

Impacted Third Molars and Anterior Crowding-Beliefs and Evidence

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ABSTRACT

Objectives: The aims of this study were firstly to assess the views of oral surgeons and orthodontists regarding prophylactic third molar extraction (TME) to prevent crowding of anterior teeth (CAT), and secondly to analyze the influence of clinical factors on such views, with a particular interest in the potential roles of age and specialty.

Materials and Methods: A cross-sectional survey was administered to oral surgeons and orthodontists in the city of Riyadh. The survey questionnaire was self-administered. Factor associations were detected with chi-squared tests.

Results: A total of 157 participants responded to the questionnaire, including 71 (45.2%) oral surgeons and 86 (54.8%) orthodontists. Most (N=96; 61.1%) disagreed or strongly disagreed that there is a cause-and-effect relationship between third molar eruption and CAT. An even larger majority (N=120; 76.4%), including 51 oral surgeons and 69 orthodontists, indicated that they do not recommend prophylactic TME to prevent CAT. The most significantly influential factors on their views about TME were age and sex ($P<0.05$), whereas specialty was not a significantly influential factor ($P>0.05$). A potential mesial drifting effect of third molars and horizontally oriented impactions were the most reported justifications for removal.

Conclusion: Most oral surgeons and orthodontists in Riyadh do not favour prophylactic TME to prevent CAT. The study outcome may combat the subjective health practice of routinely referring patients for prophylactic extraction.

Key words: Prophylactic extraction, Impacted third molar, Anterior crowding, Asymptomatic extraction, mandibular third molars

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INTRODUCTION

For several decades, there has been debate regarding whether third molars have an impact on crowding of anterior teeth (CAT) [1]. Several early studies appeared to support the notion. In Vego et al. [2] described an increase in CAT over time in patients with intact third molars. In 1982, Linquist, et al. [3] described a similar trend, but it was not clinically significant. Also, Richardson, et al. [4] reported a 5-year longitudinal study wherein orthodontic patients with impacted molars in the upper jaw were observed to have more crowding in anterior and molar regions than patients without impacted molars. In Niedzielska, et al. [5] reported evidence consistent with the supposition that the so-called Ganss ratio, which is the ratio between third molar width and the retromolar space, may be predictive of CAT. However, Esan et al. [6], found that space availability was likely not a major determinant

of CAT, but that third molar impaction type may be an important factor. Others have focused on interproximal forces between anterior teeth generated by the eruption of third molars as an indicator of CAT relapse, though the clinical significance of this index is unclear [7,8].

Meanwhile, a number of studies have failed to affirm the putative relationship between impacted third molars and CAT [9]. In Harradine, et al. [10], monitored 77 orthodontic patients for the development of CAT using plaster study casts, ortho-pantomographs, and cephalometric radiographs. Comparing Little's index of irregularity between patients with and without third molar extraction (TME), they did not find a significant effect of TME on subsequent lower incisor crowding. Several subsequent attempts to resolve this question also revealed no evidence of an effect of third molars on CAT [11], including studies examining the suggested role of impacted third molars on incisor alignment changes following orthodontic treatment [12,13].

The inclination for clinicians, including orthodontists and oral surgeons, to recommend prophylactic TME prior to

their eruption to prevent CAT seems to be based more on personal experience and opinion than on empirical evidence from the clinical literature. In the USA, oral surgeons were found to be more likely to recommend prophylactic TME than orthodontists [14]. In 2000, NICE (National Institute of Health and Care Excellence) guidelines suggested that prophylactic TME should not be performed in Britain, even if the molars are impacted, in the absence of disease (e.g., infection) [15]. This more conservative view of performing TMEs only in the presence of symptoms has gained some prominence in Europe. Notably, in Italy, majorities of oral surgeons and orthodontists do not favor asymptomatic TME for CAT prevention [16]. Meanwhile, in a 2008 study in Spain, Torres et al. [17] found that prophylaxis remained the primary justification for TME referrals, with the second most common justification being orthodontic reasons.

