Influence of clinicians' experience and gender on extraction decision in orthodontics

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Abstract

Influence of clinicians' experience and gender on extraction decision in orthodontics

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The purpose of this study is to determine if, in class I borderline cases, experienced orthodontists choose non-extraction treatments more frequently than orthodontists with less experience. A secondary aim is to evaluate if clinicians' gender and place of education play a role in extraction decision-making.

An online survey was developed using three class I borderline patient cases. The survey included questions about clinicians' demographics as well as clinical questions about the selected cases. The survey was distributed to approximately 2000 clinicians through the American Association of Orthodontics.

Two-hundred and fifty three responses were collected. A trend was observed where clinicians with more than 15 years of experience preferred an extraction treatment option more frequently than clinicians with less than 5 years of experience. There was no association between gender and place of education and the decision to extract in the

selected borderline cases. Crowding, patient's profile, and lower incisor inclination were among the top three reasons chosen by clinicians for both the extraction and non-extraction treatment decisions.

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Introduction

The issue of extraction vs. non-extraction in orthodontic treatment for class I borderline patients has been a subject of debate among orthodontists for many years. Borderline cases have been described in many different ways in the literature. Some studies only focus on crowding and consider cases with 4-8mm of crowding to be borderline [1]. However, other variables such as facial profile, Bolton discrepancy, and lip prominence also influence the extraction decision. Therefore, others define borderline in broader terms as cases where orthodontists cannot agree on whether to extract or not extract [2]. It has been shown in the literature that when presented with the same patient scenario, some clinicians choose to extract in borderline cases, while others opt for non-extraction treatment [3,4]. While different philosophies have developed over the years, the reason behind the inconsistencies in treatment plans for borderline cases is still unclear. Many different factors play a role in the treatment planning process and they vary greatly from one patient to another and from one orthodontist to another.

Multiple studies have been conducted to determine the reasons why orthodontists choose extraction vs. non-extraction treatment in borderline cases. Clearly, patients' characteristics such as crowding, facial profile, lip prominence, and curve of Spee play a significant role in the decision-making process. However, clinicians' traits and experiences may also play a role in diagnosis and treatment planning. The significance of clinicians' traits becomes apparent when different orthodontists are given the same patient scenario to evaluate. Studies looking at agreement level among orthodontists in these situations have discovered that the degree of agreement on treatment decisions is very low [3,4].

Literature on what orthodontist characteristics may affect treatment decisions is limited. The few studies that have looked at which clinicians' traits influence the treatment decision were usually done as part of larger studies focusing on patient differences. In addition, the data from these few studies are conflicting. Some have discovered an association between clinicians' traits such as gender or experience with extraction treatment decisions while others did not find any relationship between the two [5,6,7]. Kay and Nuttall attribute the differences among clinicians to either judgmental or perceptual variations. They report that perceptual differences result from two people interpreting the same thing differently while judgmental variations are seen when two people agree on what they see, but disagree on the treatment [8]. Clinicians' past experiences can influence both the perceptual as well as the judgmental aspects of the decision-making process. The influence of clinicians' educational background and philosophy, gender, and level of experience in treatment planning cannot be ignored.

The dispute regarding how treatment decisions are made in borderline extraction/non-extraction cases is far from settled. Most studies have sought answers by focusing on patient differences. The purpose of this study is to determine if, in class I borderline cases, experienced orthodontists choose non-extraction treatments more frequently than orthodontists with less experience. The patient traits on which the decisions are based on will also be evaluated. A secondary aim is to evaluate the influence of other clinicians' characteristics such as gender and place of education to determine if these factors are associated with the treatment decision.

Methods

Selection of borderline cases

The study was approved by the Institutional Review Board (IRB). Cases were selected from the Orthodontic Department graduate clinic. Inclusion criteria for the selected patients were: orthognathic profile, class I molar and canine classification, crowding of 4-8mm, complete records (intraoral and extraoral photographs, lateral cephalogram, panoramic radiograph, initial models), and full permanent dentition. Cases with the following criteria were excluded: missing teeth, abnormal tooth morphology, major dental work such as endodontically treated teeth, severe caries, periodontal disease, and ankylosed teeth.

