

Original Article

A Web-Based Survey in Croatia on Knowledge and Attitude of Non-Orthodontic Specialists toward Orthodontic Treatment

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ABSTRACT

This study aimed to evaluate the knowledge and attitudes of non-orthodontic dental specialists regarding orthodontic treatment. A web-based survey consisting of 20 multiple-choice questions with three or more options was distributed to randomly select non-orthodontic dental specialists in Croatia via email, accompanied by explanatory letters. A total of 250 questionnaires were sent. The collected data were analyzed using IBM SPSS 23.0, with statistical significance set at $p < 0.01$. Findings revealed that most participants demonstrated substantial understanding of orthodontic principles and practices. All respondents (100%) recognized that malocclusions can influence facial aesthetics and masticatory function. Statistically significant differences were observed among various non-orthodontic specialists regarding knowledge of contraindications for orthodontic therapy ($p < 0.01$). Private practitioners showed higher awareness about the optimal timing for the first orthodontic consultation (74.2%) and correctly identified that implants and periodontal issues are not contraindications for orthodontic treatment (over 70%) compared to public practitioners. The surveyed non-orthodontic specialists exhibited a commendable level of awareness and knowledge concerning orthodontic treatment principles. Enhancing practitioners' knowledge further may support patients in seeking orthodontic care earlier, potentially preventing future complications associated with malocclusion.

Keywords: Specialists, Attitude, Orthodontic treatment, Knowledge

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Introduction

Malocclusion can result from multiple factors, often leading to outcomes such as unattractive facial appearance, diminished self-esteem, higher susceptibility to dental caries, temporomandibular disorders (TMD), and difficulties in chewing and speaking [1–3]. Therefore, educating patients through a multidisciplinary approach is essential to ensure they understand the importance of orthodontic intervention. While several factors influence a patient's decision to pursue orthodontic treatment, aesthetic concerns remain the most common motivating factor [4]. Early and appropriate referral relies heavily on the ability of general dentists and non-orthodontic specialists to

identify malocclusions. Evidence suggests that, although patients may independently seek treatment, referrals from general dentists, pediatric dentists, or orthodontists play a critical role in initiating therapy [5], highlighting the significant influence of dental professionals on patients' choices [6, 7]. It is noteworthy that many specialists tend to address only the primary complaint that prompted the visit, whereas referrals to orthodontists are primarily expected from general dentists or pediatric dentists.

The increasing number of adult patients seeking orthodontic care has intensified demands on time, documentation, inter professional communication, treatment planning discussions, and informed consent procedures [8–10]. As such, collaboration across

multiple dental specialties has become essential for effectively informing patients about orthodontic treatment benefits. Non-orthodontic specialists can act as valuable educators in this context, but only if they possess sufficient knowledge and a positive attitude toward the principles and practice of orthodontics. Moreover, coordinated interdisciplinary care can enhance treatment outcomes and ensure long-lasting results.

This study aimed to investigate the knowledge and attitudes of non-orthodontic dental specialists regarding orthodontic treatment. Differences in education and field of specialization may influence perceptions of treatment necessity. Although orthodontists are considered the benchmark for assessing treatment requirements, understanding the perspectives of other dental professionals is crucial, as they can significantly affect both access to and success of orthodontic care. To our knowledge, no comparable research has been conducted in Croatia or Central Europe.

Materials and Methods

The study protocol received approval from the Ethical Committee of Zagreb University, School of Dental Medicine, and Zagreb, Croatia (05-PA-30-XXVII-5/2021).

Study design

A structured web-based questionnaire was designed to evaluate the responses of non-orthodontic dental specialists regarding orthodontic treatment. The survey comprised two sections: (1) demographic and professional details, including gender, age, academic title, employment type, and specialization; and (2) attitudes and awareness concerning orthodontic principles and clinical practice. The survey included 20 multiple-choice questions, each offering at least three answer options.

A pilot test was conducted with five dental specialists, who provided feedback on ambiguous or confusing questions. Based on their recommendations, one modification was incorporated into the final questionnaire.

Subsequently, 250 surveys were emailed to randomly select Croatian dental specialists, with the number of invitations per specialty reflecting their proportional representation in the country. Each email included an explanatory letter describing the study's purpose and emphasizing voluntary participation. Responses were anonymous, and no personal identifiers were collected. Completion of the survey was estimated to take approximately seven minutes. To enhance

participation, a reminder email was sent four weeks after the initial invitation, with the survey remaining open for eight weeks. Incomplete responses were excluded from analysis, and data access was restricted to the study authors.

