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Do orthodontists recommend Class II treatment according to evidence-based knowledge?

Os ortodontistas recomendam o tratamento das más oclusões de Classe II de acordo com os conceitos científicos atuais?

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Resumo

Introdução: A indicação correta da época de tratamento de uma má oclusão de Classe II é essencial para o exercício ético e eficiente da Ortodontia, mas os clínicos são resistentes em aceitar novos conceitos que contradizem seus métodos preferidos de tratamento. **Objetivo:** Avaliar a concordância na indicação de tratamento interceptor das más oclusões de Classe II entre um grupo de formadores de opinião em nível internacional e um grupo de ortodontistas clínicos, e comparar a indicação de tratamento com os conceitos científicos contemporâneos. **Material e método:** Um questionário eletrônico composto por fotografias representativas de diversos graus de gravidade no acometimento da má oclusão de Classe II em crianças foi enviado a dois painéis de especialistas. Painel 1 (n=28) foi composto por ortodontistas internacionais autores de artigos científicos em revistas de elevado impacto, e o Painel 2 (n=261) foi composto por ortodontistas clínicos. Baseando-se em uma escala de Likert de 5 pontos, os ortodontistas indicaram suas opções de tratamento para cada um dos 9 casos apresentados. **Resultado**: As indicações de tratamento do Painel 2 foram estatisticamente diferentes daquelas ofertadas pelo Painel 1, com pelo menos 1 ponto de divergência no sentido de tratamento mais precoce. A indicação de tratamento ortodôntico interceptor do Painel 1 está de acordo com os conceitos científicos atuais. **Conclusão:** Tratamento muito precoce parece ser a tendência de conduta entre os ortodontistas clínicos, mas não entre os ortodontistas que estão academicamente envolvidos com a interceptação ortodôntica. Existe uma lacuna entre o conhecimento científico e a prática da Ortodontia.

Descritores: Má oclusão de Angle Classe II; terapêutica; questionários.

Abstract

Introduction: The adequate indications for the timing of treatment for Class II malocclusion are mandatory for the ethical and efficient practice of orthodontics, but clinicians are reluctant to accept new information that contradicts their preferred method of treatment. **Objective:** The aim of this investigation was to assess the agreement regarding the indications for Class II malocclusion interceptive therapy between a group of international opinion-makers on early treatment and a group of orthodontists and to compare their treatment indications with the current evidence-based knowledge. **Material and method:** An electronic survey containing photographs of mild, moderate and severe Class II malocclusions in children was sent to two panels of experts. Panel 1 (n=28) was composed of international orthodontists who had authored world-class publications on early orthodontic treatment, and Panel 2 (n=261) was composed of clinical orthodontists. Based on a 5-point Likert-type scale, the orthodontists selected their therapy option for each of the 9 Class II malocclusion cases. **Result:** The Class II malocclusion treatment recommendations of Panel 2 were significantly different from those offered by Panel 1 with a skew of at least 1 scale point toward earlier treatment. The Class II malocclusion treatment recommendations of the members of Panel 1 members were in accordance with contemporary evidence-based knowledge. **Conclusion:** Class II malocclusion overtreatment appears to be the tendency among clinical orthodontists but not among orthodontists who are academically involved with early treatment. There is a gap between the scientific knowledge and the practices of orthodontists.

Descriptors: Malocclusion, Angle Class II; therapeutics; questionnaires.

INTRODUCTION

Early malocclusion treatment has been the subject of extensive debate over the past 35 years[1-5]. Selecting the timing of therapy involves several patient-related factors such as growth stage[6], malocclusion severity[7] and psychologically impairing self-comparisons[8]. However, evidence-based knowledge about effectiveness and efficiency should serve as the background guidelines[5] for decisions about when to implement an orthodontic multi-phase therapy. Orthodontics during the primary and mixed dentition stages should only be initiated if a better final outcome or less effort can be forecasted[1,5].