After an initial screening of 15 class I cases, 8 met the inclusion criteria and were selected for a pilot survey. The survey was developed using SurveyMonkey® and was distributed to 16 Orthodontic faculty members and 15 Orthodontic residents. The questions in the pilot and final study survey were identical. Three different versions of the survey with different order of patient cases were developed to minimize order effect.

After the initial pilot survey, three patients were selected for the final study survey. These were cases where extraction and non-extraction treatment options were equally distributed amongst the participating clinicians. Since clinicians with varying levels of experience could not agree on extraction vs. non-extraction treatment for these cases, we concluded that they were good examples of borderline cases. These three cases were used in the survey study described below.

Electronic Survey:

The electronic survey was developed using SurveyMonkey®. The survey was distributed through American Association of Orthodontics Partners in Research program (AAO PRP) to all active AAO members who agreed to participate in this program.

The survey consisted of two portions. Section one consisted of practitioner demographic questions such as years of experience, gender, place of education, treatment philosophy, etc. (see Appendix I). The second section included the patients' records consisting of: initial intraoral and extraoral photographs, photographs of study models, lateral cephalogram radiograph, cephalometric analysis, and the panoramic radiograph. Each clinician was required to answer if they preferred an extraction or non-extraction treatment for each case. If a non-extraction treatment option was chosen, a follow up question was asked regarding how space will be created for alignment. If an extraction treatment plan was chosen, the clinicians were asked which teeth they chose to extract (Appendix I).

Statistical Analysis:

Sample size calculation determined that to detect a difference of 40% vs. 60% in the three different experience level groups (less than 5 years, 5 to 15 years, and more than 15 years of experience) with a 0.05 significance level, 60 orthodontists were needed in each group.

Descriptive analyses were used initially to visualize the general trends in the data. Non-parametric Chi-square test was then used to determine the extraction decision

making association with level of experience, gender, and location of orthodontic training based on members' AAO constituency. The levels of significance were defined as 0.05.

The reasons why clinicians chose treatment for each case was categorized based on extraction vs. non-extraction and descriptive analysis was used to examine any trends.

Statistical analyses were performed with the R statistical package (Version 2.11.1).

Results

Clinicians' Demographic

The survey was distributed to 2005 clinicians through American Association of Orthodontists (AAO) Partners in Research Program. Two hundred fifty-three responses were collected which equals a 13% response rate. The distribution of experience among the respondents was 28% in the less than 5 years of experience, 32% in the 5-15 years, and 40% in the more than 15 years of experience group (Table I). Twenty-five percent of the respondents were female and 75% male (Table I); however, gender was not equally distributed based on the experience group. In the less than 5 years of experience, 33% of the respondents were female, while in the more than 15 years of experience group only 16% were female. This difference in number of female clinicians based on experience was statistically significant (X^2=7.08, p=0.03) (Table II).

Table I. Clinicians demographics

	Respondents	Recipients
Experience Level	**n (%)**	**n (%)**
< 5 Years	72 (28)	185 (9)
5-15 Years	80 (32)	803 (40)
>15 Years	101 (40)	1017 (51)
Gender		
Female	60 (25)	554 (28)
Male	183(75)	1451(72)
Total	**253**	**2005**

The demographic information for all the clinicians who received the survey was obtained from the AAO. Comparing the demographic of the survey respondents to the entire group of the survey recipients indicates that they were relatively similar (Table I). The main difference was that more clinicians in the less than 5 years of experience group responded to the survey (28% respondents vs. 9% of all recipients). Clinicians with more than 15 years of experience were less likely to respond to the survey (40% respondents vs. 51% of the recipients). The overall gender distribution and gender distribution with regards to experience was similar between the two groups (Table I and II).

The number of responses for each case decreased from case A to B and C. Two hundred twenty-six people completed Case A, but that number dropped to 195 for Case B

Table II. Gender vs. Experience

	< 5 Years		>15 Years	
	Respondent	Recipient	Respondent	Recipient
	n (%)	n (%)	n(%)	n(%)
Female	23 (33)	74 (40)	15(16)	210 (20)
Male	47 (67)	111 (60)	80(84)	807 (80)
		P-Value: 0.03		

and 186 for Case C. Therefore, two sets of analysis were completed: one with all the responses and one with the responses only those clinicians who completed the entire survey. Gender and experience distribution was very similar in both groups.

