acquaintance with orthodontists was highlighted as a significant factor influencing patient referral.

Conclusion: Approximately two-thirds of the surveyed pediatric dentists in Iran offered orthodontic services, primarily through the use of removable orthodontic appliances. It is crucial to develop training programs to enhance the knowledge and skills of pediatric dentists in orthodontic treatments.

Key Words: Pediatric dentistry, referral, orthodontist, orthodontic treatment

Corresponding author:
Zahra Karimi, Dental Students Research Committee, School of Dentistry, Isfahan University of Medical Sciences, Isfahan, Iran

z.karimi94dnt@gmail.com

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Introduction

Pediatric dentistry is a specialty that encompasses more than just a specific set of skills. It incorporates a range of dental techniques aimed at understanding the philosophical foundations of child development in relation to health and disease (1, 2). With a focus on diagnostic methods and the preservation of arch integrity in cases of tooth loss resulting from decay or trauma, pediatric dentistry has evolved to integrate caries treatment since its inception, which was primarily extraction-oriented (3). It was soon recognized that uncontrolled tooth extraction could lead to adverse malocclusion outcomes that could be prevented. During this era, pivotal themes included restorative methods, pulpal treatment, interventional orthodontics, and space maintenance, which regrettably remain critically relevant to contemporary dental needs (4).

Despite global advancements in orthodontic methods, considerable variation exists in the provision of orthodontic treatments by dentists, a trend observed across different countries. While orthodontists traditionally handle the bulk of orthodontic cases, the involvement of pediatric and general dentists varies significantly (5). Conflicting results regarding the extent of orthodontic services provided by these dental professionals have been reported in the literature. For instance, while some studies suggest a substantial contribution from pediatric and general dentists in orthodontic care (6), others report a more limited involvement (7). In Iran specifically, the landscape of orthodontic services provided by pediatric dentists remains relatively understudied, highlighting a significant gap in research (8).

Ensuring optimal patient care in orthodontics hinges upon early diagnosis and timely referral to specialists, a responsibility often shouldered by pediatric and general dentists. Early detection and appropriate referral protocols are pivotal, significantly influencing treatment outcomes. Pediatric dentists, as primary evaluators of children's dental health, are well-positioned to promptly identify and address malocclusion issues (9). However, in Iran, there exists a notable research gap regarding the frequency of orthodontic services provided by pediatric dentists and the factors influencing patient referrals to orthodontists. This knowledge void necessitates an investigation into the orthodontic landscape in Iran, with a specific focus on pediatric dentists' practices and the determinants of patient referrals. To address this gap, the present study endeavored to examine the prevalence of orthodontic services offered by pediatric dentists in Iran and to identify the underlying factors shaping patient referrals to orthodontists. By shedding light on these aspects, a contribution to the enhancement of orthodontic services and the optimization of patient care within the Iranian context was sought.

Materials and Methods

The current research received ethical approval from the Vice-Chancellor of Research and Technology (Isfahan University of Medical Sciences), under the ethics code ID IR.MUIRESEARCH.RCE.1399.729.

This cross-sectional study was conducted in 2021, involving a research population of 111 pediatric dentists in Iran. The inclusion criteria required a minimum of one year of work experience and willingness to participate, while the exclusion criteria included unwillingness to participate and failure to complete the questionnaire.

The sample size was determined using the following formula:

$$n=\frac{NZ^2\sigma^2}{d^2(N-1)+z^2\sigma^2}$$

In the given formula, N represents the estimated number of pediatric dentists in the entire country, which is approximately 250 based on data from [www.iapd.ir]. Z corresponds to the confidence level of 95% and has a value of 1.96. The variable σ denotes the standard deviation of the number of orthodontic procedures performed by pediatric dentists. Since the exact value of σ was unknown, it was estimated using the margin of error, d, which is calculated as k multiplied by σ.

In this case, k is assigned a value of 0.14. This sample size of 110 was determined based on the provided values and the formula, ensuring a desired level of precision and confidence for the study's results.