Sample size

The study determined a sample size of 152 dentists, calculated using the following formula:

$$Ss = \frac{[z^2 \times p(1-p)/e^2]}{1 + (\frac{z^2 \times p(1-p)}{e^2 N})} \quad (1)$$

For calculating the required sample, the following parameters were used: a Z-score of 1.96, an expected proportion of knowledgeable specialists (p) of 0.5, a margin of error (e) of 5%, and a total population (N) of 250. The population was defined based on the number of specialists registered with the Croatian Dental Chamber through relevant professional societies, as membership in the Chamber is mandatory for practicing dentists in Croatia. Applying these values, the minimum number of participants needed for the study was 152. The selected sample was further categorized according to the specialists' fields and their type of employment.

Statistical analysis

Statistical evaluation was carried out using IBM SPSS 23.0 (Armonk, NY, USA). Descriptive results were summarized in frequency tables. Group comparisons employed the Chi-square test of independence for both 3×7 and 2×3 contingency tables, with the Fisher exact test applied when assumptions for the Chi-square test were not met. A significance level of $p < 0.01$ was adopted, with a 95 percent confidence interval for interpretation of results.

Results and Discussion

Of the 250 surveys distributed, 158 were completed, corresponding to a 63% response rate. Female participants represented the majority, accounting for 61.4 percent of respondents. The age profile showed that most respondents were between 35 and 49 years old (57.6 percent), followed by the 50–65 age group, while the fewest participants were aged 27–34 years. Respondents were classified into seven specialty categories: prosthodontists, oral surgeons, endodontists, periodontists, family dentists, pedodontists, and oral medicine practitioners. Employment type revealed that a majority (57.6%) worked in public dental health, 41.8% were in private

practice, and one respondent was not actively practicing dentistry (Table 1).

Table 1. Characteristics of the non-orthodontic specialists

Characteristic	n (Number)	% (Percent)
Gender		
Female	97	61.4
Male	61	38.6
Age (years)		
27–34	30	19.0
35–49	91	57.6
50–65	37	23.4
Specialization		
Oral surgeon	32	20.3
Prosthodontist	32	20.3
Endodontist	26	16.5
Periodontist	20	12.7
Family dentist	20	12.7
Pedodontist	15	9.5
Oral medicine	13	8.2
Type of Practice		
Private dental practice	91	57.6
Public dental practice	66	41.8
Not currently practicing	1	0.6

Table 2 presents the survey findings regarding the attitudes and knowledge of non-orthodontic specialists about orthodontic principles and practices. Overall, the results demonstrate that most participants possessed a good understanding of orthodontic concepts. Notably, all respondents (100%) recognized that malocclusions can influence both facial aesthetics and masticatory function.

Table 2. Survey Results on Attitudes and Awareness of Orthodontic Principles and Practices

Question	n	%
Optimal Age for First Orthodontic Visit		
7 years old	92	58.2
After first permanent premolar eruption	48	30.4
After second permanent molar eruption	18	11.4
Best Age to Begin Orthodontic Treatment		
6–8 years	9	5.7
13–16 years	31	19.6

Varies based on dental irregularities	118	74.7
Upper Age Limit for Orthodontic Treatment		
40 years	5	3.2
50 years	4	2.5
No limit	149	94.3
Referral of Patients with Diastema in Primary Dentition to Orthodontist		
Yes	8	5.1
No	142	69.9
Unsure	8	5.1
Management of Patients with Harmful Oral Habits (e.g., thumb sucking, tongue thrusting, mouth breathing)		
Refer directly to an orthodontist	46	29.1
Cease habits before referral to an orthodontist	112	70.9
Wait for permanent dentition before treatment	0	0
Malocclusion Impacts Facial Aesthetics		
Yes	158	100
No	0	0
Unsure	0	0
Malocclusion Impacts Chewing Function		
Yes	158	100
No	0	0
Unsure	0	0
Orthodontic Treatment Contraindicated in Patients with Implants		
Yes	16	10.1
No	96	60.6
Unsure	46	29.1
Orthodontic Treatment Contraindicated in Periodontal Patients		
Yes	60	38.0
No	80	50.6
Unsure	18	11.4
Malocclusion Hinders Oral Hygiene		
Yes	115	72.8
No	36	22.8
Unsure	7	4.4
Untreated Cavities Can Cause Malocclusion		
Yes	133	84.2