Case Analysis:

Overall extraction vs. non-extraction rates for each case are listed in Table III. The majority of clinicians preferred a non-extraction treatment for the selected patients. The percentage of extraction vs. non-extraction options chosen by the clinicians were similar for cases A and C, however, the number of extraction treatment was higher in Case B relative to the other two cases.

Table III. Case Summary

	Extraction		Non-extraction	
	n	%	n	%
Case A	34	15	192	85
Case B	58	30	137	70
Case C	37	20	149	80

For Case A, 85% of the participants preferred non-extraction treatment (Table III). In the less than 5 years of experience group, only 10% of the participants preferred an extraction treatment for this patient (Table IV). In the more than 15 years of experience group 21% preferred extractions, however, this difference was not statistically significant (X^2=3.49, p=0.06). A second set of analysis was completed, comparing clinicians with less than 15 years of experience to those with more than 15 years of experience. Similar to our initial analysis, only 11% of those clinicians with less than 15 years of experience preferred extractions vs. 21% of those with more than 15 years of experience (X^2=4.09, p= 0.04). Comparable percentage of female (14%) and male participants (16%) preferred extraction in this case (Table IV). The difference in extraction treatment decision-making based on gender was not statistically significant (X^2=0.01, p= 0.90). The top two reasons provided for extractions in this case were

crowding and patient's profile, while the top two reasons chosen for non-extraction were patient's profile and lower incisor inclination (Figure I).

In Case B, non-extraction treatment was chosen by 70% of the participants (Table III). In the less than 5 years of experience group, 20% of the participants chose an extraction treatment option while in the more than 15 years of experience group, 37% chose this option. This difference was statistically significant (X^2=4.05, p=0.04). Comparing less than 15 years of experience to more than 15 years, similar trend was observed (24% extraction rate in less than 15 years vs. 37% in more than 15 years of experience, X^2=3.59, p=0.06) (Table IV). Looking at the gender differences, 29% of the males and 33% of the females preferred an extraction treatment option for this case and the difference was not statistically significant (X^2=0.04, p=0.7) (Table IV). The clinicians' top two reasons for extraction in this case were again crowding and patient's profile. Those who chose non-extractions also selected patient's profile and crowding as reasons not to extract (Figure II).

For Case C, 80% of the respondents favored non-extraction treatment over extraction (Table III). In the less than 5 years of experience group, 14% of

Table IV: Extraction vs. non-extraction based on experience and gender

	Case A		Case B		Case C	
	Extraction	Non-extraction	Extraction	Non-extraction	Extraction	Non-extraction
Experience	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**
<5 years	6 (10)	55 (90)	9 (20)	35 (80)	6 (14)	36 (86)
>15 years	20 (21)	74 (79)	33 (37)	56 (63)	22 (26)	63 (74)
		p-value: 0.06		p-value: 0.04		p-value: 0.14
Experience						
<15 years	14(11)	118(89)	25(24)	81(76)	15(15)	86(85)
>15 years	20 (21)	74 (79)	33 (37)	56 (63)	22 (26)	63 (74)
		p-value: 0.04		p-value: 0.06		p-value: 0.14
Gender						
Female	8 (14)	48 (86)	15 (33)	30 (67)	4 (10)	37 (90)
Male	26 (16)	141 (84)	43 (29)	107 (71)	33 (23)	112 (77)
		p-value: 0.90		p-value: 0.70		p-value: 0.09

participants chose an extraction treatment option compared to 26% of the more the more experienced group (X^2=2.20, p= 0.14) (Table IV). In the less than 15 years of experience group 15% of the clinicians preferred an extraction treatment option, compared to 26% of clinicians with more than 15 years of experience (X^2=2.87, p= 0.09) (Table IV). There was a larger difference in extraction treatment distribution among male and female clinicians. Only 10% of the females preferred an extraction treatment whereas 23% of male clinicians chose an extraction treatment, however, this difference was not statistically significant (X^2=0.15, p=0.09) (Table IV). For case C, lower incisor inclination and patient's profile were the primary reasons why clinicians chose extractions. On the other hand, crowding and patient's profile were the reasons chosen for non-extraction (Figure III).