To achieve this sample size, the questionnaires, designed on the Porsline platform, were distributed electronically via SMS and WhatsApp messages. These channels were used to reach potential participants until the desired sample size of 110 was achieved. This approach allowed for a random selection of respondents from the available pool, ensuring that the sample was representative of the broader population of pediatric dentists in Iran despite potential non-response from some individuals. The sampling method employed in this study was simple random sampling, which involved selecting participants from the entire population of pediatric dentists in the country. The objectives of the research were clearly explained to the potential participants, and those who expressed their willingness to participate were provided with an electronic questionnaire. The distribution of the questionnaire was facilitated through mobile phone messaging applications until the desired sample size was achieved. To ensure confidentiality, the questionnaires were anonymous, and the personal information of the dentists and their completed questionnaires were treated as confidential.

Data were collected using a questionnaire developed in previous studies (6, 10). The validity and reliability of the questionnaire were confirmed using Cronbach's alpha, with a reliability coefficient of 0.83. The questionnaire consisted of four sections. In the first section, the demographic information, including age and work experience, was collected through open-ended responses in the questionnaire provided in the Appendix.

The second section focused on orthodontic services, examining whether the dentists provided orthodontic treatments, reasons for not offering such services, and the range of orthodontic treatments provided. This encompassed various modalities such as removable orthodontic appliances, fixed orthodontics, and comprehensive orthodontic treatment. For clarity, 'comprehensive orthodontic treatment' refers to a broad spectrum of orthodontic procedures aimed at addressing diverse malocclusions and dental issues comprehensively, with the goal of achieving optimal dental alignment, occlusion, and overall oral health. Additionally, the section delved into the types of malocclusions treated, including space maintenance, oral habits, serial extraction, anterior crossbite, posterior crossbite, crowding, spacing, and more. It also explored the dentists' methods of acquiring orthodontic treatment skills, such as through academic education, short-term orthodontic training courses, and personal studies. Furthermore, the section investigated suitable strategies for teaching orthodontics to dentists.

The third section of the questionnaire focused on the reasons behind dentists not providing orthodontic treatments. This included factors such as the lack of proper training in orthodontics, time constraints and the need to prioritize other services, the nature of orthodontic treatment, unwillingness or lack of interest in providing orthodontic treatments, and the absence of sufficient and suitable facilities at the workplace. Dentists were asked to share their opinions on related obstacles and reasons.

The fourth section comprised 15 items aimed at assessing the factors influencing the referral of patients with orthodontic issues to orthodontists. Dentists were tasked with rating the significance of each factor on a 4-point Likert scale, ranging from 'unimportant' (1), 'nonsignificant' (2), 'important' (3), to 'very important' (4).

The collected questionnaires were entered into the SPSS 23 software (IBM Corp., Armonk, NY, USA) for analysis. Descriptive statistics, such as mean, standard deviation, and frequency distribution, were calculated. The chi-square test was used to determine the frequency distribution of the main traits in the subgroups of qualitative factors. To examine the means of quantitative traits in the subgroups of main qualitative traits, according to the results of the normal distribution of qualitative variables

Appendx 1: The questionnaire in English

Personal information		
Gender	**Female**	**Male**
Year of Birth		
The year of obtaining a specialized degree in pediatric dentistry		
Work history:	….years	

1)Do you provide orthodontic services?
yes
No

If your answer is no, please answer questions 9, 10 and 11, and if your answer is yes, please answer all questions.

2)How is the reception of a patient in need of orthodontics in your office?
Every orthodontic patient who comes is accepted as much as possible
Any orthodontic patient who comes and has a simple treatment plan is accepted
It is rarely accepted on a case-by-case basis

3)If you provide orthodontic services, which treatments do you perform?
Movable orthodontic treatment
Limited fixed orthodontic treatment
Comprehensive orthodontic treatments (fixed two jaws)
Items 1 and 2
Items 1 and 3

4)How did you acquire the skills related to orthodontic treatment?
University education
Short-term orthodontic training courses
Retraining courses and seminars
Personal studies
If you consider other things to be mentioned, please let me know….

