

Interceptive orthodontic practices in general dentistry: a cross-sectional study

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Objectives: To evaluate the current practice of interceptive orthodontics undertaken by general dental practitioners and identify influencing factors.

Materials and methods: Printed questionnaires were provided to 200 registered Australian general dental practitioners.

Participants were questioned about their current confidence, attitudes, and practice, related to interceptive orthodontics in general dentistry.

Results: The decision to practise interceptive orthodontics (17.4% of respondents) was strongly dependent on the confidence of the dentist ($\chi^2 = 48.693$; $df = 4$; $p < 0.001$). It was also found that the provision of interceptive orthodontics was prevented by its perceived importance ($\chi^2 = 23.559$; $df = 5$; $p < 0.001$) and benefit in a general dental setting ($\chi^2 = 9.411$; $df = 4$; $p = 0.035$). The provision of more education was not shown to likely increase the number of dentists performing interceptive orthodontics. Low clinician confidence in the provision of interceptive orthodontics was also shown to result in orthodontic consultation prior to performing treatment ($\chi^2 = 31.782$; $df = 16$; $p = 0.004$) or referral to an orthodontist ($\chi^2 = 42.465$; $df = 12$; $p < 0.001$).

Conclusions: Interceptive orthodontics was not practised by most dentists. This decision was shown to be influenced by the clinicians' confidence, further education or training, perceived importance of interceptive orthodontics and the impact that early intervention might have on future orthodontic treatment. Consideration should also be given to clarifying the orthodontic scope of practice for general dentists, in order to reduce the confusion influencing the provision of orthodontic care.

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Introduction

The general dental practitioner (GDP) is widely acknowledged to play an important role in the identification and diagnosis of malocclusions. Interceptive orthodontics (IO) is the clinical approach to eliminating or minimising a developing malocclusion and is usually performed during the mixed dentition.¹ Aberrant dental positions and misaligned skeletal relationships have been shown to have a negative impact on patients, resulting in impaired function, a decrease in self-esteem, and increases in the rates of dental decay.² It is believed that IO treatment can offer benefit to children during the mixed dentition. As many as 30–38% of children³⁻⁵ may be seen to benefit by reducing

the need or complexity of further orthodontic treatment, potentially reducing later treatment duration and associated costs.^{3,6}

Although not producing the same finish quality that a second phase orthodontic treatment may yield, studies have identified a significant reduction in treatment need following the implementation of IO.⁶⁻⁸ This involves a shift from a patient's perceived need of treatment for a malocclusion from "medically necessary" to "elective", following IO during the mixed dentition.⁹ The success of IO is shown to be influenced by the timing of the identification and treatment;^{10,11} however, it has been further shown that many GDPs do not have confidence in providing IO

treatment.^{1,12,13} The limitation of IO in a general dental setting may then be shown to have a deleterious effect on the young patient by not correcting a developing malocclusion. The present study therefore aimed to investigate the current practice of IO by GDPs and identify barriers limiting its practice.

Materials and methods

The present study was implemented according to the STROBE guidelines for the presentation of cross-sectional studies.¹⁴ Approval was obtained from the Human Research Ethics Committee of James Cook University (H7416). The study was conducted in Australia, involving participating general dentists attending the Australian Dental Association (ADA) New South Wales convention in September 2018. Applied inclusion criterion were general dentists currently registered with the Australian Health Practitioner Agency (AHPRA). Exclusion criteria included those with general dental registration with AHPRA and an additional dental specialist qualification.

A review of the relevant literature was conducted as the basis for the questionnaire. Following design, the surveys were validated by a panel of four Australian senior academic orthodontists. Reliability was determined using Cohen's kappa to determine the test-retest reliability of the questionnaire. This was performed using 10 registered dentists, one week apart. Following attainment of validity and reliability, the survey was pilot tested by five general dentists.

Statistical methods

A required sample size of 149 was calculated based on 17,240 registered dentists in Australia, a 95% confidence interval, and an 8% margin of error. Descriptive statistics were used for analysis. The prevalence and the univariate associations between

a categorical outcome and the variables under consideration were evaluated using Pearson's Chi-squared test or, if small numbers were included, Fisher's exact test was performed. The odds ratio between the practice of IO and continuing education was also assessed. A cut-off of $p \leq 0.05$ was considered to be statistically significant, with a 95% confidence interval (CI). SPSS IBM Statistics version 25 for Windows package (IL, USA) was used to analyse the data.

Results

The kappa value for the test-retest of the questionnaire to determine reliability was analysed at 0.781, indicating good agreement. Of the 200 surveys distributed to dentists inviting participation, 149 surveys were completed, resulting in a response rate of 74.5%. A survey was considered complete if >95% of the questions were answered with valid responses. Table I indicates that most GDPs do not currently practice IO (82.6%), with only one in three having undertaken additional training or professional development in orthodontics (32.9%).

GDPs' confidence in the diagnosis and provision of treatment is shown in Table II. Nearly half of all respondents stated that they had no confidence in providing IO (45.6%). When predicting growth patterns in developing patients, and when assessing the orthodontic implications prior to extracting deciduous and permanent teeth, few GDPs were confident (18.8%, 40.9% and 39.6% respectively). Generally, GDPs were more confident in the identification of aberrant eruption patterns (53.0%).