Figure I. Rational to extract vs. not extract for Case A

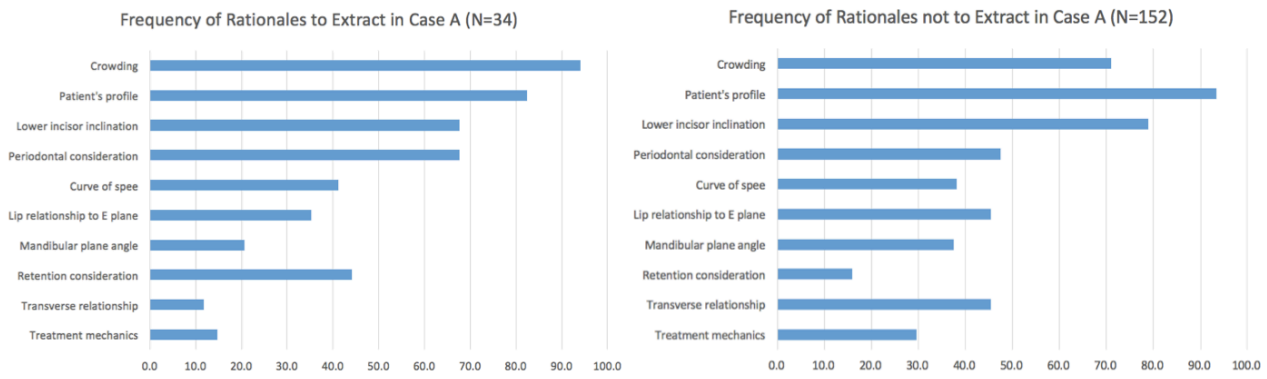


Figure II. Rational to extract vs. not extract for Case B

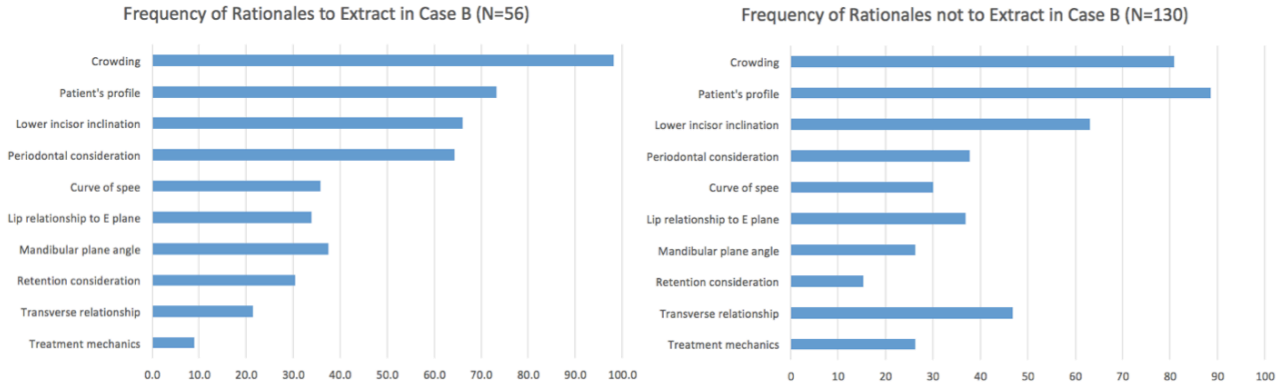
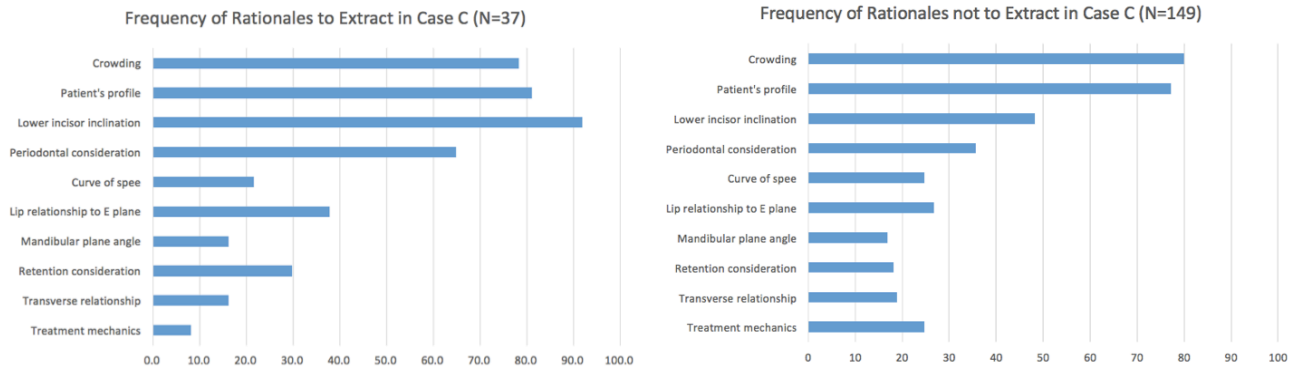