5)If you do orthodontic treatments yourself, approximately, what percentage of your patients who need orthodontic treatments do you refer to orthodontic specialists every month?
Less than 25 percent
Percent 26-50
More than 50 percent

6)If you do orthodontic treatments yourself, when do you refer the patient to an orthodontic specialist?
The request of the patient or his/her parents to provide treatment by a specialist
Complexity and difficulty of treatment
If you consider other things to be mentioned, please let me know….

7)Which of the following malocclusions do you generally treat?		
Malocclusion	**Yes**	**No**
Space maintainance		
Crowding , spasing		
Habits		
Serial extraction		
Anterior crossbite		
Posterior crossbite		
Deep bite		
Open bite		
Dental class II malocclusion		
Dental class III moloclusion		
Skeletal class II moloclusion		
Skeletal class III moloclusion		
Ectopic eruption guidance		
Molar uprighting		

8)Which of the following orthodontic treatments do you perform?
Title
Removable spring plate
Expansion screws plate
Fixed rapid palatal expansion
face mask
Functional
head gear
Fixed edgewise technique
Fixed straight wire technique

9)If you do not provide orthodontic services, which of the following reasons do you imagine?
Title
Compression of other services and insufficient time
Lack of proper training in this field
Lack of adequate and suitable facilities at workplace
The nature of orthodontic treatment (complexity and length)
Lack of interest in providing orthodontic treatments
If you consider other things to be mentioned, please let me know….

10)If you consider the provision of orthodontic services by dentists to be necessary and useful, what is the appropriate solution in your opinion to educate this group as much as possible?
Change in the university education system
Providing retraining seminars
Holding workshops by the university
If you consider other things to be mentioned, please let me know….

11)In order to introduce an orthodontist to the patient for follow-up treatment, which of the following items do you consider? Please rate each item according to the degree of importance				
The degree of importance / Effective factor in referral	unimportant	Nonsignificant	Important	Very important
Orthodontist's reputation				
Patient satisfaction and previous satisfactory experiences				
The level of attention of the specialist to the oral and dental hygiene of the patients				
Proper specialist-patient interaction				
Dentist's acquaintance with the specialist				
Patient's preference				
Proximity to the patient's home or school				
Proximity to dentist's workplace				
short waiting list				
Fast completion of treatment (shorter duration of treatment)				
Lower fees than other orthodontists				
The possibility of easy communication with the specialist and his/ her appropriate response				
Being thankful for the referral				
Giving your patients priority on his/her waiting list				
Referring patients to dentist for treatment.				

using the Kolmogorov-Smirnov test, non-parametric Mann-Whitney and Kruskal-Wallis tests were used. The significance level for all statistical analyses was set at less than 0.05.

Results

General characteristics

A total of 111 pediatric dentists working in Iran completed the questionnaires. Among them, 23 (20.7%) were male, and 88 (79.3%) were female. The mean age of the participants was 37.79±6.86 years, and their mean work experience was 9.32±6.50 years.

Providing orthodontic services and the types of orthodontic treatments and treated malocclusions by pediatric dentists

Among the pediatric dentists included in the study, 73 (65.8%) provided orthodontic services, while 38 (34.2%) did not offer such services. Among those providing orthodontic care, 34.2% accepted patients with a simple treatment plan, while 34.2% accepted patients on a rare and case-by-case basis. The frequency of orthodontic treatments provided by pediatric dentists can be found in Table 1, and the types of treated malocclusions are listed in Table 2.

Regarding removable orthodontic treatments provided by pediatric dentists, the most commonly utilized were the removable spring plate (75.5%) and the expansion screw plate (67.6%). Among fixed orthodontic treatments, the highest frequency (27.3%) was reported for the fixed rapid palatal expansion technique. Conversely, the lowest frequency was observed for edgewise fixed treatments among all the treatment options (Table 3).

Reasons for not providing orthodontic services by pediatric dentists and the ways for better training orthodontics

Table 4 presents the primary reasons identified for pediatric dentists not providing orthodontic treatment, with a significant factor being the lack of proper training in this field.

