Revista CEFAC

eISSN 1982-0216

DOI: 10.1590/1982-0216/20242634424 | Rev. CEFAC. 2024;26(3):e4424

Original articles

Knowledge of speech-language pathologists regarding malocclusion, its preventive aspects, recognition, and need for referral

Yasmin Rodrigues do Prado Chapine[1]
Viviane de Oliveira Prado[1]
Magda Feres[1]
José Tarcísio Lima Ferreira[1]
Tarek El-Bialy[1]
Silvia Helena Vieira Bastos[1]
Murilo Fernando Neuppmann Feres[1]

[1] Universidade de São Paulo, Faculdade de Medicina de Ribeirão Preto - FMRP-USP, Ribeirão Preto, São Paulo, Brasil.

Study conducted at the Ribeirão Preto Medical School of the University of São Paulo (FMRP-USP), Ribeirão Preto, SP, Brazil.

Financial support: Nothing to declare

Conflict of interests: Nonexistent

Corresponding author:
Viviane de Oliveira Prado
Faculdade de Odontologia de Ribeirão Preto da Universidade de São Paulo (FORP-USP) - Departamento de Odontopediatria / Ortodontia
Avenida do Café – Subsetor Oeste – 11 (N-11)
CEP: 14040-904 - Ribeirão Preto, São Paulo, Brazil
E-mail: vivianeprado@usp.br

Received on May 13, 2024
Received in a revised form on July 18, 2024
Accepted on September 25, 2024

ABSTRACT

Purpose: this study aims to assess speech-language pathologists' knowledge of malocclusion, and to assess their perception in recognizing the need for referral of cases.

Methods: a self-administered online questionnaire, aimed at assessing Brazilian speech-language pathologists' professional practices, orthodontic knowledge, and diagnostic skills, was applied. The collected data underwent descriptive analysis.

Results: most respondents stated regularly contacting or referring patients to orthodontists; the most frequent reason for referral was related to the professional's quality. Respondents indicated the importance of first occlusal evaluations at a very early age, and recognized the potential deleterious effects of oral habits. Most participants reported referring a normal occlusion, distocclusion, mesiocclusion, anterior open bite, deep overbite, and posterior crossbite cases, during the deciduous stage. For the mixed dentition cases, a substantial portion of the sample would refer a case without alterations, another one with mild incisal crowding, as well as deep overbite, Class II, Class III, anterior open bite, and posterior crossbite cases.

Conclusion: professionals demonstrated a good knowledge of malocclusions. Perceptions regarding the need for early referral of Class III cases, anterior open bite, and posterior crossbite, in addition to the lack of an immediate approach for patients affected by mild space problems, were frequent.

Keywords: Malocclusion; Speech-Language Pathology; Orthodontics; Knowledge; Referral And Consultation

INTRODUCTION

Interdisciplinary work in Health care tends to provide benefits both for the professionals involved, in terms of knowledge and experience acquisition, and for the patients, who are likely to receive a more comprehensive treatment. The Speech-language Pathology – mainly the Orofacial Myofunctional Therapy sub-area, and Orthodontics/Dentofacial Orthopedics are associated fields of knowledge[1,2], especially in the identification and treatment of mouth breathing patients, those with deleterious habits, orofacial myofunctional disorders, and malocclusions in general[3,4]. In this sense, both areas share the objectives of prevention, intervention, rehabilitation of the musculoskeletal facial balance and, consequently, the stomatognathic functions.

Orthodontics and Dentofacial Orthopedics are specialized areas within Dentistry that focus on improving dental and facial alignment, but they differ in some aspects. Orthodontics primarily aims to correct malocclusions and align teeth, using orthodontic appliances such as braces, aligners, and other devices, aiming to enhance dental aesthetics, function, and correct occlusal issues. Dentofacial Orthopedics focuses on influencing the growth and development of the maxilla and mandible, in addition to the facial bones. It utilizes appliances that apply forces to stimulate growth and correct skeletal discrepancies, aiming to achieve proper jaw relationships, optimize facial growth patterns, and improve aesthetics and function[5].

In order to formulate educational interventions that could possibly fill any potential communication gaps between dental and Speech-language Pathology practitioners, several studies have been conducted to verify the professionals' perceptions regarding the area of interface between both disciplines. Although it has been clearly identified the need for a better interaction[3], no studies have apparently assessed the knowledge of Speech-language Pathology professionals regarding areas of common practice, such as malocclusion, its respective preventive aspects, and the recognition of the need for referrals.

Considering the importance of the interaction between Speech-Language Pathology and Orthodontics/ Dentofacial Orthopedics professionals in the integrated approach to clinical cases, this study aims to assess speech-language pathologists' knowledge of malocclusion and its preventive aspects. It also seeks to understand these professionals' perception regarding the recognition and need for patient referral, aiming to enhance interdisciplinary collaboration and the quality of treatment provided.

METHODS

This is a descriptive observational cross-sectional study. This research has been approved by the Research Ethics Committee of the University of Guarulhos (UNG), Brazil, under evaluation report number 2.079.593 and CAAE number 64766017.6.0000.5506.

The sample consisted of speech-language pathologists (clinicians, professors, or students) associated with the following professional organizations: Brazilian Society of Speech-Language Pathology (*Sociedade Brasileira de Fonoaudiologia - SBFa*), Brazilian Association of Orofacial Motricity (*Associação Brasileira de Motricidade Orofacial - ABRAMO*), and Brazilian Academy of Audiology (*Academia Brasileira de Audiologia - ABA*), or the educational institutions: Division of Education and Rehabilitation of Communication Disorders at the Pontifical Catholic University of São Paulo (*Divisão de Educação e Reabilitação dos Distúrbios da Comunicação da Pontifícia Universidade Católica de São Paulo - DERDIC-PUC-SP*) and the Specialization Center in Clinical Speech-Language Pathology (Clinical Speech-Language Pathology Consulting - *CEFAC*). Exclusion criteria involved not being a member of these organizations.

The research was performed using an online questionnaire (Figure 1) that could be accessed by computers, tablets, or smartphones. Only one access for each IP (Internet Protocol) was made available. The professionals received general guidelines when accessing the electronic address about the objectives of the study and the description of procedures to be performed. These individuals could confirm their participation in the research after reading this information by signing an Informed Consent Form.

GENERAL DATA

1. Age:

_____

2. Gender:
o Male
o Female

3. Year of graduation:

_____

4. Specialty or area predominantly practiced:
o I don't have any specific specialty, or predominantly practiced area
o Audiology
o Swallowing Dysfunction
o Work Speech Therapy
o Educational Speech Therapy
o Neurofunctional Speech Therapy
o Gerontology
o Language
o Orofacial Myofunctional Therapy
o Neuropsychology
o Public Health
o Voice
o Other (specify) _____

5. Rate the quality of education you received in Orthodontics/ Orofacial Orthopedics throughout your professional formation:
o Very poor
o Poor
o Fair
o Good
o Excellent

6. Predominant workplace?
o Private practice office
o Hospital
o Public Health Service
o College/University

7. Hours per week dedicated to Speech Therapy
o Less than 10 hours
o 10-20 hours
o 20-40 hours
o More than 40 hours

PROFESSIONAL PRACTICES

1. Do you usually treat children?
o Yes
o No

2. What is the estimated predominant age range?
o 0-2years old
o 3-6 years old
o 7-9 years old
o 10-12 years old
o I usually don't treat children

3. What is the estimated percentage of treated children out of all of your patients?
o 1%-25%
o 26%-50%
o 51%-75%
o 76%-100%
o I usually don't treat children

4. Do you often examine the oral cavity, even if patients come to you with another complaint?
o Yes
o No

5. Do you have difficulties in recognizing/ identifying malocclusions?
o Yes
o No

6. Do you often reach out to an orthodontist or orofacial functional orthopedist for opinions?
o Yes
o No

7. With what frequency, approximately?
o More than once a week
o Once a week
o Once every 2 weeks
o Once a month
o Once every 3 months
o Once every 6 months
o Once a year
o Less than once a year
o I usually don't reach out to an orthodontist or orofacial functional orthopedist for opinions