Figure III. Rational to extract vs. not extract for Case C



When all incomplete surveys were eliminated and only completed surveys were analyzed, a similar pattern was detected. For every case, more clinicians with more than 15 years of experience preferred an extraction treatment option compared to clinicians with less than 5 years of experience. However, since we had eliminated some of our responses, our p-values decreased for Cases A and B and the differences noticed were not statistically significant (Table V). Again, the extraction rate with respect to gender was not statistically significant.

Twenty-four percent of respondents believed the extraction rates had decreased in their practice over the past 10 years. The majority attributed this to a change in either treatment philosophy (48%), aesthetic beliefs (31%), or patient desire (21%).

The clinicians were grouped into their respective AAO constituent based on their place of education. The percentage of extraction vs. non-extraction treatment choice for each case was compared between the different constituencies. There was no association between clinicians' AAO constituent and preference for extraction or non-extraction treatment in the cases presented (Table VI).

Table V: Extraction vs. non-extraction based on experience and gender completed surveys

	Case A		Case B		Case C	
	Extraction	Non-extraction	Extraction	Non-extraction	Extraction	Non-extraction
Experience	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**
<5 years	6 (14)	36 (86)	9 (21)	33 (79)	6 (14)	36 (86)
>15 years	20 (24)	65 (76)	32 (38)	53 (62)	22 (26)	63 (74)
		p-value: 0.2		p-value: 0.07		p-value: 0.14
Gender	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**
Female	7 (26)	20 (74)	8 (30)	19 (70)	3 (11)	24 (89)
Male	17 (18)	77 (82)	32 (34)	62 (66)	24 (26)	70 (74)
		p-value: 0.4		p-value: 0.7		p-value: 0.1

Table VI. Extraction vs. non-extraction based on AAO constituency

	X^2	P
Case A	4.16	0.65
Case B	6.97	0.32
Case C	2.25	0.89

Discussion

The purpose of this study was to determine if clinicians' traits such as gender and experience have an influence on extraction decision in class I borderline patients. Three borderline cases were selected and a survey was distributed to orthodontists through AAO Partners in Research program. The demographic of our survey respondents was generally similar to all the participants of the Partners in Research program. The significant difference in number of female clinicians with more than 15 years of experience who responded to our survey is reflected in the demographics of all the survey recipients. This study had a much larger percentage of clinicians with less than 5 years of experience respond to the survey (29% of respondents vs. 9% of the recipients).

Exploring the association between the extraction decision-making and experience a clear trend was observed. Experienced clinicians preferred extraction treatment option in the selected borderline cases more frequently than the less experienced group. A few other studies have evaluated the influence of the clinician's experience on extraction treatment decision-making, but this subject has not been studied using clinical cases. The results of this study indicate that experience may influence clinicians' decision-making regarding extraction vs. non-extraction in class I borderline cases. In all three scenarios, clinicians with more than 15 years of experience chose an extraction treatment option almost twice as often than those with less experience.

Baelum et al. have found that orthodontic experience was the only factor that could be correlated with differences in treatment plans by different orthodontists [5]. Another study has shown that clinicians with more experience lean towards non-extraction treatment [6]. Lastly, Weintraub et al. report that the rate of self-reported

extractions from private orthodontic practices did not correlate with the amount of experience [7].