Table 1. Frequency distribution (%) of orthodontic treatments provided by pediatric dentists

Orthodontic Treatment	Frequency (%)
Removable orthodontics	68(61.3)
Limited fixed orthodontics	0
Comprehensive orthodontics (both jaws)	0
Removable and limited fixed orthodontics	10(9.9)
Removable and comprehensive orthodontics	0

Table 2. Frequency distribution (%) of malocclusions treated by pediatric dentists

Type of Treatment	Malocclusion	Frequency (%)
Preventive	Space maintenance	99(89.2)
	Habits	84(75.5)
Interventional	Serial extraction	13(11.7)
	Anterior crossbite	77(69.4)
	Posterior crossbite	44(39.6)
	Crowding, spacing	26(23.4)
	Deep bite	8(7.2)
	Open bite	7(6.3)
Corrective	Dental class II malocclusion	5(4.5)
	Dental class III malocclusion	3(2.7)
	Skeletal class II malocclusion	4(3.6)
	Skeletal class III malocclusion	2(1.8)
	Ectopic eruption guidance	3(2.7)
	Impacted teeth	9(8.1)

Table 3. Frequency distribution (%) of orthodontic treatments provided by pediatric dentists

Orthodontic Treatment		Frequency (%)
Removable	Removable spring plate	84 (75.5)
	Expansion screw plate	75 (67.6)
	Functional	26 (23.4)
Fixed	Fixed rapid palatal expansion	20 (27.3)
	Face mask	12 (10.8)
	Head gear	4 (3.6)
	Fixed edgewise technique	1 (0.9)
	Fixed straightwire technique	4 (3.6)

Table 4. Frequency distribution (%) of the reasons for not providing orthodontic treatments by pediatric dentists

Reasons	Frequency (%)
Lack of proper training in this field	55 (49.5)
Compression of other services and insufficient time	41 (36.9)
The nature of orthodontic treatment (complexity and length)	35 (31.5)
Lack of interest in providing orthodontic treatments	24 (21.6)
Lack of adequate and suitable facilities at workplace	9 (8.1)

According to the findings of the study, among the different sources for acquiring the essential skills to offer orthodontic services and treatments, academic education was identified as the most important, with a frequency of 64%. This was followed by short-term orthodontic training courses and personal studies. Additionally, a notable proportion (77.5%) of pediatric dentists considered a change in the academic education system to be the most effective solution for improving the teaching of orthodontic treatments.

Referral of orthodontic patients to orthodontists by pediatric dentists

In our study, it was found that 55% of pediatric dentists referred more than 50% of patients requiring orthodontic services to orthodontists. The primary reasons cited for referring patients were the complexity and difficulty of treatment, which accounted for 81.1% of the cases.

Table 5 illustrates the frequency percentage of factors influencing the referral of patients to orthodontists. These factors can be categorized into personal factors, which are more related to the referring dentist, and patient-related factors, which directly benefit the patient. Among the personal factors, the most crucial factor influencing referral was the pediatric dentist's acquaintance with the orthodontist, while the least important factor was the specialist's thankfulness for the referral. Among the patient-related factors, the most significant factors were the ease of communication with specialists, their accountability, and the patient's choice, while the least important factor was the proximity of the specialist's office to the pediatric dentist's workplace.

Based on the total scores assigned to personal factors and patient-related factors, as well as the classification of the importance into low, medium, and high categories, most pediatric dentists considered personal factors to be of moderate and low importance, while patient-related factors were regarded as moderately important.

Discussion

This study aimed to evaluate the frequency of orthodontic treatments provided by pediatric dentists in Iran and identify the factors influencing their referral of patients to orthodontists. The results revealed that approximately two-thirds of the surveyed pediatric dentists offered orthodontic services, with a predominant use of removable orthodontic appliances. The most commonly treated malocclusions included space maintenance, oral habits, and anterior crossbite. Removable spring plates and expansion screw plates were among the most frequently used treatments. Notably, a significant proportion of dentists acquired their orthodontic treatment skills through academic education, and improving the academic education system was identified as a preferred solution for enhancing orthodontic education. Personal acquaintance with orthodontists emerged as a significant factor influencing patient referral.

