

Knowledge and Practices of Orthodontists, Pediatric Dentists and General Dentists on Treatment of Crowding in Mixed Dentition

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Abstract

Crowding is a common problem in mixed dentition due to tooth replacement, lack of space, parafunctional habits, among others. The aim of study was to compare the knowledge and practices between orthodontists, pediatric dentists and general dentists regarding the treatment of dental crowding in mixed dentition.

A virtual survey was used in a sample of 416 professionals divided into 207 general dentists, 77 pediatric dentists and 132 orthodontists. An electronic instrument with 21 questions was sent, consisting of an inventory and a questionnaire with adequate validity and reliability characteristics. The Chi Square test was used with a confidence level of 95%.

Regarding the level of knowledge, significant differences were found between orthodontists, pediatric dentists and general dentists ($p=0.002$); with a higher percentage of high knowledge in pediatric dentists. In the opinion of the three groups of professionals about their practices, there were no differences regarding the best time to start treatment ($p=0.108$), aspect considered to start treatment ($p=0.889$), treatment frequently used for crowding ($p=0.712$), technique used to perform dental stripping ($p=0.087$) and the type of appliance most effective to treat crowding ($p=0.151$).

It is concluded that there was a significantly higher level of knowledge about the treatment of dental crowding in pediatric dentists, followed by orthodontists and general dentists. Practices regarding the treatment of crowding in mixed dentition were similar between the three groups of professionals.

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Introduction

Crowding is observed in the temporary dentition due to the lack of primate spaces, the presence of parafunctional habits, dysfunctions and other anomalies that are aggravated in the permanent dentition. Interceptive orthodontic treatment helps prevent the progression of alterations such as dental crowding and prevents dental and skeletal complications in adults.¹⁻³ In this sense, it is common to observe the intervention of different professionals with a

certain clinical practice in orthodontics.⁴ However, there is controversy regarding the knowledge and practices of professionals who participate in the treatment of malocclusions at an early age, considering the few published studies and the lack of conclusive evidence on the subject.⁵

Although orthodontists are professionals specially trained to treat dental crowding, there are specialists in favor of early intervention and others prefer to postpone the start of treatment.⁶ While pediatric dentists receive in their daily practice patients who receive initial dental care, can identify malocclusions in an initial phase and provide treatment depending on the complexity of the case.⁷ In this scenario, the care provided by the general dentist is also frequent due to various limitations in accessing specialized orthodontic care. However, the question may remain whether there is a difference in the training or clinical

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practice of these professionals who provide interceptive orthodontic treatment of low or medium complexity.⁸

Currently, the number of dental consultations made by parents regarding possible malocclusions has increased, which has generated the need for the participation of specialized and non-specialized professionals, independently or jointly in order to cover the demand for care.⁹ For this reason, the role of the pediatric dentist in terms of managing dental crowding is to preserve temporary teeth until their physiological replacement is completed and improve or obtain correct occlusion in permanent dentition.^{10,11} Orthodontists play a very important role in the treatment. , considering their school training in the diagnosis and execution of orthodontic treatment, which may have begun previously in the pediatric dentist.¹² While the general dentist, a professional in greater numbers, whose dental care should be more accessible in any population. The general dentist, as an essential part of his daily clinical work, could identify inadequate dental relationships and make the referral when the case warrants it. There are even studies that report general dentists as professionals who are considered capable of providing low-complexity orthodontic treatment and who may tend to be successful in communicating with guardians or parents about the need for orthodontic treatment.¹³⁻¹⁵

According to what was described above, orthodontists, pediatric dentists and general dentists have the frequent opportunity to diagnose and treat problems such as dental crowding at an early age,¹⁶ which implies the need to obtain evidence that allows information about the professionals involved, their training, treatment criteria and frequent practices. The purpose of the present investigation was to compare the knowledge and practices of orthodontists, pediatric dentists and general dentists on treatment of dental crowding in mixed dentition.

Materials and methods

This study was approved by a Research Ethics Committee through resolution N°138-2023-USAT-FMED, and presents an observational, cross-sectional and comparative design. The population was made up of 23,559 general dentists, 690 pediatric dentists and 1,158

orthodontists who were registered in the Dental College of Peru, until March 2023. Professionals who did not have a current practice in interceptive orthodontics, professionals who could not be contacted by mail, telephone or social networks and professionals who did not agree to participate in the research or did not respond to the invitation were excluded. The elimination criterion included the professional who met the selection criteria but did not send her responses after three consecutive reminders.