8. Do you often make referrals to orthodontists/ functional orthopedists?
o Yes
o No

9. With what frequency, approximately?
o More than once a week
o Once a week
o Once every 2 weeks
o Once a month
o Once every 3 months
o Once every 6 months
o Once a year
o Less than once a year
o I usually don't make referrals to orthodontists/ functional orthopedists

10. Why? (More than one answer is allowed)
o I usually don't make referrals to orthodontists/ functional orthopedists
o For help for interception of deleterious oral habits, such as thumb sucking or pacifier use
o For help for reestablishing a normal deglutition pattern
o For help for reestablishing nasal breathing
o For correcting malocclusions, in general
o Other (specify) _____

11. What are the main factors you consider while choosing a professional for referrals? (More than one answer is allowed)
o Quality
o Convenience
o Reputation
o Satisfaction of previously referred patients
o Ease of communication
o I usually don't make referrals to orthodontists/ functional orthopedists

12. Which professional do you mostly refer your patients to?
o Orthodontist
o Functional orthopedists
o For both, equally. I don't see differences between orthodontists' and functional orthopedists' practice
o I usually don't make referrals to orthodontists/ functional orthopedists

13. What is your overall impression on the orthodontic/ functional orthopedic treatments of the patients you refer?
o Very positive
o Positive
o Indifferent
o Negative
o Very negative
o I usually don't make referrals to orthodontists/ functional orthopedists

14. Do you often perceive resistance from the patients you refer?
o Yes
o No
o I usually don't make referrals to orthodontists/ functional orthopedists

15. Do you try to convince a patient with malocclusion to undergo orthodontic/ functional orthopedic treatment, even if they show no interest in undergoing treatment?
o Yes
o No

KNOWLEDGE (1)

In your opinion…

1. Are there differences between the orthodontic and the functional orthopedic practices?
o Yes
o No
o I don't know

2. What is the ideal age to refer a child for his/ her first occlusal evaluation by an orthodontist/ functional orthopedist?
o 0-2 years old
o 3-6 years old
o 7-9 years old
o 10-12 years old
o After 12 years old
o I don't know

3. Can the orthodontic/ functional orthopedic treatment be initiated at any age?
o Yes
o No
o I don't know

KNOWLEDGE (2)

Provide your opinion in relation to the following statements:

1. **Children who breastfeed are less likely to develop malocclusions.**
o I completely agree
o I partially agree
o I completely disagree

2. **Children with mouth breathing are more likely to develop malocclusions.**
o I completely agree
o I partially agree
o I completely disagree

3. **Children who use pacifiers and/ or thumb suck are more likely to develop malocclusions.**
o I completely agree
o I partially agree
o I completely disagree

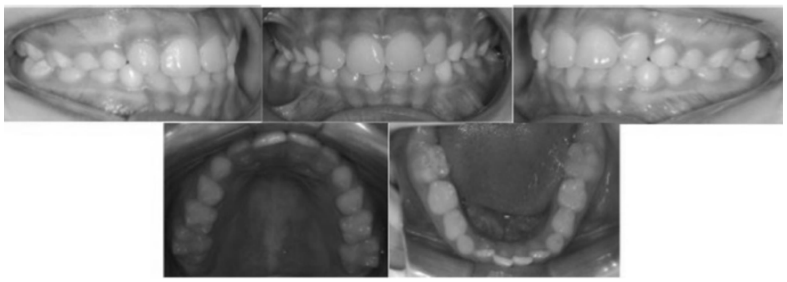
4. **Children who present tongue thrusting during speech or deglutition are more likely to develop malocclusions.**
o I completely agree
o I partially agree
o I completely disagree

5. **Children who interpose their lip between the superior and inferior teeth are more likely to develop malocclusions.**
o I completely agree
o I partially agree
o I completely disagree

DIAGNOSTIC SKILLS

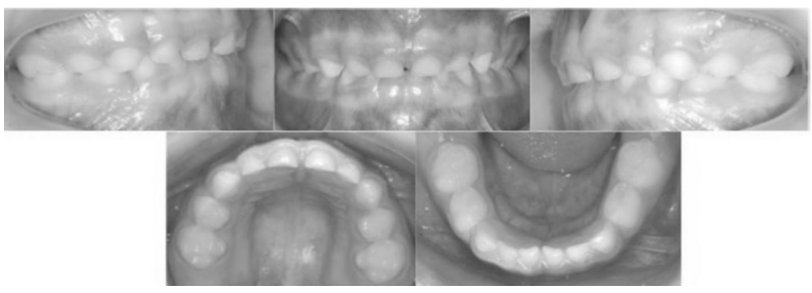
Provide your answer for the following cases:

1. **Would you refer this patient to the orthodontist/functional orthopedist?**



o Yes
o No

2. **Would you refer this patient to the orthodontist/functional orthopedist?**



o Yes
o No

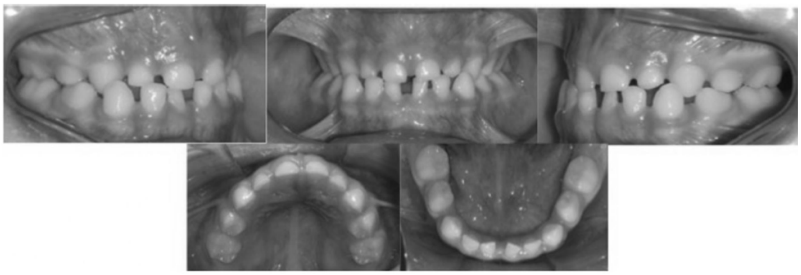
3. Would you refer this patient to the orthodontist/functional orthopedist?