It is noteworthy that older and more experienced pediatric dentists may have been underrepresented in this study. This could be attributed to the random sampling method employed and the online distribution of the questionnaire, which might have led to a higher response rate from younger practitioners. Additionally, older individuals might have been

Table 5. Frequency distribution (%) of the importance of the factors involved in the referral of patients to orthodontists

Factors involved in referral		Frequency (%)			
		Unimportant	Less important	Important	Very important
Personal	Orthodontist's reputation	33 (29.7)	38 (34.2)	34 (30.6)	6 (5.4)
Patient	Patients' satisfaction and previous favorable experiences	0	6 (5.4)	48 (43.2)	57 (51.4)
Patient	Attention to oral hygiene	2 (1.8)	12 (10.8)	57 (51.4)	40 (36.0)
Patient	Proper specialist-patient interaction	0	5 (4.5)	66 (59.9)	40 (36.0)
Personal	Dentist's acquaintance with the specialist	5 (4.5)	26 (23.4)	57 (51.4)	23 (20.7)
Patient	Patient's preference	4 (3.6)	14 (12.6)	70 (63.1)	23 (20.7)
Patient	Proximity to the patient's home or school	24 (21.6)	48 (43.2)	30 (27.0)	9 (8.1)
Patient	Proximity to dentist's workplace	27 (24.3)	53 (47.7)	30 (27.0)	1 (0.9)
Patient	short waiting list	23 (20.7)	45 (40.5)	41 (36.9)	2 (1.8)
Patient	quick cases completion	40 (36.0)	51 (45.9)	19 (17.1)	1 (0.9)
Patient	Lower fees than other orthodontists	13 (11.7)	41 (36.9)	53 (47.7)	4 (3.6)
Patient	The possibility of easy communication with the specialist and his accountability	1 (0.9)	7 (3.6)	72 (64.9)	31 (27.9)
Personal	Being thankful for the referral	46 (41.4)	41 (36.9)	21 (18.9)	3 (2.7)
Personal	Giving your patients priority on his/her waiting list	33 (29.7)	37 (33.3)	37 (33.3)	4 (3.6)
Personal	Referring patients to dentist for treatment	36 (32.4)	34 (30.6)	38 (34.2)	3 (2.7)

less inclined to participate or could have provided incomplete responses.

The analysis of the study data reveals several significant trends and variations in the orthodontic services provided by pediatric dentists in Iran. Firstly, the study found that approximately two-thirds (65.8%) of the surveyed pediatric dentists offered orthodontic services, indicating a considerable presence of orthodontic care within pediatric dental practice.

The extent of orthodontic treatment offered by pediatric dentists has been a topic of interest in previous researches. Several studies have indicated that pediatric dentists tend to provide more orthodontic services compared to general dentists. For instance, Galbreath et al. (11) reported that approximately 90% of pediatric dentists offered orthodontic services, although the majority of them dedicated less than 10% of their time to orthodontic treatments. Koroluk et al. (12) found that the majority of pediatric dentists offered comprehensive orthodontic services. In contrast, Wolsky and McNamara (13) reported that pediatric dentists treated less than 4% of patients. Another study

conducted among members of the Saudi Dental Society indicated that only 38.8% of pediatric dentists practiced orthodontics clinically (9). When examining the variability in orthodontic services offered by pediatric dentists across studies, it is vital to acknowledge its multifaceted nature. Factors such as differences in training programs, regional disparities, evolving clinical practices, and variables like place of practice, annual orthodontic education hours, treatment confidence, and proximity to orthodontists can significantly impact treatment approaches and appliance usage (14). Currently, there is a noticeable decline in the provision of orthodontic services by pediatric dentists (14), coupled with a reduction in the time allocated to such treatments (15). This shift may be attributed to heightened demand for specialized pediatric dental services from parents, alongside a rise in dental caries cases necessitating a greater focus on restorative procedures, potentially limiting the scope and frequency of orthodontic services offered (16). While the factors influencing this reduction in time spent on orthodontic treatment remain uncertain and were not thoroughly investigated, possible factors could include variations in practitioner training, practice development, individual comfort levels, economic considerations, and the promotion of alternative dental services (15).