No	18	11.4
Unsure	7	4.4
Orthodontic Treatment Always Requires Tooth Extraction		
Yes	1	0.6
No	157	99.4
Unsure	0	0
Retention Required After Orthodontic Treatment		
Yes	148	93.7
No	9	5.7
Unsure	1	0.6
Fixed Retainer Removal		
After 2 years	23	14.6
After 5 years	16	10.1
Not required	119	75.3

Orthodontic Treatment Outcomes Affect Patient Self-Esteem		
Yes	157	99.4
No	1	0.6
Unsure	0	0
Starting Orthodontic Treatment During a Pandemic Increases COVID-19 Risk		
Yes	5	3.2
No	140	86.6
Unsure	13	8.2

The findings revealed significant differences in responses regarding contraindications for orthodontic therapy among various non-orthodontic specialists (questions 12 and 13, $p < 0.01$) (**Table 3**), with a considerable number of dentists (50.6%) generally refraining from providing orthodontic treatment to patients with periodontal conditions.

Table 3. Comparison of answers of different non-orthodontic specialties.

	Question 12 (Orthodontic Therapy is Contraindicated in Patients with Implants)						Question 13 (Orthodontic Therapy is Contraindicated in Periodontal Patients)					
	Yes		No		I Don't Know		Yes		No		I Don't Know	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Oral surgeon	0	0	31	96.8	1	3.2	10	31.2	18	56.2	4	12.6
Prosthodontist	3	9.4	20	62.5	9	28.1	17	53.1	12	37.5	3	9.4
Endodontist	3	11.5	5	19.3	18	69.2	12	46.1	10	38.5	4	15.4
Periodontist	1	5	16	80	3	15	0	0	19	95	1	5
Family dentist	6	30	8	40	6	30	11	55	9	45	0	0
Pedodontist	2	13.4	8	53.3	5	33.3	6	40	7	46.7	2	13.3
Oral medicine	1	7.8	8	61.5	4	30.7	4	30.8	5	38.5	4	30.7

* Difference was statistically significant.

The responses were ultimately compared between public and private health practitioners, revealing significant differences in certain items (**Table 4**) ($p < 0.01$). Private practitioners showed greater awareness of the recommended timing for a patient's initial orthodontic consultation (74.2%) and recognized that the presence of implants or periodontal issues does not

prevent orthodontic treatment (over 70 percent), suggesting stronger knowledge of interdisciplinary care. In contrast, a larger proportion of public health specialists (37.4%) emphasized the need for immediate referral to an orthodontist for patients with detrimental oral habits such as thumb sucking, tongue thrusting, or mouth breathing.

Table 4. Comparison of Responses from Public Health and Private Health Practitioners

Question/Response	Public Health Practitioners	Private Health Practitioners	p-Value	X ²
Optimal Timing for Initial Orthodontic Visit	<i>n</i> (%)	<i>n</i> (%)	$p = 0.003^*$	11.64
At age 7 years	43 (47.2%)	49 (74.2%)		

After eruption of first permanent premolar	34 (37.4%)	13 (19.7%)
After eruption of second permanent molar	14 (15.4%)	4 (6.1%)
Management of Patients with Poor Oral Habits (e.g., thumb sucking, tongue thrusting, mouth breathing)		p = 0.009* 9.79
Refer to orthodontist immediately	34 (37.4%)	12 (18.1%)
Cease habits before orthodontic referral	57 (62.6%)	54 (81.9%)
Delay until permanent dentition	0 (0%)	0 (0%)
Orthodontic Treatment Contraindicated in Patients with Implants		p < 0.001* 28.23
Yes	11 (12.1%)	5 (7.6%)
No	39 (42.8%)	56 (84.8%)
Unsure	41 (45.1%)	5 (7.6%)
Orthodontic Treatment Contraindicated in Patients with Periodontal Issues		p < 0.001* 26.62
Yes	38 (41.7%)	15 (22.8%)
No	39 (42.8%)	47 (71.2%)
Unsure	14 (15.5%)	4 (6.0%)

* Difference was statistically significant.