Among the malocclusions that are subject to interceptive recommendations, Class II malocclusions are the most extensively studied[9-15]. Randomized clinical trials have established that early mixed dentition treatments for Class II malocclusions are no more effective and are considerably less efficient than later 1-phase treatment during adolescence[11-14]. Additionally, there is evidence that functional appliance therapy results in extra mandibular growth only if the pubertal stage is incorporated into the Class II malocclusion treatment plan[9], which does not occur during primary and early mixed dentition[6]. Thus, the current contemporary concept based on evidence-based knowledge is that corrections of Class II malocclusions prior to late mixed dentition or early permanent dentition should be classified as early treatments[16] and are not indicated unless there are incisal trauma risks[13] or psychological aspects that militate in favor of such treatment. Although this knowledge and appropriate guidelines have been available for almost a decade, it seems that orthodontists are reluctant to accept new information that contradicts their preferred method of treatment[1,16] and therefore routinely offer early treatment for Class II malocclusion.

The aim of this study was to investigate whether clinical orthodontists recommend the treatment timing for Class II malocclusion in accordance with contemporary evidence-based knowledge. Is there a gap between today's orthodontic scientific knowledge and clinical practice? Do opinion-makers on interceptive orthodontics offer treatment to growing patients according to the scientific literature? Is the offer of Class II malocclusion treatment associated with specific professional characteristics? The null hypothesis was that Class II malocclusion treatments would be recommended by the gold standard expert panel and the panel of clinical orthodontists at a similar rate.

MATERIAL AND METHOD

The participants' rights were protected, and informed consent and assent were obtained electronically (IRB 01481812.0.0000.5137).

Panel 1 (i.e., the gold standard opinion-making experts) was composed of 105 orthodontists who had authored clinical trials and/or retrospective investigations on interceptive orthodontics between June 2008 and May 2012 in four world-class dentistry journals (the American Journal of Orthodontists and Dentofacial Orthopedics, the European Journal of Orthodontists, the Journal of Dental Research, and the International Journal of Pediatric Dentistry). Panel 2 was composed of 1862 orthodontists who were registered in 2012 with the Brazilian Orthodontic Society (ABOR).

An electronic survey was created using the services of MailChimp® (the Rocket Science Group, MailChimp, Atlanta, Georgia, USA) and SurveyMonkey® (SurveyMonkey, Palo Alto, California, USA). The survey was open to both panels during a 30-day period. The survey consisted of the following 8 introductory multiple-choice questions: gender, whether their respondent's orthodontic training had taken place at an accredited institution, the length of orthodontic practice, the highest level of academic qualification, the type of orthodontic duties, the percentage of daily patients related to interceptive orthodontics, the level of interest in interceptive orthodontics, and the respondent's habits regarding the reading of the scientific interceptive orthodontic literature.

The evaluation of the Class II malocclusion treatment recommendations was based on assessments of 9 right-side lateral intra-oral images of Class II malocclusions (Figure 1). Each image represented one of the three stages of dental development (i.e., primary dentition, early mixed dentition and late mixed dentition) and one of the three degrees of severity (i.e., mild, moderate and severe). The degree of severity was based on the sagittal discrepancy measured in the primary cuspid region during primary dentition or in the first permanent molar region during mixed dentition. Increases in the risk of trauma in the maxillary incisors were also used as a parameter to classify the degree of severity by the research team.

The following statement was printed at the top of the picture page: "To answer this survey, please consider that the patients arrived at your practice at the pictured stage of dental development. The image that you see is the only information that matters for the purpose of this survey. Analyze the following images labeled "A" through "I", and select the option that best describes your recommendations for the treatment of ONLY the CLASS II MALOCCLUSIONS at the indicated stage of dental development." All of the images were accompanied by a 5-point Likert-type scale for the treatment recommendation that included the following options: definitely not recommend, probably not recommend, maybe recommend, probably recommend and definitely recommend.