o Yes
o No

4. Would you refer this patient to the orthodontist/functional orthopedist?

o Yes
o No

5. Would you refer this patient to the orthodontist/functional orthopedist?

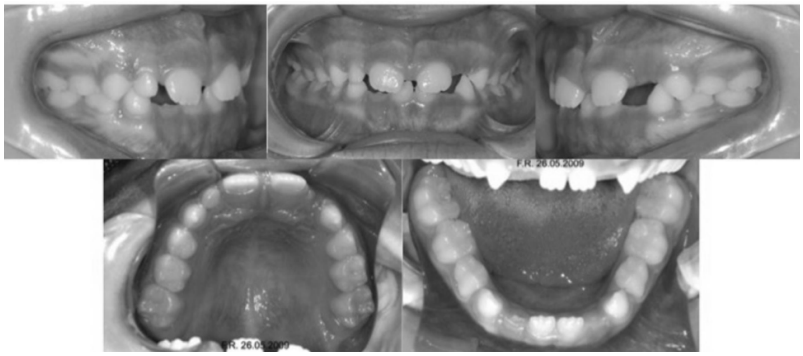


o Yes
o No

6. Would you refer this patient to the orthodontist/functional orthopedist?

o Yes
o No

7. Would you refer this patient to the orthodontist/functional orthopedist?

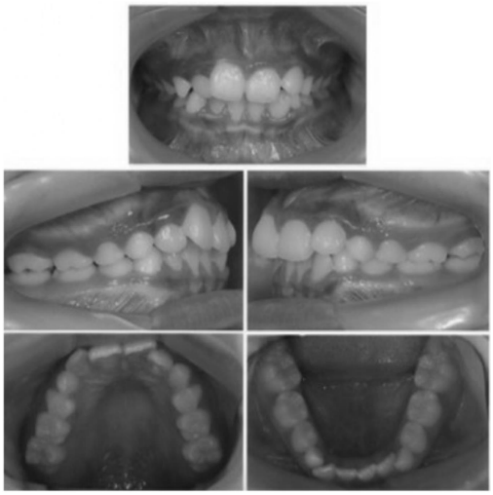


o Yes
o No

8. Would you refer this patient to the orthodontist/functional orthopedist?

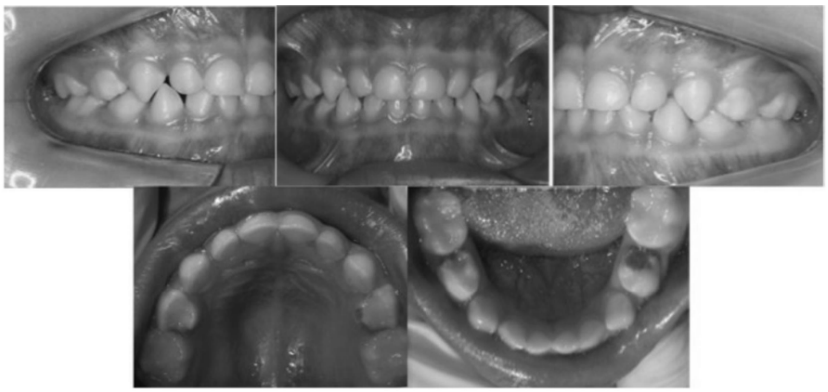
o Yes
o No

9. Would you refer this patient to the orthodontist/functional orthopedist?



o Yes
o No

10. Would you refer this patient to the orthodontist/functional orthopedist?



o Yes
o No

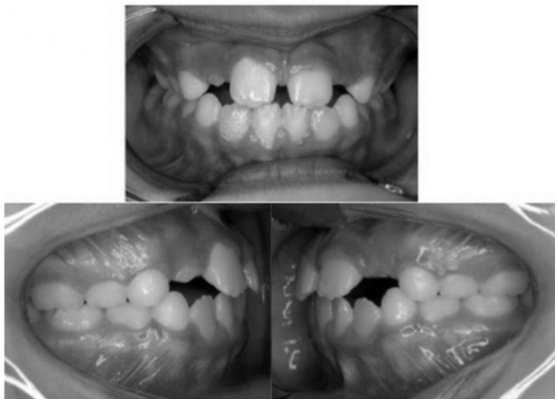
11. Would you refer this patient to the orthodontist/functional orthopedist?

o Yes
o No

12. Would you refer this patient to the orthodontist/functional orthopedist?

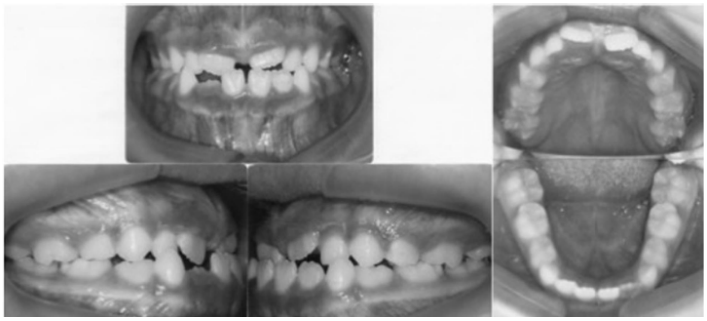
o Yes
o No

13. Would you refer this patient to the orthodontist/functional orthopedist?



o Yes
o No

14. Would you refer this patient to the orthodontist/functional orthopedist?



o Yes
o No

Figure 1. Questionnaire

The questionnaire mainly consisted of objective questions, which had been previously elaborated after discussions held by an expert panel composed of four researchers/dentists with experience in the following knowledge fields: Orthodontics, Dentofacial Orthopedics, and Pediatric Dentistry. Each of the members suggested an initial list of items that, after due debate, were subjected to changes, deletions, and additions.

The final version of the questionnaire included 45 questions, requiring approximately 12 minutes to be answered. The questions included general data, information on professional practices, knowledge, and diagnostic/referral skills. In this last category, the interviewees were confronted with intraoral photographs of different clinical cases. Different types of malocclusions at different occlusal developmental stages were included. Intraoral images of children free of occlusal alterations or who did not require an immediate orthodontic/orthopedic intervention were also included. The following clinical scenarios were presented:

- Deciduous dentition
  - Normal occlusion: not requiring referral
  - Baume type II arch: not requiring immediate referral
  - Class II/distocclusion: not requiring immediate referral
  - Class III/mesiocclusion, anterior crossbite: requiring immediate referral
  - Anterior open bite: requiring immediate referral
  - Deep overbite: not requiring immediate referral
  - Posterior crossbite: requiring immediate referral
- Mixed dentition
  - Normal occlusion: not requiring referral
  - Mild lower incisal crowding: not requiring referral
  - Class II: not requiring immediate referral
  - Class III, anterior crossbite: requiring immediate referral
  - Anterior open bite: requiring immediate referral
  - Deep overbite: not requiring immediate referral
  - Posterior crossbite: requiring immediate referral

The selected images originated from the personal file of a researcher from the Orthodontic Graduate Program of the institution where the research was conducted. The images were used after the patients and legal guardians gave due permission. The questionnaire was structured through the SurveyMonkey tool (https://pt.surveymonkey.com) using a specific model that allowed an adequate number of questions, supported a considerable number of responses, offered randomization mechanisms and ramifications, provided reports, and enabled the export of data for analysis. It was self-applied and answered over 30 days, with most responses concentrated in the first week after availability.

Analysis methods

After data extraction, they were subjected to descriptive statistical evaluation to determine relative and absolute frequencies for evaluating objective questions. Open questions related to age and year of graduation were evaluated by calculating the mean, standard deviation, and distribution into categories.

RESULTS

Sample characterization

The questionnaire was accessed by 159 speech-language pathologists, of which 153 expressed an interest in participating. Thus, a maximum responsiveness rate of 96.22% was observed. The frequencies of participation in questions throughout the questionnaire ranged from 153 to 111 recorded responses.

The average age of the participants was 45.05 (±11.69 years). In terms of specialties held or practiced, the majority of the respondents (26.62%) were specialized in Orofacial Myofunctional Therapy, followed by Audiology (17.27%) and Language (15.11%). Other areas of specialization included Dysphagia (8.63%), Voice (7.19%), and Public Health (4.32%), amongst the less frequently reported ones. A minor group of respondents (6.47%) did not hold or practice any specific specialty. Regarding their perception of the quality of education received in Orthodontics/Dentofacial Orthopedics, the majority of the respondents evaluated it positively (35.25% considered it good; 31.65% average; 19.42% poor; and 7.20% excellent). These findings highlight a diversity of specializations among the respondents, as well as varied opinions about the quality of the training they considered to have received in Orthodontics/Dentofacial Orthopedics.

Professional practices

Responses collected concerning the predominant workplaces indicate that the majority of the respondents (59.72%) work in private practices, followed by public service (21.58%), university settings (10.79%), and hospitals (7.91%). Regarding the weekly workload, the data shows that 8.63% of the respondents have a workload of less than 10 hours per week; 22.30% work between 10 to 20 hours; 43.17% work between 21 to 40 hours; and 25.90% work more than 41 hours per week. In terms of the estimated percentage of children assisted out of the total number of assistances, respondents distribute their caseload as follows: 19.69% assist 1-25% of children; 18.11% assist 26-50%; 25.98% assist 51-75%; and another 25.98% assist 76-100%. A smaller portion (10.24%) of respondents do not usually assist children, according to their reports. In analyzing the predominant age group among the assisted children, 32.28% reported assisting 3 to 6 years children; 29.93% 7 to 9 years patients; 9.45% 0 to 2 years children; 8.66% mentioned 10 to 12 years; and another 8.66% declared to assist children over 12 years old. Additionally, 11.02% of the respondents do not usually assist children, according to records. When asked about the difficulty in recognizing or identifying malocclusions, 48.82% of the respondents reported having no difficulty at all; while 36.22% mentioned having little difficulty; 10.24% declared facing moderate difficulty; and 4.72% stated having great difficulty.

Most respondents stated regularly contacting orthodontists/dentofacial orthopedists in search of their opinions (70.08%) on a monthly (20.47%); or quarterly basis (19.69%;). They also stated that they regularly referred patients to orthodontics/dentofacial orthopedists (81.89%) monthly (26.77%); or once every three (18.90%); or every six months (19.69%) (Figure 2).

The most frequent reason for referral to those professionals was due to the effective correction of occlusal deviations (73.23%) (Figure 3). The most cited factors that determined the choice of the professional to whom they refer their patients were quality (66.14%), previously referred patient's satisfaction (49.61%), and ease of communication between professionals (48.03%) (Figure 4). A larger number of speech-language pathologists answered that they refer their patients to an orthodontist (46.46%) (Figure 5) and, in general, the evaluation of the treatments performed by them was considered "positive" (49.61%) or "very positive" (29.13%;) (Figure 6).