In our clinical practice in Saudi Arabia, we receive patients who are referred for asymptomatic TME with the justification of CAT prevention frequently. The perceptions and awareness of oral surgeons and orthodontists in Saudi Arabia regarding this practice are not yet known. The primary aim of the present study was thus to assess the opinions of oral surgeons and orthodontists in Saudi Arabia regarding the usefulness of TME for the prevention of CAT with a question-based survey, and to determine what factors influence these opinions. Secondly, we also examined the respondents' justifications for supporting, or not, prophylactic TME in asymptomatic patients.

MATERIALS AND METHODS

Study design and setting

This study was approved by the Institutional Review Board of King Saud University (E-20-4857 and CDC No. FR 0581). A cross-sectional web-based survey, designed by the authors to assess awareness of prophylactic TME, was administered to oral surgeons and orthodontists in the city of Riyadh, the capital city of Saudi Arabia. A well-established protocol was used for sample size calculation [18]. Participants were approached through personal contact numbers, social media accounts, and clinic hours. Participants were informed about the aims of the study and that by answering the questions, they would be consenting to the use of the information that they were providing, with their identities being kept anonymous. The survey was distributed electronically and completed questionnaire were returned by a total of 157 respondents.

Questionnaire

Prior to being distributed, the survey was validated in a pre-survey of 8 respondents to determine the clarity and comprehensibility of the questions face validity, and content validity. Content validity was adjusted based on feedback from the orthodontists and oral surgeons that partook in the pre-survey. Face validity was adjusted by modifying choices to better fit the questions. The

questions were lastly adjusted based on their answers and their recommendations.

The questionnaire was written in English and consisted of 16 questions, including 5 demographic questions (age, gender, specialty, job title, and year of graduation). The demographic questions were followed by short descriptive questions aimed at determining the respondents' opinions regarding the causative relationship between third molar impaction and CAT, and whether they recommend the prophylactic TME for prevention of CAT. Additional questions asked about recommendation justifications, including the potential importance of impaction type. The final question asked about the factors that play a role in the respondent's decision making regarding prophylactic TME. Responses were a mixture of Likert scale, five-choice multiple choice, yes/no/ (I don't know), and open-ended format.

Statistical analysis

Questionnaire responses were compiled in an Excel® (Microsoft Office 2017) spreadsheet. Prior to the data analysis, the answers were divided according to clinician demographics, namely age, gender, specialty, job title, and year of graduation. Specifically, the respondents were divided into four age groups (≤ 30 , 31–40, 41–50, and 51–60 years), two specialty groups (oral surgeon and orthodontist), three job title groups (professor/consultant, registrar/specialist, or lecturer/resident), and four groups for year of professional school graduation (up to 1989, 1990–1999, 2000–2009, and 2010–2019).

Descriptive statistics was computed. Categorical data are presented as numbers (frequencies) and percentages. Question responses with 95% confidence intervals were compared across demographic groups with chi-square tests in SPSS version 23; P values less than 0.05 were considered as statistically significant. Graphs were produced in Excel®.

RESULTS

Sample characteristics

The present study sample of 157 participants included 95 men (60.5%) and 62 women (39.5%) and had the following age group distribution: ≤ 30 years, N=33 (21%); 31–40 years, N=75 (47.8%); 41–50, N=34 (21.7%); and 51–60 years, N=15 (9.6%). There were 71 oral surgeons (45.2%) and 86 orthodontists (54.8%), and their distribution among job titles groups was as follows: professor/consultant, N=66 (42%); registrar/specialist, N=55 (35%); and lecturer/resident, N=36 (22.9%). With respect to year of professional school graduation, the sample had the following distribution: up to 1989, N=7 (4.4%); 1990–1999, N=19 (12.1%); 2000–2009, N=53 (33.8%); and 2010–2019, N=78 (49.7%).

Questionnaire responses

The results of our analysis of demographic factors on questionnaire responses are reported in Table 1. Some key findings are presented in Figures 1–3. The responses according to demographic groups for the main study question, “Based on your knowledge, does the eruption of third molars cause anterior teeth crowding?” are

reported in detail in Table 2. Notably, a majority of the year being significant factors in the responses. Regarding age, respondents in the youngest age group (≤ 30 years) were the most likely answers either “disagree or strongly disagree (78.8%), data illustrated in (Figure 1). Responses to this question did not differ significantly across the two specialties (Figure 2).