The comparisons between the Class II malocclusion treatment recommendations of the 2 panels of experts were performed in several manners: a) the cases were compared individually; b) the cases were grouped by the stage of dental development; c) the cases were grouped by malocclusion severity; and d) all cases were grouped together to evaluate the overall frequency of the recommendations for early treatment of Class II malocclusions.

Descriptive statistics were used to describe the main characteristics of both panels. Histograms were created to represent the frequencies of the treatment recommendations for each Class II malocclusion case. A non-parametric test (Mann-Whitney) was used to comparing the medians of the groups. Odds ratios were calculated, and a chi-squared test was performed to compare the panels` recommendations after the treatment recommendations were dichotomized (all options ≥ "maybe recommend treatment" were taken as "recommend"). Spearman's correlation analyses were performed to assess the correlations between the treatment recommendations and five predictors (i.e., gender, orthodontic

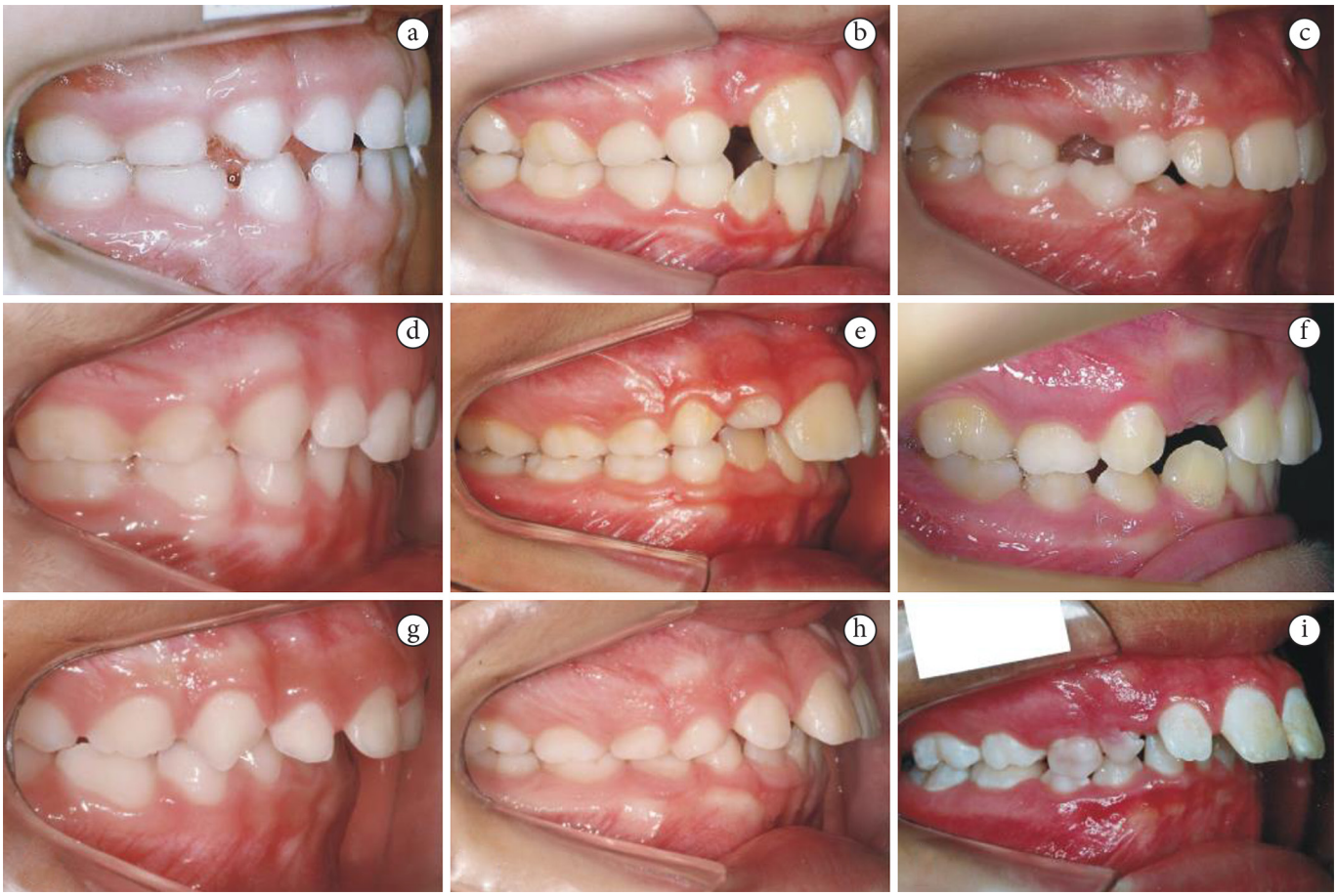

Figure 1. Intra-oral lateral views of Class II malocclusion during primary, early mixed and late mixed dentition. Cases a, b and c show mild malocclusion; d, e, f represent moderate, and g, h, i present severe Class II malocclusions.

activity, percentage of patients related to interceptive orthodontics in daily practice, level of interest in interceptive orthodontics, and reading habits of the scientific literature related to interceptive orthodontics). Multiple regression analysis was performed to establish and quantify the relationships between the treatment recommendation and predictors. The significance level was set at 0.05.

RESULT

The overall response rate was 14.6% (n=289). The response rate of Panel 1 was 26.7% (n=28) and that of Panel 2 was 14.0% (n=261). The mean durations of orthodontic experience were 22.6 years ± 8.8 years for Panel 1 and 14.2 years ± 10.8 years for Panel 2. The demographics of the 289 orthodontists who completed the survey are presented in Table 1. The orthodontists' recommendations regarding Class II treatments are summarized below.

The Class II Malocclusion Treatment Recommendations Offered by the Gold Standard Expert Panel Differed from those of the Clinical Orthodontists