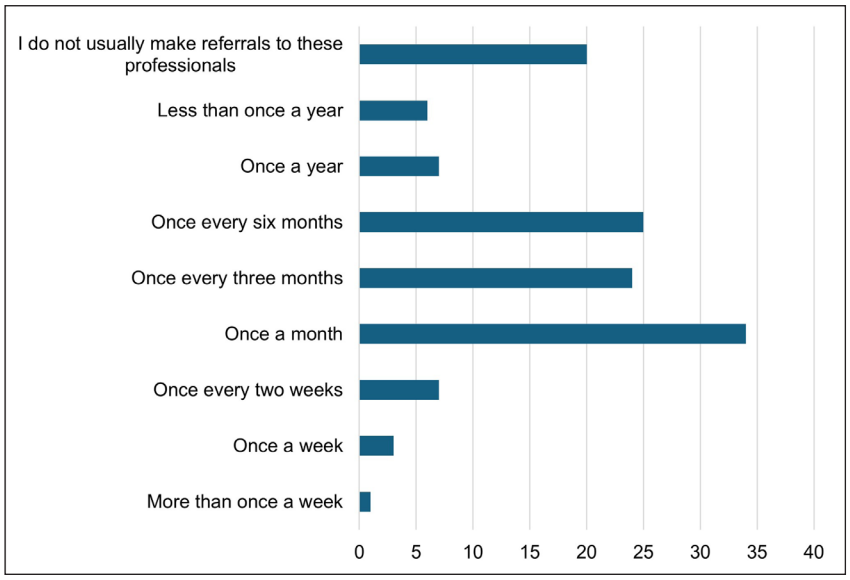


Figure 2. Estimated frequency of referrals to orthodontics/dentofacial orthopedists

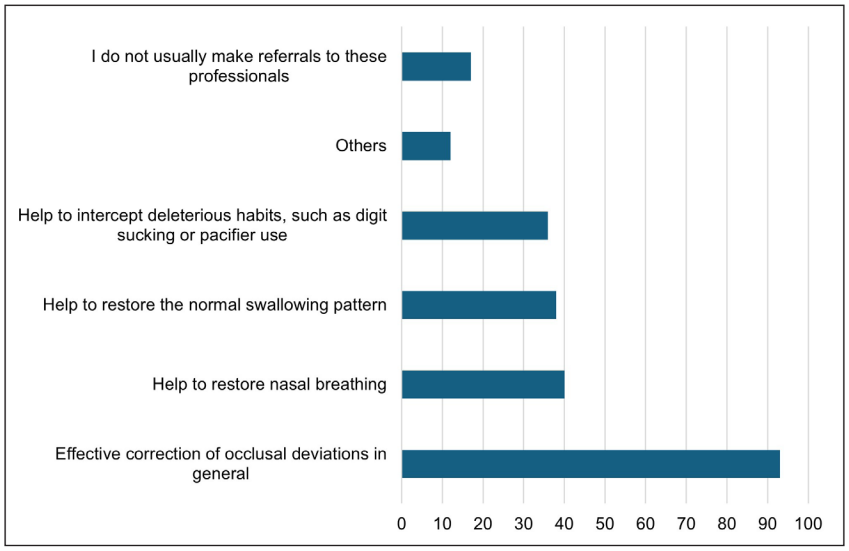


Figure 3. Motivations for referrals to orthodontics/dentofacial orthopedists (More than one alternative could be chosen)

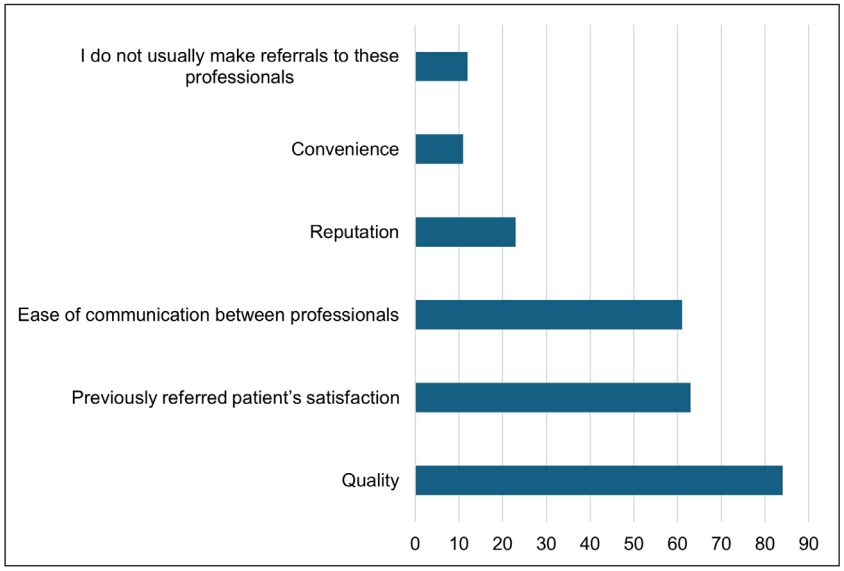


Figure 4. Factors that determine the choice of professional for referrals (More than one alternative could be chosen)

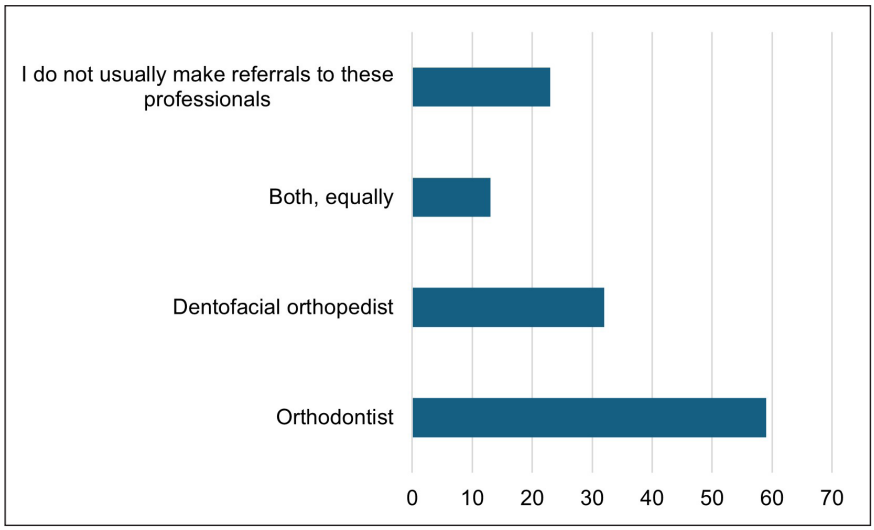


Figure 5. Type of professional to whom the patient is predominantly referred

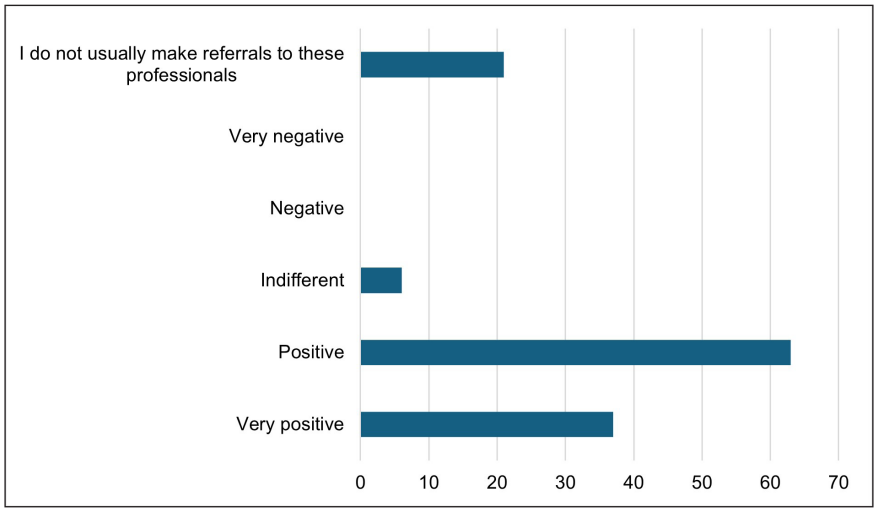


Figure 6. General evaluation of the treatment performed after referral

Knowledge

Most participants stated that they recognized differences between Orthodontics and Dentofacial Orthopedics practices (81.97%). When questioned about the most recommended age for occlusal evaluation of children, most speech-language pathologists would indicate 3 to 6 years (65.57%). A relevant portion of the sample understood the possibility of applying orthodontic/dentofacial orthopedic treatments at any age (44.26%; 54/122) (Table 1).