We rely on our past experiences to solve problems on a day to day basis [9], therefore, it is reasonable to assume that orthodontists' past experiences may play a role in their treatment decisions. For example, it has been stated in the literature that clinicians' past experiences may lead them to categorize a certain facial pattern as "non-extraction face". Therefore, they choose non-extraction treatment in those patients regardless of other factors such as crowding [10]. The effect of extraction on patients' profile may lead clinicians to choose one treatment option over the other. It has been shown that non-extraction treatment does not affect the patient's profile while extraction treatment affect on profile is proportional to the relationship of lips to the E plane [11]. We can speculate that with experience, clinicians become more familiar with which borderline cases are best treated with extractions and are more comfortable making that decision. On the other hand, clinicians with less experience may be hesitant to extract teeth in these patients in order to avoid any negative changes.

Another reason why more experienced clinicians prefer an extraction treatment option more frequently could be due to training differences. In the past, due to use of bands on all teeth, extraction treatments were more common. Clinicians with more experience who trained and worked during that era may be more likely to choose an extraction treatment option.

The results of this study suggest that gender does not play a role in extraction vs. non-extraction treatment decision-making in class I borderline cases. In every patient case, almost equal percentage of female and male clinicians preferred an extraction

treatment. The same results were achieved when our data was stratified based on gender and experience. Another study in the literature has also shown that gender does not influence treatment decision-making[5]. Gentry, however, discovered that female practitioners needed more discrepancy from normal values when choosing an extraction treatment option[6].

Most clinicians who participated in this survey preferred a non-extraction treatment for the selected borderline cases. One explanation for this observation can be that the selected cases were not truly borderline. The cases were selected based on a preliminary survey completed by a group of clinicians who either trained at the same institution or have been teaching at the same department for many years. Training or teaching at the same institution will expose clinicians to certain philosophies which may influence one's treatment planning decision. One of the secondary aims of this study was to determine if place of education affects a clinician's decision to choose an extraction treatment decision. The analysis on the effect of place of education on clinicians' decision-making process was inconclusive. Research in this area is scarce, however, another study has shown that place of education does not influence clinicians' decision-making [5].

Lastly, another reason for this observation could be that non-extraction treatments have become more popular with clinicians over the past few years. Extraction rates were around 10% in the 1950's and they increased to about 50% in the 1960's, then gradually declined to approximately 10% in the 1990's. The frequency of extractions in orthodontics has since increased to 27-30% [12,13,14]. As indicated in our results, 24% of the participants believe that the extraction rate in their practice has decreased over the past 10

years. The majority of clinicians attributed this change in extraction rates in their practice to change in treatment philosophy, change in aesthetic believes or patient desires. Development of new treatment mechanics, such as TAD's may could have also attributed to this decrease in extraction rates. Since extraction rates have been decreasing, one can assume that in borderline cases, more clinicians will choose the non-extraction treatment option.

In order to better comprehend the decision-making process, one must consider how clinicians' traits, such as experience and gender, may lead them to look at patients' characteristics differently. In this study patient's profile, crowding, and lower incisor inclination were among the top reasons chosen by both the clinicians who preferred extractions and those who chose non-extraction treatment option. Baumrind et al. also discovered that crowding was the number one reason cited by most clinicians when they decided to extract [15]. Other patient factors that may affect the clinicians' decisions include the position of the third molars, flexibility of the labial tissues, the need for profile improvement, lower lip relationship to E-plane and incisor protrusion [9,15,16]. Although some of these factors can be measured objectively, others may be subject to interpretation and perceptual variation amongst orthodontists. As mentioned before, determining if there is a need for profile improvement can be subjective and clinicians' past experiences and personal characteristics may influence their diagnosis and treatment plan. Our study confirms that clinicians are choosing the same diagnostic information as reasons to either extract or not extract.

The number of survey respondents decreased from case A to B to C. The reason some participants did not complete the survey was due to fatigue. Two separate sets of

analysis were completed to ensure that this decrease in response rate did not affect the outcome. In both analyses it was evident that clinicians with more than 15 years of experience preferred to extract more frequently than clinicians with less than 5 years of experience. The main difference between the two analyses was that our p-values decreased only when looking at the completed surveys due to a decrease in the number of responses analyzed.