The frequencies of each of the treatment recommendations by Panels 1 and 2 are presented in independent histograms for each case (Figure 2). In 7 of the 9 cases, statistically significant differences in the median values were observed between the two groups. Only in Cases "A" and "I" did both panels offer the same treatment recommendations. When a mild Class II malocclusion was found in the primary dentition stage (Case "A"), the majorities of orthodontists in both groups selected the "definitely do not recommend" treatment option. When a severe Class II malocclusion was diagnosed during late mixed dentition (Case "I"), strong majorities of the orthodontists in both groups "definitely recommended" treatment. Comparisons of the median scores of the treatment recommendations of Panels 1 and 2 for "Class II malocclusion overall early treatment recommendation", "stage of dental development" and "severity of malocclusion" are shown in Figure 3. Significant differences between the panels were observed for all three of these variables.

The Opinion-maker Orthodontists were More Conservative in their Class II Malocclusion Treatment Recommendations than the Clinical Orthodontists

Based on the median Class II malocclusion treatment recommendations (Figure 3), Panel 1 definitely did not recommend "overall early Class II malocclusion treatment" for the 9 cases presented in the survey, whereas Panel 2 would have possibly recommended treatment. Significant differences were also observed between Panels 1 and 2 in the treatment recommendations when the stage of dental development and the Class II malocclusion severity were fixed as the studied variables. Panel 1 definitely did not recommend Class II malocclusion treatment during primary dentition, probably would not have recommended treatment during early mixed dentition,

Table 1. Descriptive data of 289 orthodontists who completed the survey

Characteristic	Panel 1 (%) n=28	Panel 2 (%) n=261
Gender		
Male	85.2	59.2
Level of academic education		
Certificate	0	51.9
Master degree	18.5	30.2
PhD	81.5	17.9
Orthodontic activity		
Academy	81.5	28.2
Solo private practice	29.6	72.5
Group private practice	7.4	27.1
Public employment	14.8	4.2
% Interceptive orthodontic patients		
< 30%	62.9	49.3
> 30%	37.1	50.7
Interest on interceptive orthodontics		
None	0	0.4
Low	7.4	2.3
Moderate	7.4	17.6
High	37.0	48.5
Extremely high	48.1	31.3
Articles/year (reading)		
0	0	3.8
1-3	22.2	30.2
4-6	14.8	25.2
7-9	14.8	12.6
10 or more	48.1	28.2

and would possibly have recommend treatment during late mixed dentition. The greater the severity of the Class II malocclusion, the higher was the Likert type-scale point recommendation of Panel 1.