Overall, nearly all interviewees in this study agreed, partially or totally, that breastfeeding has the potential to reduce the risk of developing malocclusions (97.4%) and, on the other hand, mouth breathing (99.15%), non-nutritive sucking habits (99.15%), tongue (95.76%), or lip thrusting (96.6 %) have the potential to increase the risk of occlusal deviations (Table 1).

Table 1. Relative and absolute frequencies regarding the knowledge of respondents about orthodontic/orthopedic topics

Recognition of the difference between orthodontics and dentofacial orthopedics	**%**	**n**
Yes	81.97	100
No	1.64	2
I do not know how to answer	16.39	20
TOTAL	100.00	122
Recommended presumptive age for first occlusal evaluation	**%**	**n**
0-2 years	9.02	11
3-6 years	65.56	80
7-9 years	12.30	15
10-12 years	4.10	5
Over 12 years	0.00	0
I do not know how to answer	9.02	11
TOTAL	100.00	122
Can orthodontic/ dentofacial orthopedic treatment be started at any age?	**%**	**n**
Yes	44.26	54
No	38.52	47
I do not know how to answer	17.22	21
TOTAL	100.0	122
"Breastfed children are less likely to develop malocclusion"	**%**	**n**
I completely agree	44.07	52
I partially agree	53.39	63
I completely disagree	2.54	3
TOTAL	100.00	118
"Children with mouth breathing are more likely to develop malocclusion"	**%**	**n**
I completely agree	80.51	95
I partially agree	18.64	22
I completely disagree	0.85	1
TOTAL	100.00	118
"Children who use pacifiers and/or have digit sucking habits have a high chance of developing malocclusion"	**%**	**n**
I completely agree	82.20	97
I partially agree	16.95	20
I completely disagree	0.85	1
TOTAL	100.00	118
"Children who have tongue thrusting during speech or swallowing are more likely to develop malocclusion"	**%**	**n**
I completely agree	63.56	75
I partially agree	32.20	38
I completely disagree	4.24	5
TOTAL	100.00	118
"Children who interpose the lip between their teeth are more likely to develop malocclusion"	**%**	**n**
I completely agree	59.32	70
I partially agree	37.29	44
I completely disagree	3.39	4
TOTAL	100.00	118

Diagnostic and referral skills

Considering the different representative clinical cases during the deciduous dentition developmental stage, most participants reported referring an illustrative case of normal occlusion (72.97%), although they reported not doing so for a Baume type II arch case (66.36%). Furthermore, most respondents declared that they would refer cases of sagittal malocclusions of distocclusion (95.50%) and mesiocclusion with anterior crossbite (81.08%) for orthodontic/dentofacial orthopedic evaluation. Almost all professionals declared that they would refer cases of vertical deviations for treatment both for the anterior open bite (99.11%) and for deep overbite (94.59%). The same was observed for the transverse occlusal deviation posterior crossbite (94.59%) (Figure 7).

In the mixed dentition phase, a significant portion of the sample would refer a case without occlusal alterations (72.98%), although most of them would refer a case with mild incisal crowding (40.37%). Similar to the answers collected for deciduous dentition, a substantial portion of respondents stated that they would refer a case of deep overbite (75.89%), while almost all of them would do so for Class II (89.19%), Class III (98.20%), anterior open bite (95.50%), and posterior crossbite cases (92.86%) (Figure 8).

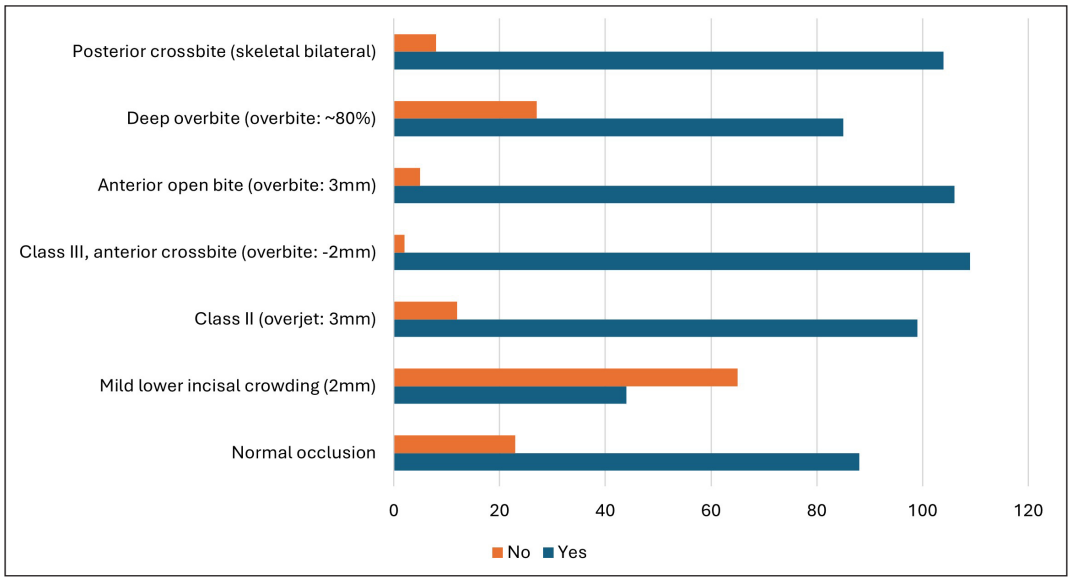


Figure 7. Relative and absolute frequencies regarding the diagnostic and referral skills of respondents - Deciduous dentition

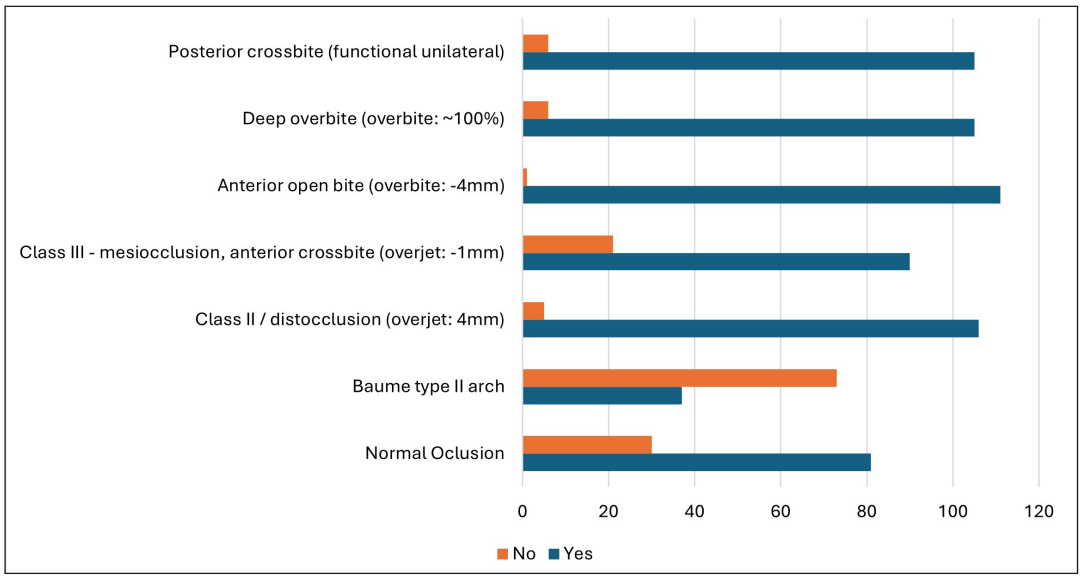


Figure 8. Relative and absolute frequencies regarding the diagnostic and referral skills of respondents - Mixed dentition

DISCUSSION

Approximately 70% of 5-year-old Brazilian children at the end of the deciduous dentition exhibit at least one occlusal deviation[6]. An important national longitudinal study showed that children with malocclusion during the deciduous dentition were more likely to persist with the occlusal disorder throughout the mixed dentition[7]. A Brazilian cohort study confirmed that the presence of malocclusions at 6 years of age can be considered a high-risk factor for the installation of clinical conditions that require orthodontic treatment at 12 years of age[8]. For this reason, both the dentist and the speech-language pathologists should be aware of that interceptive orthodontics aims to interrupt malocclusion development as soon as it is diagnosed, while preventive orthodontics works to prevent the development of malocclusion[9].

