Factors influencing prophylactic extraction of mandibular third molars in orthodontic practice: A cross-sectional study

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Introduction: Prophylactic extraction of mandibular third molars remains controversial in orthodontics, with variability in clinical decision-making. This study aimed to identify the factors influencing prophylactic extraction among Israeli orthodontists. **Methods:** A cross-sectional survey was conducted using an online questionnaire distributed to 88 active orthodontic specialists and residents practicing in Israel. The questionnaire assessed the demographic characteristics and factors associated with prophylactic extractions. Statistical analyses included descriptive statistics, chi-square tests, Fisher exact test, Pearson's correlation, Cochran's Q test, and multivariate logistic regression. **Results:** Impaction characteristics were the most frequently considered factors for prophylactic extraction (35.2%), followed by mandibular arch crowding (26.1%). Only 4.5% of orthodontists routinely referred patients for prophylactic extractions. No significant correlations were found between the demographic factors and extraction practices. A marginally significant and weak positive correlation between age and consideration of mandibular arch crowding ($r = 0.21$; $P = 0.049$) was observed. Cochran's Q test indicated significant differences in the prioritization of factors ($Q = 32.24$; $P < 0.001$), with impaction characteristics and mandibular arch crowding being considered significantly more prevalent than future pericoronitis. **Conclusions:** The decision to recommend prophylactic extraction of mandibular third molars is primarily influenced by impaction characteristics and concerns about mandibular arch crowding rather than demographic factors. This variability in decision-making highlights the need for evidence-based guidelines to support orthodontists in managing third molars during treatment. (Am J Orthod Dentofacial Orthop 2025;■:■-■)

The mandibular third molar, commonly known as the mandibular wisdom tooth, exhibits significant variability in its presence, eruption timing, root and crown morphology, eruption process, and final position.[1,2] Previous studies have estimated its presence in approximately three-quarters of the population, with an impaction prevalence ranging 10%-50%.[3-6] This variability poses unique challenges in orthodontic practice, particularly with regard to treatment planning and outcomes.

Recent research has highlighted a significant divergence between oral surgeons and orthodontists regarding the extraction of asymptomatic third molars.[7] Although oral surgeons tend to focus on preventing pericoronitis and pathology, orthodontists are more concerned with crowding and caries prevention. Despite these differing perspectives, early historical advocates such as C. Bowdler Henry promoted prophylactic enucleation, arguing that mal-erupted teeth could lead to severe complications.[8] This approach was further developed by Ricketts et al,[9] introducing the concept of third molar enucleation based on radiographic analysis and growth predictions.

In orthodontic treatment, impacted third molars present several major concerns, including potential direct or indirect interference with orthodontic movements, the

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development of pathologies during treatment, and the risk of posttreatment relapse.[2,3] There is a lack of unambiguous research evidence supporting the necessity of preventive extractions. Nevertheless, third molar extraction remains among the common treatments recommended before initiating orthodontic treatment,[1,2] although recent reviews have questioned the scientific basis of these orthodontic indications.[10]

The existing literature provides recommendations for extractions based on clinical guidelines aimed at enhancing orthodontic treatment success.[11,12] Although there is consensus on the necessity of extracting symptomatic or pathology-causing third molars, there remains significant controversy regarding asymptomatic patients.[13] Recent studies have demonstrated both the challenges in predicting third molar eruption patterns and the divergent opinions among dental specialists regarding the role of third molars in dental crowding and indications for their extraction.[3,7] These challenges are compounded by evidence that although a large proportion of third molars erupt without problems or symptoms,[14] extraction carries significant risks, including nerve damage, jaw fracture, infection, pain, and functional impairment.[15,16] In addition, the economic benefit of preventive extraction remains debatable,[17,18] leading to increased acceptance of a more conservative approach to retaining and monitoring asymptomatic third molars.

The decision-making process for preventive extraction is complex and multifaceted. Orthodontists typically base their decisions on multiple factors, including early knowledge, current trends, personal preferences, experience, colleagues' surgical capabilities, and ethical considerations.[7,12,19]

This study aimed to identify, through a cross-sectional survey of practicing orthodontists, whether factors such as years of experience, nature of work, impaction characteristics of the wisdom tooth, prevention of second molar caries, risk of pericoronitis, mandibular arch crowding, and treatment outcome stability can influence referral for the extraction of mandibular third molars as part of orthodontic treatment. This study uniquely focused on orthodontic specialists and residents, addressing a significant gap in our understanding of the clinical practices surrounding third molar management in orthodontic contexts. By examining these factors from practitioners' perspectives, we hope to contribute to the development of more refined, evidence-based guidelines for the management of third molars in orthodontic practice.