Clinical Orthodontists were More Likely to Recommend Early Class II Malocclusion Treatment than the Orthodontists who were Academically Involved with Interceptive Therapy

Table 2 shows the frequencies (%) of the panelists who recommended treatment at each stage of dental development and for the different degrees of severity and the corresponding odds ratios. Panel 2 was more likely (OR = 6.6) to recommend "overall early Class II malocclusion treatment" than Panel 1. When the children were in the late mixed dentition stage, the difference between the panels decreased, but the clinical orthodontists (Panel 2) still recommended treatment 2.6 times more frequently.

The Class II Malocclusion Treatment Recommendations were Associated with Academic involvement and the Percentage of Interceptive Orthodontic Patients

Table 3 presents the results of the correlation and multiple regression analyses of the orthodontists' characteristics and the indications for Class II treatment according to the stages of occlusal development and malocclusion severity. Multiple regression analysis including the variables (predictors) with the higher correlations revealed that the percentage of daily patients requiring interceptive orthodontics in the orthodontists' practices and academic involvement were positively correlated with all of the dependent variables. The coefficients of multiple determination for the multiple regression ranged from 27% to 46%. The clinicians with higher demands of patients seeking "early" orthodontic treatment indicated earlier Class II therapies than the orthodontists with small percentages of young patients ($P < 0.01$). Academic involvement was inversely correlated with Class II treatment ($P < 0.01$), i.e., a greater the academic involvement was associated with fewer Class II treatment indications. The other predictors did not correlate significantly with the Class II therapy indications.

DISCUSSION

The online electronic survey conveniently enabled access to a large number of panelists (n=1967) within a 30-day interval. Specifically, Panel 1 was composed of opinion-maker orthodontists from 16 different countries, including Brazil, and the Panel 2 respondents were composed of Brazilian orthodontists from the 5 major regions of this country. The sampling process did not intend to represent the over 16,000 orthodontists registered with the Brazilian National Dental Council in 2014 but only to represent the preferred Class II treatment timings of the nearly 2,000 clinical orthodontists who are affiliated with an officially recognized national orthodontic society. Initially, one might think that the response rate was low, but the expected response rates for internet surveys in the health science field is below 5%[17]. Our overall rate was significantly higher (>14%) than this expected rate. We found that among the group of orthodontists who were involved with interceptive orthodontics (Panel 1), the response rate was higher (26.7%) than that of Panel 2 (14%). Thus, the motivation to complete the survey was apparently associated with the level of involvement in the investigated topic. The sample size calculation indicated that 22 questionnaires would be sufficient for Panel 1 and that 247 questionnaires would be sufficient for Panel 2. Therefore, because the minimum sample size was obtained within 3 weeks, the survey was closed after 30 days.

Systematic reviews[10,13] and randomized clinical trials[11,12,14] with high-standard evidence-based investigational designs have shown that early treatment should not be considered as an efficient method for the treatment of the majority of Class II malocclusion patients. Class II treatments should not be performed unless specific circumstances favor these treatments. Indeed, the Panel 1 experts offered such evidence-based recommendations. Importantly, when

the degree of severity implied a dental trauma risk or a risk of myofunctional impairments during primary dentition (Case G), approximately 30% of the Panel 1 orthodontists recommended Class II malocclusion treatment. The overall early Class II malocclusion treatment recommendations from Panel 1 skewed toward conservative non-treatment approaches. The increase in the frequency of treatment recommendation during the late mixed dentition stage was in agreement with the literature because such