Therefore, referrals made by other professionals who deal with growing patients could be potentially decisive for the success of preventive/interceptive orthodontic therapy, if we consider relatively greater effectiveness when malocclusions are addressed early[10,11]. The knowledge of professionals such as speech-language pathologists about malocclusions and preventive aspects must be assessed because given their frequent interaction with young patients during crucial developmental stages. To the best of our knowledge, this is the first scientific attempt to assess speech-language pathologists on topics directly related to Orthodontics/Dentofacial Orthopedics.

Our sample of respondents may not have been representative of the Brazilian population of speech-language pathologists although we had an adequate number of respondents. This limitation could be attributed to our reliance on databases of professional entities and, although they present records from the entire national territory, there is no means of confirming that the distribution of respondents was representative regarding geographic regions, modalities, and levels of training and professional practice. Thus, we recommend that the results provided by this study are not taken as a reference for the formulation and implementation of public educational policies, but only as indicative of trends, worthy of detailed future investigations with the use of demonstrable representative samples. However, we were able to provide an adequate characterization of our study sample, so that readers could define, individually, the degree of generalizability of the data collected here.

Among the different specialties of speech-language pathology, Orofacial Myofunctional Therapy has a relatively larger interface with Orthodontics/Dentofacial Orthopedics[1-3], as it is the field of knowledge that encompasses not only the restoration of normality in facial musculature, but also the functional aspects related to this musculature, which are important factors to consider in the etiology of occlusal disorders. Most of the samples evaluated here were composed of specialist professionals who work in private practice for more than 20 hours a week. They typically treat children, including patients aged 3 to 9 years, which corresponds to an age group suitable for identifying occlusal deviations and potential etiological factors.

The high percentages of respondents who reported routinely examining the oral cavity, had received training in Orthodontics/Dentofacial Orthopedics of fair to good quality, and reported not facing difficulties in recognizing occlusal deviations seem to have also contributed to the high frequency of reports of regular referrals to orthodontics/dentofacial orthopedics. Therefore, we consider that, despite the limitations of our sample, our findings can be considered an indication that education, area of expertise, habits and professional skills, and profile of treated patients are factors that may potentially influence the pattern of referrals to orthodontics/dentofacial orthopedists.

Overall, the respondents shared a positive experience in relation to the orthodontic/orthopedic treatment performed on their patients after referrals. This must be the justification for a relevant portion of the interviewed professionals to have also stated that they get in touch with specialists regularly. According to our results, the factors most often considered by professionals when choosing a specialist are quality, the satisfaction of previously referred patients, and ease of communication. Our findings corroborate the collected literature. Past studies not only confirmed these three criteria as relevant, but also highlighted the reputation of orthodontists/ dentofacial orthopedists and the fact that they are careful with oral hygiene, kind to children, and attentive to the appointment of referred patients[12]. Considering this scenario, it seems reasonable to reinforce the recommendation for orthodontists/dentofacial orthopedists to adopt a professional attitude that is not only technical but also sensitive to patients' complaints and needs and accessible to work partners, such as speech-language pathologists. These attitudes tend to facilitate communication and treatment results, involving more than one professional, but should

be considered as a single one, whose objective is to achieve harmony in the craniofacial complex.

The profile of this sample appears to be characterized by a strong conscientious concern in relation to potential occlusal deviations. Most respondents recognized the possibility of implementing orthodontic/dentofacial orthopedic treatments at any age, although a relevant portion of the sample also agreed that the first occlusal assessment should be performed early in the deciduous dentition, which is in line with a previous study[13]. Aldrees et al.[14] which demonstrated that both general and pediatric dentists would indicate patients during deciduous and early mixed dentition stages to initiate orthodontic/dentofacial orthopedic treatment to the detriment of late mixed dentition and permanent stages. However, it is important to emphasize that most treatments should be ideally implemented from 6 years of age, as the patient might present greater potential for cooperation and adherence to the proposed therapy at this age onwards.

Respondents in this study recognized the proven protective influence that breastfeeding plays[15] and the potentially harmful influence of mouth breathing[16] and deleterious oral habits such as non-nutritive sucking[17], as well as the myofunctional deviations with tongue[18] or lip interposition[19]. Supervising the development of occlusion, managing the occurrence of problems during the transition from mixed to permanent dentition, and the control of environmental factors that contribute to the establishment of malocclusion are important actions that enable obtaining an adequate occlusion with facial balance[13].

A positive finding of this exploratory study is related to the fact that most respondents did not identify an immediate need for referral of cases with mild crowding, whether during deciduous or mixed dentition, during the inter-transitional period. Discrepancies of this nature can preferably be intercepted later, at the end of the mixed dentition, at the time of exfoliation of deciduous second molars, as indicated in the American Academy of Pediatric Dentistry guideline[20]. According to the classic study[21], a spare space of 3.6 mm is estimated in the arch perimeter, when deciduous second molars are replaced by second premolars. Therefore, maintaining arch length in mild and moderate cases in a timely manner could potentially resolve temporary space shortages[22].

Worsening of the distocclusion/Class II occlusal condition over time has been generally documented[23]. In this sense, most respondents were in favor of referral for orthodontic/dentofacial orthopedic treatment in cases involving deciduous and early mixed dentition. These findings are consistent with results published in the literature, according to which professionals verified maximum malocclusion severity, requiring immediate treatment in a Class II case affecting an 8-year-old patient (coincident with the early mixed dentition period) [14]. However, as widely reported in the literature, there is no conclusive evidence of the maintenance of clinical results achieved by therapies implemented in the pre-spurt phase[24,25], which points to the preference of the therapeutic approach during the pubertal growth spurt. Although there is a point of disagreement between what most of the evidence points to and the opinion of the interviewees, the attitude of speech-language pathologists is appropriate when referring to a professional competent in diagnosing occlusion, that is, the dentist, to define the need to intervene and the best time to do so.

Bearing in mind the perceived need for referral in mesiocclusion/ Class III cases, most respondents agreed to refer them. This perception finds relevant support in the literature[26-29], according to which effective results are obtained when Class III therapy starts early. Thus, the importance of early diagnosis and recognition of the due severity of this type of malocclusion stand out. The view shared by most participants in this research coincides with that demonstrated in a previous study[14]. In that case, most professionals (general and pediatric dentists) detected an extremely severe malocclusion and the need for immediate treatment in a Class III case at 8 years of age.

Anterior open bite is strongly associated with environmental etiological factors such as non-nutritive sucking habits and tongue thrusting during deciduous dentition[30]. The prevalence of this type of malocclusion decreases among children in the mixed dentition phase[31], with a trend towards attenuation or complete remission with time[32]. Nevertheless, intercepting deleterious oral habits that would decrease the chances of inducing the appearance of irreversible malocclusions if removed early is essential[33]. In accordance with these considerations, most interviewees noted the need to refer cases of anterior open bite affecting both deciduous and mixed dentition. In a case presented in a similar study[14], characterized by the presence of anterior open bite in an 8-year-old patient (corresponding to the mixed dentition phase), most pediatric and general dentists evaluated extremely severe malocclusion that demanded immediate treatment according

to most opinions. The anterior open bite persists during the pubertal growth spurt and, therefore, it rarely self-corrects[32]. Thus, the importance of its early diagnosis and perception of severity is accomplished.