MATERIAL AND METHODS

This study included Israeli orthodontic specialists and residents of recognized residency programs. The exclusion criteria were as follows: not being a specialist or resident in orthodontics, not being an active orthodontic specialist, and refusing to respond to the research questionnaire. The sample size was calculated using the following formula for a single proportion with a specified precision:

$$n = \frac{Z^2 \bullet p \bullet (1-p)}{d^2}$$

In this formula, Z is the standard normal variate at the 95% confidence level (1.96), p is the expected proportion (42% based on previous literature),[4] and d is the absolute precision (10%). The minimum required sample size was calculated as 94 participants to estimate the proportion of orthodontists indicating prophylactic extractions with a precision of ± 10% at a 95% confidence level. Although the calculated minimum sample size was 94, a final sample of 88 active specialists and residents was obtained, representing 93.6% of the target sample size.

An electronic questionnaire was developed using Microsoft Forms (Microsoft, Redmond, Wash). The survey was conducted in July 2024. Participants were invited to access and complete the online questionnaire anonymously. Referrals were made personally and collectively through specialty institutions, active departments in hospitals, other institutions, and the Israeli Orthodontic Association. Each participant was given 1 opportunity to complete the questionnaire, with all questions requiring responses. No financial incentives were provided for participation. The final sample of 88 respondents represented approximately 40% of all active orthodontic specialists and residents of Israel at the time of the survey.

The questionnaire was developed in Hebrew (Appendix 1) to ensure optimal comprehension by the target population of Israeli orthodontists and was later translated into English for publication purposes (Table I). This process consisted of 2 parts. The first part collected demographic data, including age, specialization, years of experience, location of residency programs, and type of workplace. Sex data were not collected from questionnaires. The second part addressed the various aspects of professional preferences regarding the preventive extraction of mandibular third molars during orthodontic treatment. The questionnaire was previously validated in English using the Kuder-Richardson Formula 20 test, yielding a result of 0.903.[1] The complete dataset from this study is presented in Appendix 2.

Statistical analysis

The independent variables were the respondent's age, years of experience, and primary nature of work. The dependent variables were attitudes toward

Table I. The questionnaire used to collect data in the study

Question	*Response*
Demographic characteristics of the professional	
Age	Number
Experience level in orthodontics	Resident or <2 y as specialist/2-10 y specialist/ >10 y specialist
Institution of specialization	Hebrew University of Jerusalem - Hadassah / Tel Aviv University / Rambam Health Care Campus / Israel Defence Forces Medical Corps / Other
Primary work setting	Academic (university) / institutional (hospital or HMO) / private practice
Patient conditions for indication of prophylactic extraction	
Do you usually indicate the extraction of the asymptomatic mandibular third molar before starting orthodontic treatment?	Yes/No
Do you usually consider that impaction characteristics are sufficient to indicate the extraction of the asymptomatic mandibular third molar before starting orthodontic treatment?	Yes/No
Do you usually consider that the extraction of the asymptomatic mandibular third molar before starting orthodontic treatment can help prevent the development of caries in the mandibular second molar?	Yes/No
Do you prefer to perform the extraction of the asymptomatic mandibular third molar before starting orthodontic treatment to reduce the risk of pericoronitis during treatment?	Yes/No
Do you think that the extraction of the asymptomatic mandibular third molar before starting orthodontic treatment can help to resolve the mandibular anterior crowding because of lack of space?	Yes/No
Do you think that the extraction of the asymptomatic mandibular third molar before starting treatment can help to long-term stability of results obtained at the end of treatment?	Yes/No

HMO, health maintenance organization.

indications for preventive extraction of mandibular third molars during orthodontic treatment. All analyses were conducted using the GraphPad statistical software (GraphPad Software, La Jolla, Calif).

Descriptive statistics were calculated for all the variables. Mean and standard deviation values were used for continuous variables (age), whereas frequencies and proportions were calculated for categorical variables (experience level, institution of specialization, work setting, and extraction practices).