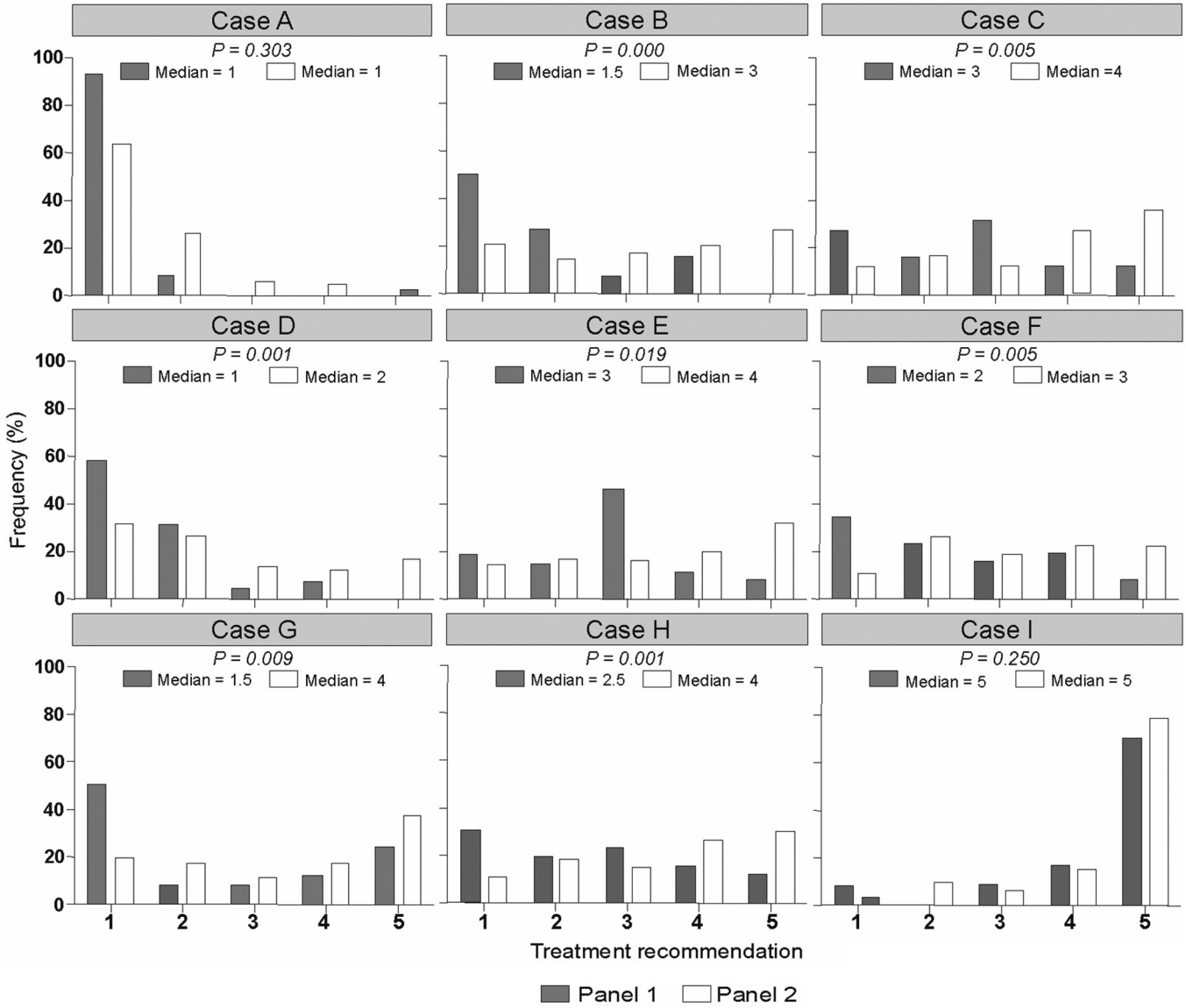

Figure 2. Frequency of treatment recommendation. Histograms for each case.