With respect to the use of oral appliances, less than half of the GDPs were confident in the use of space maintainers following the extraction of deciduous teeth (42.3%). In providing appliances to correct antero-posterior and transverse discrepancies, most clinicians were not confident (72.4% and 67.8%,

Table I. General dentists' current practice of interceptive orthodontics versus training in interceptive orthodontics *†.

	Dentists having received additional training/professional development in orthodontics		
	Yes	No	Total
Dentists currently practicing interceptive orthodontics	Yes	21	26
	No	28	123
	Total	49	149

* $\chi^2 = 32.719$; $df = 1$; $p < 0.001$; † Odds ratio 14.2

respectively). Despite this, GDPs were balanced in their confidence regarding the identification and treatment of parafunctional habits (not confident, 36.9%; and confident, 37.6%). Table II also indicates that less than half of the responding GDPs were confident in providing any aspect of IO, other than the identification of aberrant eruption patterns.

In an assessment of GDPs' attitudes towards IO (Table III), only 15.4% of GDPs felt that the current orthodontic scope of practice for dentists was clearly outlined. Further, 65.1% of clinicians stated

that the clarity of scope influenced their IO provision. This may be explained by 76.5% of dentists reporting that, to some degree, medico-legal implications influence their willingness to provide IO treatment (Table IV). Interestingly, most GDPs considered that it was important to perform IO in general dental practice (44.9%) despite believing that intervention may only sometimes reduce the need for further orthodontic treatment (58.4%). It was also determined that most GDPs would be more willing to perform IO following further training or professional development (57.7%).

Table II. General dentists' confidence in interceptive orthodontic practice.

	Confidence										Total
	None		Slightly		Average		Fairly		Completely		
	N	%	N	%	N	%	N	%	N	%	
The provision of interceptive orthodontics	68	45.6	35	23.5	24	16.1	18	12.1	4	2.7	149
Predicting growth patterns in developing patients	26	17.4	45	30.2	49	32.9	24	16.1	4	2.7	148
Identifying aberrant eruption patterns	7	4.7	13	8.7	50	33.6	62	41.6	17	11.4	149
Assessing the orthodontic implications prior to extracting deciduous teeth	8	5.4	23	15.4	56	37.6	45	30.2	16	10.7	148
Assessing the orthodontic implications prior to extracting permanent teeth	18	12.1	32	21.5	40	26.8	41	27.5	18	12.1	149
In the use of space maintainers following extraction of deciduous teeth	31	20.8	30	20.1	24	16.1	36	24.2	27	18.1	148
In the use of functional appliances to treat differential antero-posterior jaw growth	82	55.0	26	17.4	24	16.1	12	8.1	5	3.4	149
At designing and using appliances to correct transverse discrepancies	70	47.0	31	20.8	23	15.4	17	11.4	6	5.4	149
At identifying and treating parafunctional habits	26	11.4	29	29.5	38	25.5	41	27.5	15	10.1	149

Table III. General dentists' attitude towards interceptive orthodontics.

	Attitude										Total
	None		Slightly		Average		Fairly		Completely		
	N	%	N	%	N	%	N	%	N	%	
How clearly the current scope of practice outlines orthodontic treatment for dentists	26	17.4	41	27.5	56	37.6	16	10.7	7	4.7	146
Influence of scope of practice on provision of interceptive orthodontics	52	34.9	19	12.8	26	17.4	33	22.1	19	12.8	149
Importance of interceptive orthodontics in general practice	13	8.7	26	17.4	42	28.2	47	31.5	20	13.4	148
Willingness to provide interceptive orthodontic treatment with further training/education	23	15.4	14	9.4	26	17.4	52	34.9	34	22.8	149

Finally, when evaluating the frequency of GDPs seeking orthodontist consultation prior to performing IO treatment themselves, or referring to an orthodontist to perform the IO treatment, it was evident that orthodontists were heavily involved in the provision of treatment (79.2% and 93.9%, respectfully).

The resulting odds ratio indicates that dentists are 14.25 times more likely to practice IO (Table I) if they had received additional education or training in orthodontics ($\chi^2 = 32.719$; $df = 1$; $p < 0.001$). The analysis of additional factors affecting the IO practice of GDPs is shown in Table V. In addition, IO practice was positively influenced by the confidence of clinicians ($\chi^2 = 48.693$; $df = 4$; $p < 0.001$), the perceived importance of IO in general practice ($\chi^2 = 23.559$; $df = 5$; $p < 0.001$), and perceived benefits of IO ($\chi^2 = 9.411$; $df = 4$; $p = 0.035$). The confidence of clinicians in the delivery of IO was also shown to result

in orthodontic consultation prior to undertaking treatment ($\chi^2 = 31.782$; $df = 16$; $p = 0.004$) or referral to an orthodontist to perform IO treatment ($\chi^2 = 42.465$; $df = 12$; $p < 0.001$).