Table 1: Summary of survey question responses of all participants (N=157), according to age, gender, specialty (Spec), job title (Title), and graduation year (Grad y).

Question	Response	Responses N. %	χ^2 [p value]				
			Age	Gender	Spec	Title	Grad y
Based on your knowledge, does the eruption of third molars cause anterior teeth crowding?	Strongly agree	6. 3.8%	33.44 [$<.001$]†	14.47 [.006]*	6.053 [0.195] ns	20.42 [.009]*	26.37 [0.010]*
	Agree	28. 17.8%					
	Neutral	27. 17.2%					
	Disagree	58. 36.9%					
	Strongly disagree	38. 24.2%					
Do you believe that the eruption of third molars causes relapse of anterior teeth following orthodontic treatment?	Yes	43. 27.4%	10.35 [0.016]*	0.139 [0.718] ns	0.026 [$>.999$] ns	7.089 [0.029]*	7.191 [0.066] ns
	No	114. 72.6%					
Do you advocate/ recommend the cause and effect relationship between anterior teeth crowding and eruption of third molars?	Yes	37. 23.6%	5.21 [.157] ns	0.055 [0.850] ns	1.524 [0.258] ns	3.554 [0.170] ns	9.252 [0.026] ns
	No	120. 76.4%					
Do you recommend or apply in your practice the prophylactic removal of impacted third molars to prevent anterior teeth crowding?	Yes	30. 19.1%	24.25 [$<.001$] †	11.22 [.004]*	0.827 [.661] ns	11.75 [0.019]*	13.58 [0.035]*
	No	120. 76.4%					
	I don't know	7. 4.5%					
Have you come across any scientific evidence to support your opinion?	Yes	126. 80.3%	0.796 [0.854] ns	2.37 [0.152] ns	0.156 [0.693] ns	0.177 [0.916] ns	1.46 [0.691] n
	No	31. 19.7%					
Which of the following scenarios justifies the opinion regarding the prophylactic removal of impacted third molars to prevent anterior crowding?	Mild to moderate crowding	9. 5.7%	27.49 [0.007]*	10.02 [0.040]*	2.233 [0.693] ns	5.643 [0.687] ns	12.79 [0.384] ns
	Small arch perimeter	22. 14.0%					
	Faster mandibular growth	2. 1.3%					
	May exert mesial drifting	41. 26.1%					
	There is no relationship	83. 52.9%					
Based on your knowledge, does the type of impaction play a role in the anterior teeth crowding?	Neutral	38. 24.2%	22.89 [0.029]*	12.14 [0.016]*	2.317 [0.678] ns	13.26 [0.103] ns	23.75 [0.022]*
	Agree	34. 21.7%					
	Disagree	39. 24.8%					
	Strongly agree	14. 8.9%					

	Strongly disagree	32. 20.4%					
If you think that the type of impaction plays a role in the anterior teeth crowding, which type of impaction does it apply to ?	Bucco-lingual or transverse	2. 2%	16.66 [0.339] ns	4.16 [0.523] ns	5.643 [0.343] ns	13.03 [0.222] ns	13.86 [0.536] ns
	Disto-angular	4. 4%					
	Horizontal	52. 52.5 %					
	Mesio-angular	38. 38.4%					
	Vertical	2. 2%					
	Vertical. horizontal. disto-angular	1. 1%					
Do you support that the width of third molars and its relation to the ramus is related to lower anterior crowding?	Yes	42. 26.8%	4.13 [2.47] ns	0.047 [0.856] ns	3.289 [0.074] ns	5.295 [0.071] ns	5.748 [1.25] ns
	No	115. 73.2%					
Which one of the factors play a role in determining your decision for prophylactic removal of third molars to prevent anterior teeth crowding?	Clinical experience	30. 19.1%	12.78 [0.385]	9.12 [0.058]	20.38 [<0.001]†	15.34 [0.053]	17.04 [0.148]
	I do not recommend	53. 33.8%					
	Patient belief and request	7. 4.5%					
	Referred from others	15. 9.6%					
	Scientific evidence	52. 33.1%					

*. Significant; †. Highly significant; ns. Not significant.