In the present study, the primary type of orthodontic treatment provided by pediatric dentists was removable orthodontic appliances, accounting for 61.3% of the treatments. A smaller proportion of treatments, 9.9%, involved a combination of removable and fixed orthodontics, while other types of treatments were not performed. These findings are in line with previous studies, which have also reported a significant utilization of removable orthodontic appliances by pediatric dentists (9, 16). However, it is worth noting that Koroluk et al. (12) found that 62% of pediatric dentists performed comprehensive orthodontic treatment, which suggests some variation in the range of treatments provided among different studies.

In the present study, the highest frequency among the treated malocclusions was observed in preventive and interventional treatments. Specifically, space maintenance had the highest frequency (89.2%), followed by oral habits (75.5%) and anterior crossbite (69.4%). On the other hand, skeletal class III malocclusion had the lowest frequency (1.8%) among the treated malocclusions. These findings are consistent with previous studies that have also reported space maintenance, anterior crossbite, posterior crossbite, and oral habits as the most frequent malocclusions, while skeletal class III malocclusion was the least frequent (15, 17). However, it is important to note that in a study by Najafi et al. (18), the use of space retainers and treatment of dental and skeletal class II problems were the most frequent treatments, with habit breaking being the least frequent, which differs slightly from the findings of the present study.

In the present study, the highest frequency of orthodontic treatments performed by pediatric dentists was found to be related to the use of removable spring plates (75.5%) and expansion screw plates (67.6%). Among the fixed treatments, the most common one reported was fixed rapid palatal expansion (27.3%). These findings are consistent with a study conducted by Hilgers et al., which also reported similar results (19). In various studies involving general dentists, the most widely used appliances were found to be removable spring plates, expansion screw plates, and functional appliances (9-12, 14, 16, 17, 19-22).

In recent times, there has been a decline in the range of orthodontic treatments provided by pediatric dentists compared to the past (21). This trend highlights the need for updated and comprehensive orthodontic training in pediatric dental programs to address the evolving demands in orthodontic care (14). Recognizing this, the American Association of Pediatric Dentistry has developed a guideline called "Management of the Developing Dentition and Occlusion in Pediatric Dentistry." This guideline emphasizes the importance of pediatric dentists acquiring knowledge in craniofacial development, diagnosing malocclusions and dental abnormalities, managing oral habits, and

being proficient in early interventional orthodontics (14). These guidelines aim to enhance the skills and capabilities of pediatric dentists in providing effective orthodontic care to their young patients.

In the current study, the orthodontic services provided by pediatric dentists in Iran align with the orthodontic training they receive during their postgraduate training indicating a resemblance to global trends (15, 23). The curriculum of pediatric dentistry in Iran includes three units of theoretical orthodontics and four units of clinical orthodontics. These educational components cover various aspects such as the diagnosis, prevention, and treatment of oral habits, management of anterior and posterior crossbite, development of occlusion, stages and methods of space management (including space maintenance, regaining, and supervision), diagnosis and treatment of minor dental abnormalities in the mixed dentition stage, as well as the control and guidance of jaw development in children using removable orthodontic appliances, biomechanics, and removable appliances (24). The findings of this study suggest that the orthodontic services offered by pediatric dentists in Iran are in line with the training they have received during their postgraduate training. Enhancing the training of pediatric dentistry residents could involve implementing specific strategies such as comprehensive clinical and theoretical workshops. These workshops would focus on orthodontic care, preventive dentistry, and other pertinent areas, providing residents with hands-on experience and in-depth knowledge to prepare them for various clinical scenarios. Furthermore, fostering collaborations between academic institutions and dental practices could enrich the training experience. By offering residents exposure to real-world dental settings, mentorship opportunities, and access to a wider range of patients, this collaborative approach ensures a well-rounded training experience for pediatric dentistry residents.