One of the main limitations of this study was that the number of extraction vs. non-extraction treatment was not equally distributed for every scenario. Despite the strict measures that were taken to ensure the patients included in the final survey were truly borderline, the larger population of orthodontists mostly preferred non-extraction treatments for these cases. Although we reached our sample size goal of 60 for each experience group and gender, some of the other analysis we intended to perform could not be completed since, in most instances, a very small number of participants chose the extraction treatment option. This problem could have been avoided if more clinicians had chosen an extraction treatment option or if more recipients responded to the survey.

Conclusion:

The results of this study indicate that there could be an association between clinicians' experience and the decision to extract, however, further studies are needed to confirm the results. Clinicians with more than 15 years of experience chose an extraction treatment option more frequently than clinicians with less than 5 or 15 years of

experience. No association was found between the clinicians' gender or place of education and extraction treatment choice. The reasons why orthodontists chose to extract or not extract for each case were similar for both treatment options.

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Appendix I. Survey Questions

Clinicians' Demographic Questions:

1. What is your gender?
    a. Female
    b. Male

2. What is your ethnicity? (Please select all that apply.)
    a. American Indian or Alaskan Native
    b. Asian or Pacific Islander
    c. Black or African American
    d. Hispanic or Latino
    e. White/Caucasian
    f. Prefer not to answer
    g. Other (please specify)

3. How many years have you practiced orthodontics?
    a. Less than 5 years
    b. 5-15 years
    c. More than 15 years

4. Compared to earlier in your practice, how would you describe the overall extraction rate for your patients in the past 10 years?
    a. Increased
    b. Decreased
    c. Not changed
    d. Prefer not to answer

5. To what do you attribute the change in extraction rates in your practice?
    a. Development of new mechanics such as TAD's
    b. Change in treatment philosophy
    c. Change in aesthetics beliefs
    d. Patient's desire
    e. Not sure
    f. Other (please specify)

6. Approximately, how many hours/week do you practice?

7. Did you attend a 2-year or 3-year orthodontic program?
    a. 2-year
    b. 3-year
    c. Other (please specify)

8. What year did you graduate from your orthodontic program?

9. Do you currently teach in a graduate program?
    a. Yes
    b. No
    c. Prefer not to answer

10. How many hours/week do you teach?

11. Do you practice based on a certain philosophy
    a. Yes
    b. No
    c. Prefer not to answer

12. Please specify which philosophy you follow in your practice:

13. Which orthodontic program did you attend? (optional)

Clinical Cases:

1. Case A is best treated by:
    a. Extractions, other than third molars
    b. Non-extraction

2. Please specify the extraction pattern you prefer: (select all that apply)
    a. UR4 (#5)
    b. UR5 (#4)
    c. UL4 (#12)
    d. UL5 (#13)
    e. LL4 (#21)
    f. LL5 (#20)
    g. LR4 (#28)
    h. LR5 (#29)
    i. One lower incisor
    j. Prefer not to answer
    k. Other (please specify)

3. For non-extraction treatment, how will you create space to level/align the teeth? (Please check all that apply)
    a. Expansion
    b. Proclination of incisors
    c. Leveling curve of Spee
    d. Leveling curve of Wilson
    e. Distalization of molars
    f. Interproximal reduction
    g. Prefer not to answer
    h. Other (please specify)

4. Please briefly describe your treatment plan:

5. The decision to extract or not extract is based on the following considerations: (please select all that apply.)
    a. Crowding
    b. Patient's profile
    c. Lower incisor inclination
    d. Curve of Spee
    e. Transverse relationship
    f. Lip relationship to E plane
    g. Retention consideration
    h. Periodontal consideration
    i. Mandibular plane angle
    j. Treatment mechanics
    k. Prefer not to answer

l. Other (please specify)

6. Which long-term retention mechanism do you prefer for maxillary teeth?
    a. Hawley
    b. Essix
    c. Fixed retainer
    d. Other (please specify)

7. Which long-term retention mechanism do you prefer for mandibular teeth?
    a. Hawley
    b. Essix
    c. Fixed retainer
    d. Other (please specify)