Table 2. Frequency (%) comparison and odds ratio of Class II treatment recommendation between panels according to studied categories

Category	Panel 1 (n=27)	Panel 2 (n=262)	Significance (chi-square test)	OR (95% CI)
Overall Class II	12%	50.8%	0.000***	6.6 (2.0-21.5)
Dentition				
Primary	11.5%	40.5%	0.004**	4.6 (1.4-15.1)
Early mixed	34.6%	62.6%	0.005**	2.8 (1.3-6.1)
Late mixed	68%	86.6%	0.013*	2.6 (1.2-5.7)
Malocclusion severity				
Mild	12%	55.7%	0.000***	7.9 (2.4-25.8)
Moderate	40%	61.1%	0.041*	2.1 (1.0-4.6)
Severe	60%	80.5%	0.016*	2.4 (1.1-5.2)

OR indicates odds ratio; CI confidence interval. *P< .05. ** P <.01. *** P < .001.

treatment provides the opportunity to preserve the E-space in the maxillary arch as the first step of Class II malocclusion management and because at this time, many children are experiencing accelerated pubertal mandibular growth[1,6].

In our survey, we presented images of children with three degrees of severity: mild, moderate, and severe. This grading was intended to enable the evaluations of the differences in the early treatment recommendations in different situations. The Panel 1 treatment recommendations according to severity followed the same pattern as the treatment recommendations accord to the stage of dental development. Mild and moderate malocclusions did not elicit treatment recommendations, whereas treatment was occasionally recommended for severe Class II malocclusion cases. Therefore, we conclude that the Panel 1 experts recommended Class II malocclusion treatments according to contemporary evidence-based concepts with respect to both timing and severity.

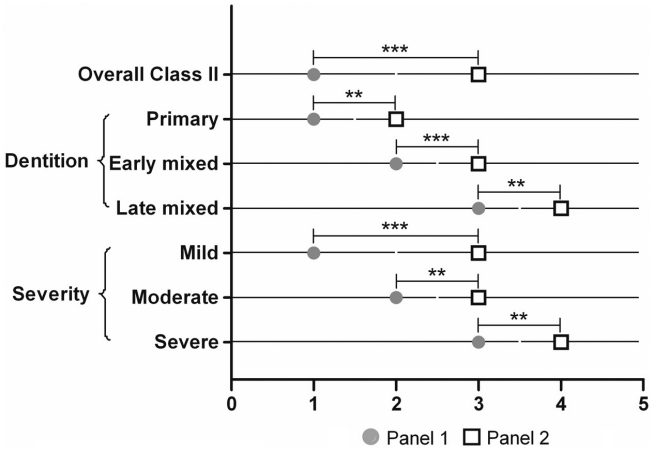

Figure 3. Median treatment indication of Panel 1 and Panel 2, according to overall Class II malocclusion, stage of occlusal development and severity.

In contrast, the odds ratio for Class II malocclusion treatment recommendations from the Panel 2 orthodontists was significantly higher than that of the Panel 1 orthodontists (Table 2). The treatment recommendations from Panel 2 were at least 1 scale point higher than the recommendations from Panel 1 in terms of both the stage of dental development and malocclusion severity (Figure 3). The treatment recommendations exhibited statistically significant differences in all of the comparisons between the groups. This pattern of treatment recommendations is compatible with the treatment paradigms from 2 decades ago. King et al.[4] reviewed the literature related to Class II malocclusion treatments up to the late 1980s and reported that although late treatment had advocates, the contemporary concept at that time was that early treatment was advantageous due to improved tissue adaptability and patient compliance among these young patients. All of the orthodontists in Panel 2 were involved in continuing education, and the majority (80.2%) reported a high or extremely high level of interest in interceptive orthodontics and significant reading on this topic (> 4 articles/year). Thus, the question arises, why were these orthodontists following the outdated paradigm instead of the evidence-based data from the up-to-date research journals?