The study identified academic education (64%), short-term orthodontic training courses, and personal studies as the primary sources for acquiring the necessary skills to provide orthodontic services. This finding aligns with previous research by Galbreath et al. (11) which also emphasized the significance of academic education and specialized training courses. Additionally, a significant proportion (77.5%) of pediatric dentists advocated for changes in the academic education system as the most effective solution for enhancing the teaching of orthodontic treatments. Given that the lack of training in orthodontics is a major reason cited by pediatric dentists for not performing orthodontic treatments, there is a pressing need to reform the educational process and curriculum for pediatric dentistry residents. For instance, clinical training in orthodontics could involve residents examining a diverse range of pediatric patients under the guidance of experienced professors, allowing them to develop treatment plans tailored to individual cases. Moreover, engaging with relevant literature and case studies under the mentorship of faculty members can further augment residents' orthodontic expertise. This highlights the need for continuous enhancements and updates in dental education programs to meet the evolving demands of dentists and patients.

The present study revealed that the primary reasons for pediatric dentists not providing orthodontic treatments were attributed to a lack of proper training in this specialized field. This was followed by challenges related to managing other dental services and time constraints. Furthermore, the nature of orthodontic treatments, characterized by their complexity and duration, also contributed to the limited provision of such services. These findings closely align with the results reported by Najafi et al. (18), emphasizing the consistent nature of these factors across studies.

In the present study, the significance of personal and patient-related factors in the referral of patients to orthodontists was investigated. Among the personal factors, it was found that personal acquaintance between the referring dentist and the orthodontist played a prominent role, while the orthodontist's thankfulness for patient referrals was deemed

less important. As for patient-related factors, the factors that held the most importance were patients' satisfaction and previous favorable experiences, as well as the ease of communication with the specialist and their accountability. On the other hand, the proximity of the specialist's office to the pediatric dentist's workplace was considered the least significant factor.

Similar studies have reported various factors as being more important when choosing an orthodontist for patient referral. Walley et al.(25) highlighted factors such as the orthodontist's reputation, the level of medical care provided, and proximity to the patient's home as crucial considerations. McComb et al.(26) identified factors such as waiting list length and the standard of treatments offered by the specialist as significant determinants. These findings align with the results of the present study, which underscored the importance of patient satisfaction, previous positive experiences, and the specialist's adherence to health principles. A similar study conducted by De Bondt et al. (6) also emphasized patient satisfaction and the specialist's commitment to maintaining health standards.

The study encountered several challenges, including securing cooperation from pediatric dentists for participation and ensuring the accuracy of responses from respondents. Additionally, the reliance on closed-ended questions may have limited the depth of responses, and the absence of clear definitions for certain conditions or treatments might have led to misclassification of concepts. To mitigate these limitations, future research efforts could incorporate more objective measures and longitudinal designs to provide a more nuanced understanding of pediatric dentistry practices.

Turning to the broader implications of the findings, policymakers and practitioners can draw valuable insights from the study to optimize orthodontic services and enhance patient care. By gaining a deeper understanding of the frequency of orthodontic treatments and the factors influencing patient referrals, practitioners can tailor their services to better meet the needs of patients. Policymakers, on the other hand, can leverage these findings to inform dental education policies and resource allocation decisions, ultimately contributing to the improvement of the quality and accessibility of pediatric dental services.

In light of these findings, it is recommended to prioritize the enhancement of training programs for pediatric dentistry residents. Developing practical and theoretical workshops focused on orthodontic treatments and addressing any identified training gaps can better equip residents with the necessary competencies to effectively serve their patients. It is important to emphasize that pediatric dentistry encompasses more than just orthodontic treatment; it also involves preventive care and oral health education to promote long-term oral health and well-being in children. By nurturing healthy dental habits and advocating for children's oral health within the healthcare system, pediatric dentistry plays a crucial role in promoting overall societal well-being.

Conclusion

Most pediatric dentists in Iran do not offer orthodontic services, attributing this to insufficient training. Key factors for acquiring orthodontic skills include academic education and short-term training. Patient satisfaction and communication with specialists were important for referrals. Targeted training workshops are recommended to enhance orthodontic expertise and improve communication between pediatric dentists and orthodontists.

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