The sample was determined using the following formula for studies that use the non-parametric chi-square test:

$$n = \delta_{\alpha,\beta} \left[\sum_{i=1}^3 \sum_{j=1}^3 \frac{(p_{ij} - p_i.p_j)}{p_i.p_j} \right]^{-1}$$

With an $\alpha=0.05$, a $\beta=0.20$ and with proportions obtained from a pilot study, to form a final sample of 207 general dentists, 77 pediatric dentists and 132 orthodontists, with a power for the study of 0.80. Non-probability snowball sampling was used to reach a larger number of participants through referral.

An electronic questionnaire was developed to measure the level of knowledge of professionals, with 12 closed multiple-choice and single-answer questions, which generated a final score of high (9-12 points), intermediate (4-8 points) and low (0-3 points). An electronic inventory was also created that recorded the practices of general dentists, orthodontists and pediatric dentists, consisting of 5 closed multiple-choice and single-answer questions. The content validation of the electronic instruments was carried out through the evaluation of three judges (K.R.V., M.A.T., A.A.N.). The reliability of the instrument was evaluated through the responses of 45 professionals who participated in a pilot study. Regarding internal consistency, the coefficients were for general dentists 0.731, pediatric dentists 0.770 and orthodontists 0.746, that provided high reliability in the three groups of professionals. Reliability was also evaluated through temporal stability in a test-retest technique to obtain coefficients of 0.543 in general dentists, 0.807 in pediatric dentists and 0.725 in orthodontists, indicating moderate

stability in general dentists, and high stability in pediatric dentists and orthodontists.

A strategy was proposed to identify and contact professionals based on the data published on the website of the Dental College of Peru and through social networks. Subsequently, selection criteria were verified, the purpose of the study was explained, and they were invited to participate in research. The application of electronic instruments was coordinated with participants, they received an information sheet and an access link for the survey using Survey Monkey software through social networks WhatsApp, Facebook via Messenger, personal emails or any other means provided by participants. After sending the link, a maximum waiting time of 15 days was established to receive responses and reminders were sent up to three times. In absence of a response, the participant was replaced by another. Each link sent was coded by participant to ensure correspondence between instrument sent and responses received. A Microsoft Excel sheet was designed to record responses to questions and in numerical values to allow data processing.

Data analysis was carried out in the statistical program SPSS Version 25.0, to obtain absolute and relative frequencies. The bivariate comparison analysis was performed using the Chi Square test with a significance level of 5%.

Results

The results show that orthodontists are mostly men (75%), with average ages of 45.77 ± 9.09 years and average professional experience of 14.92 ± 8.19 years. The majority of pediatric dentists are women (63.6%), with an average age of 42.86 ± 8.33 years and an average professional experience of 9.22 ± 7.3 years. Among general dentists, women are slightly more frequent (52.7%), somewhat younger with 34.19 ± 9.06 years on average and with less experience of 3.45 ± 4.76 years.

Table 1 shows that there were significant differences between orthodontists, pediatric dentists and general dentists with respect to knowledge about the treatment of crowding during mixed dentition ($p=0.002$). The majority of professionals in the three groups presented moderate knowledge. In low knowledge, general dentists had a higher percentage of professionals with 3.9%, followed by pediatric dentists with

2.6%, while no orthodontist had low knowledge on the subject. Regarding high knowledge, pediatric dentists had a higher percentage with 37.7%, followed by orthodontists with 23.5% and general dentists with 18.4%.

Knowledge about the treatment of dental crowding	Orthodontists		Pediatric dentists		General dentist	
	N°	%	N°	%	N°	%
Low	0	0.0	2	2.6	8	3.9
Intermediate	101	76.5	46	59.7	161	77.8
High	31	23.5	29	37.7	38	18.4
Total	132	100.0	77	100.0	207	100.0

Table 1. Knowledge of professionals about treatment of dental crowding during mixed dentition.

Chi-square test = 16.528, P value = 0.002

Table 2 compares the best time for the treatment of dental crowding in mixed dentition according to the professionals surveyed. Similar practices are observed between the three groups of professionals, and therefore no significant differences were found ($p=0.108$). Most orthodontists, pediatric dentists and general dentists identified the best time to treat dental crowding as a period of time prior to the eruption of the upper permanent lateral incisors and after the complete eruption of the permanent molars in occlusion.

Best time to perform dental crowding treatment	Orthodontists		Pediatric dentists		General dentist	
	N°	%	N°	%	N°	%
Before eruption of UPLI and after PMs are erupted and are in occlusion	42	31.8	24	31.2	65	31.4
After eruption of UCI and ULI	40	30.3	13	16.9	53	25.6
After eruption of both UC	5	3.8	8	10.4	26	12.6
Before UPLI eruption	6	4.5	5	6.5	6	2.9
After PMs have finished erupting and are in occlusion	39	29.5	27	35.1	57	27.5
Total	132	100.0	77	100.0	207	100.0

Table 2. Best time according to professionals to treat dental crowding during mixed dentition.