Similar to the cases of anterior open bite, the posterior crossbite led to perceptions of prompt referral of the cases presented here. It is already known that the posterior crossbite in the deciduous dentition rarely self-corrects[34]. Thus, early treatment is recommended to normalize the occlusion and create conditions for normal development[35]. Therefore, there is a fair concern of the interviewed professionals relative to the diagnosis and recognition of the need for treatment of this type of occlusal deviation.

The literature points to only modest improvements in deep overbite in cases treated early[36]. In relative terms, similar clinical results can be achieved with higher efficiency and stability if approached in the permanent dentition phase, that is, after the periods investigated here[37]. Considering the pattern of answers obtained in our survey, characterized by frequent perceptions of the need for immediate referral of early mixed dentition cases, we point out here another incompatibility with what the literature that deals with this topic indicates.

A similar trend was observed when most respondents indicated the need for referral for cases considered normal, both during the deciduous and mixed dentition. In this regard, frequent referrals of normal cases or even those that would require specialized attention only in later periods of development, as observed for Class II cases and deep overbite, can become potentially harmful for large-scale health systems, especially those who intend to contemplate high demands. Thus, obtaining higher precision in referrals is achieved by increasing the training of speech-language pathologists, which leads to the minimization of potential costs arising from the care of patients who fall into the group of people who present a normal picture in the evolution of the development of occlusion.

Although this study has provided valuable insights into the practices and perceptions of speech-language pathologists regarding malocclusions, some limitations should be considered when interpreting its results. For example, the sample partially comprised members of ABRAMO (Brazilian Association of Orofacial Myology), specialized in Orofacial Myology, which may have positively influenced part of the responses and perceptions regarding orthodontic issues. Additionally, the use of self-administered questionnaires may have introduced social desirability bias, where respondents may have provided socially acceptable answers, potentially masking real knowledge gaps[38-41]. For future studies, it is recommended to include a more diverse sample of speech-language pathologists. It would also be relevant for further researchers to explore how the professional training and experience of speech-language pathologists influence their referral decisions and their perception of malocclusions across different age groups.

CONCLUSION

In general, the interviewed speech-language pathologists demonstrated a good degree of knowledge about malocclusion and its preventive aspects. Additionally, there was a frequent perception of the need for early referral for Class III cases, anterior open bite, and posterior crossbite. These perceptions are crucial, considering the importance of early diagnosis and timely intervention in interceptive orthodontics, aiming not only to correct malocclusions but also to mitigate potential complications and promote proper development of occlusion and the craniofacial complex. Additionally, it is noteworthy that the respondents also indicated a perceived need for treatment in cases considered normal or not requiring immediate referral, such as deep-bite, both during the deciduous and mixed dentition. Future efforts in curriculum development should focus on improving training programs to refine these specific referral criteria.

REFERENCES

1. Silva TR da, Canto G de L. Dentistry-speech integration: The importance of interdisciplinary teams formation. Rev. CEFAC. 2014;16(2):598-603. https://doi.org/10.1590/1982-02162014222-12

2. Figueiredo RF, Santos BL, Ana Paula AP, Silva LM, Crepaldi MLS, Crepaldi AA. Interdisciplinary relationship between orthodontics and phonoaudiology. Rev FAIPE. 2018;8(1):85-100. https://doi.org/10.1590/S2176-94512012000300010

3. Vanz RV, Rigo L, Vanz AV, Estancia A, Nojima LI. Interrelation between orthodontics and phonoaudiology in the clinical decision-making of individuals with mouth breathing. Dental Press J Orthod. 2012;17(3):e1-e7. https://doi.org/10.1590/S2176-94512012000300010

4. Saccomanno S, Berretin-Felix G, Coceani Paskay L, Manenti RJ, Quinzi V. Myofunctional Therapy Part 4: Prevention and treatment of dentofacial and oronasal disorders. Eur J Paediatr Dent. 2021;22(4):332-34. https://doi.org/10.23804/ejpd.2021.22.04.12 PMID: 35034469.