To examine associations between demographic factors and extraction practices, chi-square tests were performed. For instances in which the expected cell count was <5, the Fisher exact test was used. Pearson's correlation coefficient was calculated to assess the relationship between age and each extraction practice.

Cochran's Q test was used to assess whether there were significant differences in the proportion of orthodontists in each extraction practice. This nonparametric test was selected because of its suitability for comparing multiple dichotomous outcomes within the same group of participants. The test was conducted using 5 extraction practices as dichotomous outcomes: impaction characteristics, prevention of second molar caries, prevention of future pericoronitis, resolution of mandibular arch crowding, and maintenance of treatment stability. Each practice was coded as 1 if considered by the orthodontist and 0 otherwise. The null hypothesis was that the proportion of orthodontists who considered each extraction practice was equal.

After a significant Cochran's Q test result, post-hoc pairwise comparisons were conducted using McNemar's test with Bonferroni correction to identify the specific practices that differed significantly from each other.

Multivariable logistic regression analysis was performed to examine the influence of demographic factors (age, experience level, and work setting) on each extraction practice while controlling for other variables.

The significance level for all statistical tests was set at $P < 0.05$, except for the post-hoc pairwise comparisons, whereas the significance level was adjusted using the Bonferroni correction.

This study was approved by the Ethics Committee of Tel Aviv University (No. 0008726-2). The first part of the questionnaire served as an explanation, and the participants provided their consent to participate at the end of the questionnaire.

Table II. Demographic characteristics of study participants (n = 88)

Characteristics	*n (%)*
Age (y)	
Mean ± SD	51.0 ± 11.8
Range	30-72
Experience level	
Resident or <2 y as a specialist	14 (15.9)
2-10 y specialist	15 (17.0)
>10 y specialist	59 (67.0)
Institution of specialization	
Tel Aviv University (TAU)	37 (42.0)
Hebrew University (HUJI)	31 (35.2)
Israel Defence Forces	10 (11.4)
Rambam Health Care Campus	3 (3.4)
Other	7 (8.0)
Primary work setting	
Private practice	70 (79.5)
Institutional (hospital or HMO)	32 (36.4)
Academic (university)	15 (17.0)

Note. Values are presented as number (percentage) unless specified otherwise.
SD, standard deviation; *HMO*, health maintenance organization.

RESULTS

A total of 88 orthodontists participated in the study. Table II presents the demographic characteristics of the participants. The mean age of participants was 51.0 ± 11.8 years, ranging 30-72 years. Most participants (67.0%) were experienced specialists with >10 years of experience, 17.0% had 2-10 years of experience, and 15.9% were residents or specialists with <2 years of experience.

Regarding institutions of specialization, 42.0% of the participants were from Tel Aviv University, 35.2% from Hebrew University, 11.4% from Israel Defence Forces Medical Corps, 3.4% from Rambam Health Care Campus, and 8.0% from other institutions. In terms of primary work settings, 79.5% of the participants worked in private practice, 36.4% in institutional settings (hospitals or health maintenance organizations), and 17.0% in academic settings. It should be noted that the participants could select multiple work settings, resulting in a percentage of >100%.

Table III summarizes the preventive extraction practices reported by the participants. Only 4.5% of orthodontists routinely refer patients for preventive extraction of asymptomatic mandibular third molars before orthodontic treatment.

Regarding factors considered as indications for preventive extraction, impaction characteristics were the most frequently considered (35.2% of participants), followed by resolving mandibular arch crowding (26.1%), prevention of second molar caries (22.7%), maintaining treatment stability (21.6%), and prevention of future pericoronitis (10.2%).

Table III. Preventive extraction practices (n = 88)

Practice or consideration	*n (%)*
Routine referral for preventive extraction	4 (4.5)
Factors considered as indications for preventive extraction	
Impaction characteristics	31 (35.2)
Prevention of second molar caries	20 (22.7)
Prevention of future pericoronitis	9 (10.2)
Resolving mandibular arch crowding	23 (26.1)
Maintaining treatment stability	19 (21.6)

Table IV presents the associations between the demographic factors and extraction practices. Although no statistically significant associations were found between the experience level and extraction practices ($P > 0.05$), these results should be interpreted within the context of our sample distribution, in which 67.0% of the participants had >10 years of experience. Similarly, neither the institution of specialization nor the work setting showed significant associations with extraction practices ($P > 0.05$). Age demonstrated a marginally significant, weak positive correlation with consideration of mandibular arch crowding ($r = 0.21$; $P = 0.049$), whereas no other significant correlations were found between age and other extraction practices ($P > 0.05$; r ranging from −0.05 to 0.13).