UPLI: Upper permanent lateral incisors; PMs: Permanent molars; UCI: Upper central incisors; ULI: Upper lateral incisors; UC: Upper canines.

Chi-square test = 13.118, P value = 0.108

Table 3 shows that orthodontists in 28.8%, pediatric dentists in 28.6% and general dentists in 30%, mostly chose dentoalveolar discrepancy as the most important characteristic of patient to start treatment of the crowding in mixed dentition. Due to the similarity in the choice, no statistical differences were observed between the groups of professionals ($p=0.889$).

Most important characteristic of patient to start crowding treatment	Orthodontists		Pediatric dentists		General dentist	
	N°	%	N°	%	N°	%
Magnitude of crowding	31	23.5	18	23.4	44	21.3
Presence of dentoalveolar discrepancy	38	28.8	22	28.6	62	30.0
Magnitude of Leeway space	16	12.1	12	15.6	22	10.6
Type of skeletal malocclusion	23	17.4	16	20.8	39	18.8
Vertical growth and patient profile	24	18.2	9	11.7	40	19.3
Total	132	100.0	77	100.0	207	100.0

Table 3. Most important characteristic of patient to start crowding treatment according to professionals.

Chi-square test = 3.630, P value = 0.889

Table 4 shows that maxillary expansion was the main treatment used by majority of orthodontists for slight or moderate crowding at 37.9%, followed by pediatric dentists at 37.7%. Regarding general dentists, the highest percentage of choice was between the choice of stripping with 30.9% and maxillary expansion with 30%. Due to similarities in the choice of professionals, there were no significant differences ($p=0.712$).

Type of treatment used in cases of slight or moderate crowding	Orthodontists		Pediatric dentists		General dentist	
	N°	%	N°	%	N°	%
Interproximal stripping	41	31.1	24	31.2	64	30.9
Maxillary expansion	50	37.9	29	37.7	62	30.0
Hyrax type screw	23	17.4	11	14.3	41	19.8
Hass type screw	9	6.8	7	9.1	16	7.7
Space maintainer	9	6.8	6	7.8	24	11.6
Total	132	100.0	77	100.0	207	100.0

Table 4. Type of treatment performed by professionals for slight or moderate dental crowding in mixed dentition.

Chi-square test = 5.420, P value = 0.712

The technique used to perform dental stripping in cases of crowding during mixed dentition is presented in Table 5. It is observed

that orthodontists, pediatric dentists and general dentists mostly chose metal strips as main technique in similar percentages: 42.4%, 46.8% and 45.4%, respectively. In this sense, no significant differences were found between the three groups of professionals with respect to this procedure ($p=0.087$).

Technique used for interproximal stripping in mixed dentition	Orthodontists		Pediatric dentists		General dentist	
	N°	%	N°	%	N°	%
Abrasive metal strips	56	42.4	36	46.8	94	45.4
Burs for stripping	33	25.0	17	22.1	49	23.7
Diamond discs	10	7.6	8	10.4	34	16.4
Oscillating contra-angle system	7	5.3	7	9.1	9	4.3
Abrasive strips with handle	26	19.7	9	11.7	21	10.1
Total	132	100.0	77	100.0	207	100.0

Table 5. Technique used by professionals for interproximal stripping in mixed dentition.

Chi-square test = 13.198, P value = 0.087

Table 6 shows type of interceptive appliance considered by professionals as the most effective for treatment of slight or moderate dental crowding in mixed dentition. The three groups of professionals mostly chose expansion plate, with 50.8% for orthodontists, 46.8% for pediatric dentists and 44.4% for general dentists. As result of similarity in percentages, there was no significant difference between them ($p=0.151$).

Appliance considered most effective in treatment of slight or moderate dental crowding	Orthodontists		Pediatric dentists		General dentist	
	N°	%	N°	%	N°	%
Expansion plate	67	50.8	36	46.8	92	44.4
Space maintainer	15	11.4	15	19.5	41	19.8
Expansion plate with lifting plane	28	21.2	13	16.9	47	22.7
Maxillary fan expander screw	16	12.1	5	6.5	12	5.8
Y-shaped plate – Bertoni screw	6	4.5	8	10.4	15	7.2
Total	132	100.0	77	100.0	207	100.0

Table 6. Type of interceptive appliance considered by professionals as most effective in treatment of mild or moderate dental crowding in mixed dentition.