5. McNamara Jr. JA. Orthodontic and orthopedic treatment in the mixed dentition. 3rd ed. Ann Arbor: Needham Press, 2001.

6. Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde, Departamento de Atenção Básica, Projeto SB Brasil 2010: Condições de saúde bucal da população brasileira 2009-2010: resultados principais; 2010, 52p.
7. Góis EG, Vale MP, Paiva SM, Abreu MH, Serra-Negra JM, Pordeus IA. Incidence of malocclusion between primary and mixed dentitions among Brazilian children. A 5-year longitudinal study. Angle Orthod. 2012;82(3):495-500. https://doi.org/10.2319/033011-230.1 PMID: 21981755; PMCID: PMC8865814.
8. Peres KG, Peres MA, Thomson WM, Broadbent J, Hallal PC, Menezes AB. Deciduous-dentition malocclusion predicts orthodontic treatment needs later: Findings from a population-based birth cohort study. Am J Orthod Dentofacial Orthop. 2015;147(4):492-8. https://doi.org/10.1016/j.ajodo.2014.12.019 PMID: 25836009.
9. Serigioli JLC, Gabriel NIAD. Ortodontia preventiva e interceptativa: diferenças entre os termos. Revisão de literatura. Journal of Multidisciplinary Dentistry. 2024;12(1):159-63. https://doi.org/10.46875/jmd.v12i1.975
10. Feres MF, Abreu LG, Insabralde NM, Almeida MR, Flores-Mir C. Effectiveness of the open bite treatment in growing children and adolescents. A systematic review. Eur J Orthod. 2016;38(3):237-50. https://doi.org/10.1093/ejo/cjv048 PMID: 26136439; PMCID: PMC4914905.
11. Oh H, Baumrind S, Korn EL, Dugoni S, Boero R, Aubert M et al. A retrospective study of Class II mixed-dentition treatment. Angle Orthod. 2017;87(1):56-67. https://doi.org/10.2319/012616-72.1 PMID: 27391205; PMCID: PMC8388598.
12. de Bondt B, Aartman IH, Zentner A. Referral patterns of Dutch general dental practitioners to orthodontic specialists. Eur J Orthod. 2010;32(5):548-54. https://doi.org/10.1093/ejo/cjp148 PMID: 20083808.
13. Silva DBHD, Gonzaga AS. Importance of orthodontic intervention of the Class III malocclusion in mixed dentition. Dental Press J Orthod. 2020;25(5):57-65. https://doi.org/10.1590/2177-6709.25.5.057-065.bbo PMID: 33206830; PMCID: PMC7668065.
14. Aldrees AM, Tashkandi NE, AlWanis AA, AlSanouni MS, Al-Hamlan NH. Orthodontic treatment and referral patterns: A survey of pediatric dentists, general practitioners, and orthodontists. Saudi Dent J. 2015;27(1):30-9. https://doi.org/10.1016/j.sdentj.2014.11.001 PMID: 25544812; PMCID: PMC4273289.
15. Geddes DT, Gridneva Z, Perrella SL, Mitoulas LR, Kent JC, Stinson LF et al. 25 years of research in human lactation: From discovery to translation. Nutrients. 2021;13(9):3071. https://doi.org/10.3390/nu13093071 PMID: 34578947; PMCID: PMC8465002.
16. Lin L, Zhao T, Qin D, Hua F, He H. The impact of mouth breathing on dentofacial development: A concise review. Front Public Health. 2022 Sep 8;10:929165. https://doi.org/10.3389/fpubh.2022.929165 PMID: 36159237; PMCID: PMC9498581.
17. Ling HTB, Sum FHKMH, Zhang L, Yeung CPW, Li KY, Wong HM et al. The association between nutritive, non-nutritive sucking habits and primary dental occlusion. BMC Oral Health. 2018;18(1):145. https://doi.org/10.1186/s12903-018-0610-7 PMID: 30134878; PMCID: PMC6106723.
18. Rapeepattana S, Thearmontree A, Suntornlohanakul S. Etiology of malocclusion and dominant orthodontic problems in mixed dentition: A cross-sectional study in a group of thai children aged 8-9 years. J Int Soc Prev Community Dent. 2019;9(4):383-9. https://doi.org/10.4103/jispcd.JISPCD_120_19 PMID: 31516872; PMCID: PMC6714419.
19. Lorente AA, Cortes O, Guzmán S, Vicente A, Garrido N. Oral malocclusion and its relation to nutritive and non-nutritive habits in school children. Open J Dent Oral Med. 2019;7(1):1-8. https://doi.org/10.13189/ojdom.2019.070101
20. Management of the developing dentition and occlusion in pediatric dentistry. Practice Guideline. Pediatr Dent. 2017;39(6):334-47. https://pubmed.ncbi.nlm.nih.gov/29179373/ PMID: 29179373.
21. Moorrees CF. Dental development. A growth study based on tooth eruption as a measure of physiologic age. Rep Congr Eur Orthod Soc. 1964;40:92-106. https://pubmed.ncbi.nlm.nih.gov/14318040/ PMID: 14318040.
22. Gianelly AA. Treatment of crowding in the mixed dentition. Am J Orthod Dentofacial Orthop. 2002;121(6):569-71. https://doi.org/10.1067/mod.2002.124172 PMID: 12080302.
23. Baccetti T, Franchi L, McNamara JA Jr, Tollaro I. Early dentofacial features of class II malocclusion: A longitudinal study from the deciduous through the mixed dentition. Am J Orthod Dentofacial Orthop. 1997;111(5):502-9. https://doi.org/10.1016/s0889-5406(97)70287-7 PMID: 9155809.
24. Sunnak R, Johal A, Fleming PS. Is orthodontics prior to 11 years of age evidence-based? A systematic review and meta-analysis. J Dent. 2015;43(5):477-86. https://doi.org/10.1016/j.jdent.2015.02.003 PMID: 25684602.
25. Maspero C, Galbiati G, Giannini L, Guenza G, Farronato M. Class II division 1 malocclusions: Comparisons between one- and two-step treatment. Eur J Paediatr Dent. 2018;19(4):295-9. https://doi.org/10.23804/ejpd.2018.19.04.8 PMID: 30567446.
26. Watkinson S, Harrison JE, Furness S, Worthington HV. Orthodontic treatment for prominent lower front teeth (Class III malocclusion) in children. Cochrane Database Syst Rev. 2013 Sep 30;(9):CD003451. https://doi.org/10.1002/14651858.CD003451.pub2 PMID: 24085611.
27. Cordasco G, Matarese G, Rustico L, Fastuca S, Caprioglio A, Lindauer SJ et al. Efficacy of orthopedic treatment with protraction facemask on skeletal class III malocclusion: A systematic review and meta-analysis. Orthod Craniofac Res. 2014;17(3):133-43 https://doi.org/10.1111/ocr.12040 PMID: 24725349.
28. Yang X, Li C, Bai D, Su N, Chen T, Xu Y et al. Treatment effectiveness of Fränkel function regulator on the class III malocclusion: A systematic review and meta-analysis. Am J Orthod Dentofacial Orthop. 2014;146(2):143-54. https://doi.org/10.1016/j.ajodo.2014.04.017 PMID: 25085296.
29. Wendl B, Muchitsch AP, Winsauer H, Walter A, Droschl H, Jakse N et al. Retrospective 25-year follow-up of treatment outcomes in angle Class III patients: Early versus late treatment. J Orofac Orthop. 2017;78(3):201-10. https://doi.org/10.1007/s00056-016-0076-7 PMID: 28220182; PMCID: PMC5429343.
30. Kasparaviciene K, Sidlauskas A, Zasciurinskiene E, Vasiliauskas A, Juodzbalys G, Sidlauskas M et al. The prevalence of malocclusion and oral habits among 5-7-year-old children. Med Sci Monit. 2014 Oct24;20:2036-42. https://doi.org/10.12659/MSM.890885 PMID: 25344319; PMCID: PMC4215577.
31. Urzal V, Braga AC, Ferreira AP. The prevalence of anterior open bite in Portuguese children during deciduous and mixed dentition-correlations for a prevention strategy. Int Orthod. 2013;11(1):93-103. https://doi.org/10.1016/j.ortho.2012.12.001 PMID: 23375918.

32. Phelan A, Franchi L, Baccetti T, Darendeliler MA, McNamara JA Jr. Longitudinal growth changes in subjects with open-bite tendency: A retrospective study. Am J Orthod Dentofacial Orthop. 2014;145(1):28-35. https://doi.org/10.1016/j.ajodo.2013.09.013 PMID: 24373652.

33. Moimaz SA, Garbin AJ, Lima AM, Lolli LF, Saliba O, Garbin CA. Longitudinal study of habits leading to malocclusion development in childhood. BMC Oral Health. 2014 Aug 4;14:96. https://doi.org/10.1186/1472-6831-14-96 PMID: 25091288; PMCID: PMC4126276.

34. Heimer MV, Tornisiello Katz CR, Rosenblatt A. Non-nutritive sucking habits, dental malocclusions, and facial morphology in Brazilian children: A longitudinal study. Eur J Orthod. 2008;30(6):580-5. https://doi.org/10.1093/ejo/cjn035 PMID: 18775881.

35. Thilander B, Lennartsson B. A study of children with unilateral posterior crossbite, treated and untreated, in the deciduous dentition-occlusal and skeletal characteristics of significance in predicting the long-term outcome. J Orofac Orthop. 2002;63(5):371-83. https://doi.org/10.1007/s00056-002-0210-6 Erratum in: J Orofac Orthop. 2002;63(6):516. PMID: 12297966.

36. Franchi L, Baccetti T, Giuntini V, Masucci C, Vangelisti A, Defraia E. Outcomes of two-phase orthodontic treatment of deepbite malocclusions. Angle Orthod. 2011;81(6):945-52. https://doi.org/10.2319/033011-229.1 PMID:21801005; PMCID: PMC8903849.

37. Tulloch JF, Proffit WR, Phillips C. Outcomes in a 2-phase randomized clinical trial of early class II treatment. Am J Orthod Dentofacial Orthop. 2004;125(6):657-67. https://doi.org/10.1016/j.ajodo.2004.02.008 PMID: 15179390.

38. Kaplan CP, Hilton JF, Park-Tanjasiri S, Perez-Stable EJ. The effect of data collection mode on smoking attitudes and behavior in young African American and Latina women. Face-to-face interview versus self-administered questionnaires. Eval Rev. 2001;25(4):454-73. https://doi.org/ 10.1177/0193841X0102500403 PMID: 11480308.

39. Vuillemin A, Oppert JM, Guillemin F, Essermeant L, Fontvieille AM, Galan P et al. Self-administered questionnaire compared with interview to assess past-year physical activ- ity. Med Sci Sports Exerc. 2000;32(6):1119-24. https://doi.org/10.1097/00005768-200006000-00013 PMID: 10862539.

40. O'Toole BI, Battistutta D, Long A, Crouch K. A comparison of costs and data quality of three health survey methods: Mail, telephone and personal home interview. Am J Epidemiol. 1986;124(2):317-28. https://doi.org/10.1093/oxfordjournals.aje.a114390 PMID: 3728446.

41. Cook DJ, Guyatt GH, Juniper E, Griffith L, McIlroy W, Willan A et al. Interviewer versus self-administered questionnaires in developing a disease-specific, health-related quality of life instrument for asthma. J Clin Epidemiol. 1993;46(6):529-34. https://doi.org/10.1016/0895-4356(93)90125-k PMID: 8501479.

Author's contribuitions:

YRPC: Data curation; Formal analysis; Investigation; Methodology.

VOP: Formal analysis; Investigation; Methodology; Writing - Original draft; Writing - Review & editing.

MF: Conceptualization; Data curation; Formal analysis; Investigation; Methodology.

JTLF, TEB: Formal Analysis; Investigation; Methodology.

SHVB: Conceptualization; Data curation; Formal analysis; Investigation.

MFNF: Conceptualization; Data curation; Formal analysis; Investigation; Methodology; Project administration.

Data sharing statement:

If necessary and upon proper request, the study data may be shared by the researchers according to the criteria and timeframe agreed upon with the requester.