Discussion

The present study examined general dentists' confidence and attitudes towards IO, and their likelihood of providing IO treatment for their patients. In addition, the understanding of the factors affecting the implementation of IO in primary dental care remains limited in academic texts.¹ The results of the present study show that only one-in-six dentists practice IO, despite nearly one-in-three receiving further orthodontic training after graduating from dental school. This is notable as one-in-two dentists believe that it is important to practice IO as part of

Table IV. General dentists' attitude and practice in interceptive orthodontics.

	Attitude								Total
	Never		Sometimes		Often		Always		
	N	%	N	%	N	%	N	%	
Interceptive orthodontic practice influenced by medico-legal implications	35	23.5	38	25.5	21	14.1	54	36.2	148
Interceptive orthodontics ability to reduce the need for further orthodontic treatment	4	2.7	87	58.4	36	24.2	21	14.1	148
Consultation with an orthodontist prior to performing interceptive orthodontics	30	20.1	29	19.5	28	18.8	61	40.9	148
Referral to an orthodontist to perform interceptive orthodontics	8	5.4	19	12.8	40	26.8	82	55.0	149

Table V. Statistical analysis of factors affecting interceptive orthodontic practice.

	χ^2	df	p-value
Decision to practice interceptive orthodontics			
Perceived importance of Interceptive orthodontics in general practice	23.559	5	<0.001
Perceived ability of interceptive orthodontics in the reduction of future orthodontic treatment	9.411	4	0.035
Medico-legal implications of practice	7.286	4	0.111
Effect of more education	4.669	4	0.318
Effect of confidence			
Decision to practice Interceptive orthodontics	48.693	4	<0.001
Scope of practice	9.105	4	0.068
Orthodontist consultation prior to treatment	31.782	16	0.004
Orthodontic referral for treatment	42.465	12	<0.001

general dental practice, and so questions arise as to why there is a disconnect between these groups. In an attempt to explain the reluctance of GDPs, it was shown that the perceived importance and treatment benefit were strongly associated with the current practice of IO. The contemporary practice of GDPs is the avoidance of IO due to perceived questionable importance or benefits, contrasting to the limited literature showing that the inclusion of IO in general practice may reduce the severity of a malocclusion.⁶⁻⁸

GDPs' confidence in providing IO was reported to be low. No more than half of the responding dentists indicated confidence in its provision. Interestingly, the apparent lack of confidence included topics that likely received considerable coverage in dental school, such as the orthodontic implications of permanent tooth extractions.¹⁵ The confidence of GDPs in performing IO has been investigated previously,¹² and the present findings are in accordance with results showing that a lack of confidence was strongly associated with a reluctance to practise IO. Furthermore, the results of the present study suggest that practicing GDPs may not be staying abreast of topics covered as part of their foundational education, and so revisiting theoretical and practical understanding of IO following graduation may offer some benefit. Although it was shown that more than half of the GDPs surveyed would be more likely to perform IO if more training and education was provided, this was not statistically significant when compared with those practitioners currently providing IO.

The present orthodontic scope of practice for general dentists varies between countries. IO practice, and in some cases corrective orthodontics, is considered within the scope of GDPs¹⁶ but the present findings report that approximately 85% of dentists do not believe the current scope is clear in its guidelines. This is of concern as more than three-in-five dentists reported their practice is influenced by their understanding of the scope of practice. Though this finding was not shown to be statistically significant, clinical significance in this matter is considered important. As most respondents were unclear regarding the current scope of practice of GDPs in orthodontics, the outcome of practicing beyond a defined scope may easily lead to medico-legal misadventure. Further statistical analysis of the relationship showed that neither the current scope of practice, nor the risk of medico-legal implications of treatment, led to a

significant difference in general dentists' willingness to provide IO.

In consideration of the relationship between the GDP and the specialist orthodontist, the low confidence in providing IO was shown with significance to result in dentists seeking consultation for their patients with, or treatment by, a specialist. As expected, an inverse relationship was observed between GDP confidence and a referral to an orthodontist. Particularly for patients with limited access to specialist orthodontic care, through social, economic or geographic limitations, the lack of fundamental interceptive practices by GDPs may result in a further burden for these children.^{5,17} To reduce this likelihood, modalities such as teledentistry may present a viable approach for GDPs, in the provision of IO care. Remote supervision of general dentists by orthodontists has been shown to reduce the severity of a malocclusion in disadvantaged children where it is not feasible to refer to an orthodontist.

The limitation of the present study includes participants not being provided with a clear definition or list of treatments associated with IO. Although the definition of IO is well established in the literature and in undergraduate dental education, there may be a difference in the interpretation of the topic and included treatment modalities. Additionally, although the chosen recruitment method may lead to a potential for selection bias, a representative sample of dentists was acquired, mitigating the risk.

Conclusions

- IO is not performed by most GDPs. This decision is shown to be influenced by the confidence of clinicians, further education or training, the perceived importance of IO, and the possible impact on future orthodontic care.
- Clarification of the scope of practice for GDPs in providing orthodontics should be considered. Clarification may be seen to reduce confusion that may be limiting general dental IO treatment.
- It is recommended that future research be undertaken to examine methods of improving GDP confidence in the practice of IO.

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