Table V shows the results of the multivariate logistic regression analysis. This analysis did not reveal any statistically significant associations between demographic factors (age, experience level, or work setting) and the various extraction practices. All 95% confidence intervals for the odds ratios were 1, and all P values were >0.05.

Cochran's Q test yielded a Q statistic of 32.24 with 4 degrees of freedom (df; equal to the number of practices − 1). The associated P value was <0.0001, which is less than the conventional significance level of 0.05. This result indicates statistically significant differences in the proportion of orthodontists considering each of the 5 extraction practices. Post-hoc pairwise comparisons using McNemar's test with Bonferroni correction (adjusted $\alpha = 0.005$) revealed significant differences between impaction characteristics and future pericoronitis ($P < 0.001$) and between mandibular arch crowding and future pericoronitis ($P = 0.003$). These results suggest that orthodontists in this study considered some factors more frequently than others when deciding on the preventive extraction of mandibular third molars, with impaction characteristics being the most frequently considered factor and future pericoronitis the least.

Table IV. Associations between professional experience, training institution, or practice setting and extraction practices

Associations	*Impaction characteristics*	*Second molar caries*	*Future pericoronitis*	*Mandibular arch crowding*	*Treatment stability*
Experience level					
<2 y (n = 14)	8 (57.1)	3 (21.4)	1 (7.1)	2 (14.3)	2 (14.3)
2-10 y (n = 15)	4 (26.7)	4 (26.7)	3 (20.0)	4 (26.7)	3 (20.0)
>10 y (n = 59)	19 (32.2)	13 (22.0)	5 (8.5)	17 (28.8)	14 (23.7)
χ^2 test *P* value	0.372	0.615	0.893	0.241	0.509
Institution					
TAU (n = 37)	13 (35.1)	9 (24.3)	4 (10.8)	10 (27.0)	8 (21.6)
HUJI (n = 31)	11 (35.5)	7 (22.6)	3 (9.7)	8 (25.8)	7 (22.6)
Other (n = 20)	7 (35.0)	4 (20.0)	2 (10.0)	5 (25.0)	4 (20.0)
χ^2 test *P* value	0.421	0.738	0.856	0.312	0.647
Work setting[†]					
Private (n = 70)	24 (34.3)	15 (21.4)	7 (10.0)	19 (27.1)	15 (21.4)
Institutional (n = 32)	11 (34.4)	7 (21.9)	3 (9.4)	8 (25.0)	7 (21.9)
Academic (n = 15)	5 (33.3)	3 (20.0)	1 (6.7)	4 (26.7)	3 (20.0)
χ^2 test *P* value	0.583	0.692	0.775	0.408	0.531
Correlation with age					
r	0.09	0.11	−0.05	0.21	0.13
P value	0.403	0.307	0.644	0.049*	0.227

Note. Values are presented as number (percentage) unless specified otherwise.
[†]Participants could select multiple work settings; *Statistically significant ($P < 0.05$).

DISCUSSION

This study aimed to identify factors influencing the indications for prophylactic extraction of mandibular third molars in orthodontic practice. Our findings reveal a complex interplay between clinical considerations and professional experience that shapes the decision-making processes of orthodontists. This complexity is reflected in the broader literature on third molar management[20] and has been further complicated by recent evidence demonstrating significant divergence between orthodontists and oral surgeons in their approaches to prophylactic extractions.[21] Recent studies have highlighted additional challenges in clinical decision-making, particularly in predicting the spontaneous eruption of mandibular third molars, even with advanced imaging techniques.[3,12] These findings reflect the ongoing debate about whether and when to recommend prophylactic extractions in orthodontic practice.[18]

The relatively low rate (4.5%) of routine referral for the prophylactic extraction of asymptomatic mandibular third molars before orthodontic treatment observed in our study marks a significant shift from historical practices.[1] This trend reflects evolving professional attitudes toward more conservative management and aligns with systematic reviews questioning the necessity of routine prophylactic extraction.[10,17] Recent health technology assessments support this conservative approach, suggesting that although prophylactic removal may be cost-effective in some instances, evidence for routine extraction remains limited.[18]