Chi-square test = 12.012, P value = 0.151

Discussion

The results obtained show that there are significant differences in terms of knowledge about crowding in mixed dentition, between the groups of professionals, which could imply some

difference in clinical practice of professionals who provide interceptive orthodontic treatment. In regard, Acharya et al.¹⁴ concluded that there are no significant differences between general dentists and non-orthodontic specialists with respect to knowledge of orthodontic treatment; while Kappor et al.³ and Deshmukh et al.¹⁷ did find differences in knowledge between both types of professionals when evaluating a specific topic such as early orthodontic treatment. It was observed that pediatric dentists achieved a higher percentage of high knowledge, possibly related to a greater perception of the need and urgency of orthodontic treatment along with a greater number of malocclusions diagnosed in mixed dentition. That is, part of this knowledge could be explained by a greater exposure to malocclusions in initial phases, which could imply complementary self-education training to cover the need for care in mixed dentition.¹³ According to training received by orthodontists, better knowledge about the treatment of mixed dentition was assumed. However, professionals have reported in surveys an overwhelming greater practice of corrective orthodontics compared to interceptive orthodontics, which has generated a desire to improve curricula apparently focused on corrective orthodontics.¹⁸

Likewise, no differences were found between professionals when they chose the best time for the treatment of dental crowding in mixed dentition. This agreement to choose most appropriate moment coincides with other reports that indicate an age of approximately seven years as opportune moment.^{13,19} Among the reasons are that crowding can facilitate better oral hygiene, less exposure to caries, and whether crowding is associated with excessive overjet because it represents a greater risk of trauma. Additionally, some professionals will wait to start interceptive treatment in late mixed dentition in the hope that the leeway space can help resolve the crowding.²⁰

The results also show that the majority of orthodontists, pediatric dentists and general dentists take into account patient's dentoalveolar discrepancy as the most important aspect to initiate treatment of dental crowding in mixed dentition. In this sense, Türkkahraman et al.²¹ observed that crowding of mandibular incisors not only depends on the discrepancy in arch, but also the dentofacial characteristics. Sampson et al.²² showed factors that explain mesiodistal

differences between primary and permanent dentitions such as degree of initial crowding, integrity of contact point, soft tissue morphology and variation in dentoalveolar growth.¹⁰

Regarding treatments mentioned in the present study, majority of orthodontists and pediatric dentists consider maxillary expansion as the treatment of choice for slight or moderate crowding. A similar panorama is observed in other studies that have reported maxillary expansion as one of the most frequent and reliable procedures according to same type of professionals.^{12,13} Furthermore, maxillary expansion has been shown to have a positive effect on the resolution of anterior maxillary crowding and indirectly on mandibular crowding.²³ While stripping was chosen by general dentists as an option equally important as maxillary expansion, perhaps because it is a direct technique in the office, relatively easy to perform and with evidence of having greater stability than maxillary expansion. However, it requires a prior evaluation to ensure that interproximal enamel reduction will not produce unfavorable effects such as periodontal problems, pulp sensitivity and alterations in enamel surface that favor bacterial adhesion.²⁴

From results it can be stated that the groups of professionals most frequently use abrasive metal strips to perform stripping with purpose of solving slight or moderate crowding in mixed dentition and avoiding extraction. Consequently, the choice of abrasive strips can be justified as a conservative option because it produces less roughness on the enamel surface compared to rotary and oscillating techniques; however, all of the techniques described for interproximal wear depend on a careful polishing process.²⁵ While in the aspect of heat generation, it has been reported that the more abrasive manual strips depending on the material may have a disadvantage compared to low speed rotary techniques that have cooling.²⁶

Finally, expansion plate was considered by majority of groups of professionals as the most effective appliance in treatment of slight or moderate dental crowding in mixed dentition. Several studies shown that palatal expansion can help solve dental crowding due to lack of space through increasing arc length, intercanine width, and intermolar width; independent if a slow or fast activation protocol is used.^{16,27} It should be considered that increasing arch length is limited

by the amount of alveolar bone available and consequently the options depend on whether the patient is growing and how much expansion is required.²⁰ For a required expansion of less than 5 mm, a removable screw plate can be used; while for a greater number of millimeters, rapid maxillary expansion would be better indicated.²⁸ However, it should not be forgotten that these appliances are mainly used to correct crossbites, but as a secondary product they are a useful resource for the treatment of crowding in mixed dentition.^{27,29}

Among the limitations of a self-administered virtual survey is possibility of incomplete understanding in some questions that could not be communicated or resolved, even though the instrument used met expert validation. Another limitation is that the sample is not representative of population due to non-probabilistic sampling technique used.

Conclusions

With the results obtained in the present study, it can be concluded that the level of knowledge of orthodontists, pediatric dentists and general dentists was different, with a higher percentage of high knowledge in pediatric dentists. With respect to the practices reported by the three groups of professionals, there was similarity in decision to choose best time to start treatment, the most important characteristic of the patient to start treatment, the most frequently used treatment to resolve crowding, technique generally used to perform dental stripping and the most effective type of appliance for treatment of slight or moderate dental crowding.

Declaration of Interest

The authors report no conflict of interest.

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