In orthodontics, other factors may explain why Class II malocclusion overtreatment is so common. We believe that the majority of clinical orthodontists base their Class II malocclusion

Table 3. Correlation between the orthodontists' characteristics and the indication of Class II treatment

		Gender	Academic	% daily patients	Interest	Reading
Dentition	Overall Class II	0.086	-0.118*	0.163**	0.058	0.027
		Adjusted r^2=0.30 F=4.005 P=0.008 (Predictors Academic, % daily patients)				
	Primary	0.079	-0.051	0.078	-0.010	-0.016
		No model was generated				
	Early mixed	0.060	-0.110*	0.159**	0.074	0.025
		Adjusted r^2=0.27 F=4.005 P=0.007 (Predictors Academic, % daily patients)				
	Late mixed	0.149**	-0.135*	0.175**	0.073	0.044
		Adjusted r^2=0.46 F=5.594 P=0.001 (Predictors Gender, Academic, % daily patients)				
Severity	Mild	0.085	-0.162*	0.114*	0.125*	-0.023
		Adjusted r^2=0.40 F=5.002 P=0.002 (Predictors Academic, % daily patients)				
	Moderate	0.084	-0.055	0.154*	0.080	-0.009
		Adjusted r^2=0.38 F=6.985 P=0.009 (Predictors Academic, % daily patients)				
	Severe	0.122*	-0.114*	0.182**	0.043	-0.067
		Adjusted r^2=0.45 F=5.575 P=0.001 (Predictors Academic, % daily patients)				

Predictors: Gender, Academic (Academic duties), % daily patients (percentage of daily patients with interceptive orthodontic need), Interest (level of interest in interceptive orthodontics), and Reading (scientific literature reading about interceptive orthodontics). **Note:** *P< .05. ** P <.01.

management protocols on the concepts they were trained on at an average of 14 years ago when the current evidence was not available. Sixty-one percent of the Panel 2 members recommended treatment during early mixed dentition. This finding suggests that if professionals do not overcome the barrier to acquiring new information, they will retain old paradigms. If orthodontists are not convinced that efficiency is an important attribute of the excellence of their practice, indiscriminate recommendation of early Class II malocclusion treatment may not be a concern. Another explanation might be related to differing professional decisions without explanatory factors related to such recommendations[18].

Health service delivery and clinical practice could be improved through the introduction of novel interventions with efficacies that are backed strong evidence[19]. However, the uptake and implementation of innovations in healthcare have often proven challenging and very slow in some cases. Consequently, research findings are not always translated into changes in clinical practice. Some authors have proposed that the adoption of new ideas is a process that is far more dynamic and complex than previously suggested by the classic innovation diffusion model of change, which proposes that the adoption of innovations is a rational and linear process. However, this model has been criticized for assuming a simplistic rational view of change and ignoring the complexities of this process including human cognitive limits and bounded rationality[20], cognitive dissonance, individual personalities and predispositions to change, culture (values, beliefs, habits and assumptions) and attitudes, and possible economic interests[21]. Economic reasons might motivate a clinician outside of an academic practice setting to initiate Class II treatment early. The fear of losing patients due to competition and pressure from parents may also explain such behaviors. Additional investigation on this topic should be conducted.

The gap between what we know and what we do is a very important theme that has been debated by health authorities over the last several years. The World Health Organization's Director-General stated that "Health work teaches us with great rigor that action without knowledge is wasted effort, just as knowledge without action is a wasted resource.[22]" We understand that additional interdisciplinary investigations are necessary to clarify the factors that contribute to the resistance of orthodontists to the abandonment of their earlier concepts and their acceptance of new scientific evidence-based information.

CONCLUSION

- The null hypothesis was rejected. Class II malocclusion overtreatment appeared to be the tendency of clinical orthodontists but not the orthodontists who were academically involved with publications related to interceptive orthodontics.
- The clinical orthodontists did not recommend Class II malocclusion treatment according to the contemporary evidence-based knowledge.
- The opinion-makers on interceptive orthodontics recommended Class II malocclusion treatment for growing patients in accordance with the scientific literature.

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CONFLICTS OF INTERESTS

The authors declare no conflicts of interest.

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