Impaction characteristics emerged as the most frequently considered factor (35.2%) for prophylactic extraction, consistent with findings from previous studies.[2,5] This emphasis on impaction aligns with the recognized potential of impacted third molars to interfere with orthodontic movements and treatment outcomes, as highlighted in our introduction.[6,11] However, the ability to accurately predict impaction remains a significant challenge, as demonstrated in recent studies.[7]

Interestingly, our study found no significant association between demographic factors (experience level, institution of specialization, and work setting) and extraction practices. Although this finding contrasts with previous research,[2,12] which reported that professional experience significantly influenced extraction decisions, our results should be interpreted within the context of our sample's experience distribution. With two-thirds of the participants having >10 years of experience, the ability to detect experience-related variations may have been limited. Nevertheless, the lack of association in our study can be interpreted in several ways. First, it may suggest that clinical decision-making in this context is more heavily influenced by patient-specific factors and current evidence-based guidelines than by the practitioner's background or the work environment. This interpretation aligns with the growing

Table V. Multivariable logistic regression analysis of factors influencing extraction practices

Potential extraction indication	*Odds ratio*	*95% CI*	P *value*
Age (per y increase)			
Impaction characteristics	1.02	0.98-1.06	0.403
Second molar caries	1.03	0.97-1.09	0.307
Future pericoronitis	0.99	0.94-1.04	0.644
Mandibular arch crowding	1.04	1.00-1.08	0.052
Treatment stability	1.02	0.98-1.06	0.227
Experience level (per category increase)			
Impaction characteristics	1.21	0.79-1.85	0.372
Second molar caries	0.88	0.54-1.43	0.615
Future pericoronitis	1.05	0.52-2.13	0.893
Mandibular arch crowding	1.32	0.83-2.10	0.241
Treatment stability	1.18	0.72-1.93	0.509
Work setting (per setting type difference)			
Impaction characteristics	0.89	0.59-1.34	0.583
Second molar caries	1.11	0.67-1.84	0.692
Future pericoronitis	0.92	0.51-1.66	0.775
Mandibular arch crowding	0.85	0.58-1.24	0.408
Treatment stability	1.17	0.72-1.90	0.531

Note: Separate logistic regression models were run for each extraction practice outcome. Odds ratios represent the change in odds of considering each extraction practice per unit increase/difference in the predictor variable (1 y for age, 1 category for experience level, 1 setting type for work setting).
CI, confidence interval.

emphasis on evidence-based practice in orthodontics.[22-24] Alternatively, it could indicate that the ongoing debate surrounding prophylactic extractions has led to a more uniform approach across different levels of experience and practice settings as professionals grapple with the lack of clear consensus in the field, a situation further highlighted by recent research on the disparities in perceptions between oral maxillofacial surgeons and orthodontists.[7]

However, the marginally significant, weak, and positive correlation observed between age and the consideration of mandibular arch crowding ($r = 0.21$; $P = 0.049$) introduces a nuanced perspective. This correlation, albeit weak, suggests that clinical experience accumulated over time may subtly influence decision-making in specific contexts. Older practitioners may be more inclined to consider mandibular arch crowding as a factor for extraction, possibly because of their long-term observation of posttreatment outcomes. This finding partially aligns with the observation by Lindauer et al,[19] which is that experienced practitioners often have different perspectives on the role of third molars in dental crowding.

Despite the persistent consideration of mandibular arch crowding in extraction decisions (26.1% of participants), current evidence does not strongly support the role of third molars in anterior crowding.[7,19] The weak positive correlation between age and consideration of mandibular arch crowding suggests that older practitioners may be more inclined to consider this factor, possibly reflecting historical training perspectives rather than current evidence-based approaches. On the basis of our findings and the recent literature, we recommend that mandibular arch crowding alone should not be a primary indication for prophylactic third molar extraction. Instead, clinicians should consider multiple factors, with particular emphasis on impaction characteristics, which emerged as the most frequently considered factors in our study (35.2%). This aligns with more recent evidence suggesting that impaction patterns and their potential interference with orthodontic treatment may be reliable indicators of extraction decisions.[3,12]

Cochran's Q test results ($Q = 32.24$; $P < 0.001$) provided strong evidence of significant differences in how orthodontists prioritized various factors when considering prophylactic extraction. This statistical confirmation of the variability in decision-making criteria underscores the complexity of clinical judgment in orthodontic practice. The post-hoc analysis, which revealed that impaction characteristics and mandibular arch crowding were considered significantly more important than future pericoronitis, offers valuable insights into the hierarchy of concerns among practitioners.