Malocclusion ranks as the third most prevalent dental condition, following dental caries and periodontal diseases [11]. Its adverse effects—spanning physical, social, and psychological domains—render it a significant global public health concern [12]. Timely and appropriate intervention is therefore essential, as it prevents the development of severe complications, supports proper orofacial growth, and mitigates the negative consequences associated with malocclusions. Early treatment also often reduces overall costs, since neglected cases frequently necessitate complex and costly procedures. Consequently, modern dentistry emphasizes interdisciplinary collaboration to ensure optimal outcomes. Research indicates that a patient's oral health knowledge, attitude toward seeking specialist care, and initiation of timely treatment are closely connected to the competence and positive disposition of dental practitioners [13]. This study aimed to assess specialists' awareness and understanding of orthodontic therapy, highlighting knowledge and attitude as key determinants for potential collaboration with orthodontists. As expected, the majority of respondents were female, reflecting the gender distribution within the profession [14], while the youngest age group (<35 years) was least represented, likely because many young dentists are either awaiting or completing their specialization. Effective orthodontic therapy relies on knowing the appropriate timing for the first examination, the ideal age to start treatment, and the age limits for initiating therapy. Literature suggests that the optimal age for the first assessment is seven years [15], which aligned with

the responses of most participants. Pedodontists demonstrated the highest accuracy, whereas only about half of oral surgeons, periodontists, and prosthodontists answered correctly. Encouragingly, nearly all respondents recognized that age does not pose a strict barrier to orthodontic intervention.

Children frequently exhibit harmful oral habits such as thumb sucking, lip or nail biting, and mouth breathing, all of which contribute to malocclusion development [16]. Eliminating these habits promptly is crucial to establish a functional environment conducive to normal growth [17]. Notably, this study found that most specialists believed such habits should be addressed prior to an orthodontic evaluation, with private practitioners endorsing this view more often than public practitioners. Tanaka *et al.* demonstrated that ineffective management of these habits can prolong their persistence, exacerbate malocclusions, and delay treatment initiation [18]. Orthodontists are specifically trained to manage and eliminate detrimental oral habits, underscoring the need for further education among specialists, particularly pedodontists and family dentists.

The number of adult patients seeking orthodontic care has risen markedly in recent decades, including those with periodontal conditions or dental implants. Evidence indicates that orthodontic treatment in periodontal patients can aid in managing underlying periodontitis: proper tooth alignment enhances dental stability, stimulates new bone formation, strengthens teeth, and improves oral hygiene [19, 20]. This approach offers multiple advantages, including

alveolar bone preservation or recovery, correction and stabilization of dental positions, use of splints to maintain outcomes, and improved facial aesthetics. Orthodontic intervention is also beneficial for patients with implants to optimize aesthetics [21]. However, the present survey revealed that most specialists lacked adequate knowledge in this area, except for oral surgeons and periodontists familiar with implants and periodontal therapy. Consequently, many practitioners might not refer patients with malocclusions who also present periodontal issues or require orthodontic management alongside implants. Comparative analysis showed that private practitioners were more aware than public practitioners that dental implants and periodontal conditions do not constitute contraindications for orthodontic treatment.

In this study, over 95% of participants recognized that malocclusions negatively impact facial aesthetics, mastication, and self-esteem. These results align with previous research, which reported that dentists are aware that the primary benefits of orthodontic treatment are psychosocial, and they also acknowledge its role in reducing susceptibility to dental diseases [22, 23]. Multiple studies have demonstrated that dentists' attitudes significantly influence patients' decisions to pursue orthodontic treatment [6, 7, 24–26], highlighting the importance of specialists' understanding of the health benefits associated with orthodontic care. No significant differences in responses were observed based on specialty or type of employment.

Following orthodontic treatment, the British Orthodontic Society (BOS) recommends mandatory retention. Fixed retainers have become increasingly common, prompting research on their advantages and drawbacks. The main concern with long-term use of fixed retainers is their potential impact on oral hygiene and periodontal health. The current survey showed that respondents generally held a positive view of fixed retainers, with most indicating that removal is unnecessary. Interestingly, endodontists and oral surgeons more frequently suggested removal after 2 to 5 years, while periodontists—despite evidence of increased plaque and calculus accumulation—were expected to favor time-limited retention.

Given the ongoing pandemic, the study also assessed specialists' perceptions of infection risk when initiating orthodontic treatment. Although new research continues to emerge, the consensus is that dentists face a higher risk of COVID-19 exposure, while patients are not at increased risk in dental offices [26, 27]. In the present survey, 96% of respondents agreed that beginning orthodontic treatment during the pandemic

does not elevate COVID-19 infection risk. These findings are consistent with a multinational study by Kamate *et al.*, which reported that dental practitioners demonstrated high knowledge and practice scores regarding infection control [28]. It remains essential for dentists to implement infection prevention measures, adhere to CDC and WHO guidelines, and continue providing patient care.

Conclusion

Within the study's limitations, it can be concluded that most respondents demonstrated awareness of orthodontic treatment principles and practices. Non-orthodontic specialists in the private sector exhibited better knowledge regarding the timing of referrals and indications for orthodontic therapy compared to those working in public health.

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