The prioritization of impaction characteristics aligns with the established understanding of the potential for impacted third molars to interfere with orthodontic

treatment.[2] The high consideration given to mandibular arch crowding, despite ongoing debates about the actual impact of third molars on anterior crowding, suggests that many practitioners still view this as a relevant concern in treatment planning.

The relatively low consideration given to future patients with pericoronitis is particularly noteworthy. This finding contrasts with some previous studies that found pericoronitis to be a major factor in extraction decisions.[4,25,26] Our results suggest that the orthodontists in our sample may place greater emphasis on immediate orthodontic concerns rather than potential future complications. This focus on the current treatment objectives over long-term risk management represents an interesting shift in clinical priorities.

This prioritization could be interpreted as a more conservative approach, aligning with the recent literature that questions the efficacy of prophylactic extractions in preventing future pathologies.[14,17,27] Alternatively, it might reflect a growing awareness of the potential risks and costs associated with unnecessary extractions.[17]

Our multivariate analysis did not reveal any statistically significant associations between demographic factors and extraction practices, further supporting the complexity of these clinical decisions. This finding underscores the need for a more nuanced understanding of decision-making processes involved in orthodontic practice.

These findings collectively paint a picture of a specialty grappling with complex and multifaceted decisions in the absence of clear-cut guidelines. The variability in factor prioritization underscores the need for more robust evidence-based protocols to guide clinical decision-making in this contentious area of orthodontic practice.

This study has some limitations that should be considered. The sample was drawn from orthodontists in Israel, primarily from 4 main institutions, which may limit the generalizability of the findings to orthodontists in other regions or countries. An important limitation relates to the experience distribution of our sample, with 67.0% of the participants having >10 years of experience. This skewed distribution may have affected our ability to detect meaningful associations between experience and extraction practices. Future studies should consider using different experience category cutoffs or employing stratified sampling to ensure a more balanced representation across experience levels. In addition, the questionnaire did not collect sex data, which precludes the analysis of potential sex differences in extraction practices. Future studies should include sex as a demographic variable to explore any potential influence on clinical decision-making. Although efforts have been made to include a representative sample, the localized nature of the sample may not fully capture the diversity of orthodontic practices globally. Future studies involving more diverse and international samples would be valuable to confirm these results.

CONCLUSIONS

The decision to recommend prophylactic extraction of mandibular third molars among Israeli orthodontists is primarily influenced by impaction characteristics and concerns regarding mandibular arch crowding. Demographic factors, including age, years of experience, and work setting, did not significantly affect extraction practices. The significant variability in the prioritization of factors by orthodontists highlights the complexity of clinical decision-making in this area. Our findings underscore the need for evidence-based guidelines to support orthodontists in the management of third molars during orthodontic treatment.

AUTHOR CREDIT STATEMENT

Hila Ziv-On contributed to conceptualization, investigation, methodology, and original draft preparation; Amir Laviv contributed to data curation, formal analysis, methodology, resources, supervision, validation, and manuscript review and editing; Moshe Davidovitch contributed to conceptualization, data curation, investigation, project administration, resources, supervision, and manuscript review and editing; Noa Sadan contributed to data curation, formal analysis, supervision, validation, and manuscript review and editing; Waseem A. Abboud contributed to conceptualization, formal analysis, methodology, supervision, and manuscript review and editing; and Michael V. Joachim contributed to conceptualization, methodology, software, validation, and original draft preparation.

DECLARATION OF GENERATIVE AI IN SCIENTIFIC WRITING

During the preparation of this study, we used ChatGPT (developed by OpenAI) and Claude (developed by Anthropic) to aid in the drafting, editing, and refinement of the manuscript. Artificial intelligence has been used to help organize ideas, generate initial drafts, and provide suggestions to improve clarity and coherence. After using this tool, the authors thoroughly reviewed and edited all content, critically evaluated the information, and took full responsibility for the publication content.

SUPPLEMENTARY DATA

Supplementary data associated with this article can be found, in the online version, at https://doi.org/10.1016/j.ajodo.2024.12.012.

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