Table 2: Responses of participants, by demographic group, to the question addressing the main aim of the study: “Based on your knowledge, does the eruption of third molars cause anterior teeth crowding?”

Factor	Group	Response					Statistics
		Strongly agree	Agree	Neutral	Disagree	Strongly disagree	
Age, years	≤ 30	0	5	2	12	14	$\chi^2=33.44$
		0.00%	15.20%	6.10%	36.40%	42.40%	$p<0.001$ †
	31-40	3	13	8	31	20	
		4.00%	17.30%	10.70%	41.30%	26.70%	
	41-50	1	9	12	8	4	
		2.90%	26.50%	35.30%	23.50%	11.80%	
	51-60	2	1	5	7	0	
13.30%		6.70%	33.30%	46.70%	0.00%		
Total	6	28	27	58	38		
		3.80%	17.80%	17.20%	36.90%	24.20%	
Gender	Male	2	14	23	29	27	$\chi^2=14.47$
		2.10%	14.70%	24.20%	30.50%	28.40%	$p=0.006^*$
	Female	4	14	4	29	11	
		6.50%	22.60%	6.50%	46.80%	17.70%	
	Total	6	28	27	58	38	
		3.80%	17.80%	17.20%	36.90%	24.20%	
Specialty	Oral surgeon	5	10	15	24	17	$\chi^2=6.053$

		7.00%	14.10%	21.10%	33.80%	23.90%	p=0.195 (ns)
	Orthodontist	1	18	12	34	21	
		1.20%	20.90%	14.00%	39.50%	24.40%	
	Total	6	28	27	58	38	
		3.80%	17.80%	17.20%	36.90%	24.20%	
Job title	Professor/ consultant	0	5	2	12	17	χ ² =20.42
		0%	13.90%	5.60%	33.30%	47.20%	p<0.009*
	Registrar/ specialist	2	13	8	21	11	
		3.60%	23.60%	14.50%	38.20%	20.00%	
	Lecturer/ resident	4	10	17	25	10	
		6.10%	15.20%	25.80%	37.90%	15.20%	
	Total	6	28	27	58	38	
		3.80%	17.80%	17.20%	36.90%	24.20%	
Graduation year	Before 1989	0	1	3	2	1	χ ² =26.37
		0%	14.30%	42.90%	28.60%	14.30%	p=0.010*
	1990-1999	2	3	6	8	0	
		10.50%	15.80%	31.60%	42.10%	0%	
	2000-2009	3	11	13	15	11	
		5.70%	20.80%	24.50%	28.30%	20.80%	
	2010-2019	1	13	5	33	26	
		1.30%	16.70%	6.40%	42.30%	33.30%	
	Total	6	28	27	58	38	
		3.80%	17.80%	17.20%	36.90%	24.20%	

*, significant; †, highly significant; ns, not significant.

Regarding the question “Do you believe that the eruption of third molars causes relapse of anterior teeth following orthodontic treatment?”, almost three quarters of the respondents answered no, and only age and job title emerged as significant factors (p<0.05) (Table 1). In our sample, about three quarters answered no to the question “Do you advocate/recommend a cause-and-effect relationship between anterior teeth crowding and eruption of third molars” (Table 1). None of the five examined factors were found to be significantly related to the respondents' answers to this question (all P>0.05).

Slightly more than three quarters of the respondents overall (76.4%) indicated that they do not recommend or apply in their practices the prophylactic removal of impacted third molars to prevent CAT (Table 1). Age, job title, and year of graduation were found to be significantly related to answers to this question (all P<0.05). Interestingly, about four fifths of the respondents indicated that their opinion regarding prophylactic TME was supported by scientific evidence that they have seen, with none of the five examined factors having a significant influence on the responses (all P<0.05; Table 1).

When presented with the question regarding the scenario in which prophylactic TME to prevent CAT was justified, the most common answer, representing a slight overall majority, was to indicate that there was no relationship of TME with CAT and thus no justification. Of the four justifications proposed, an effect of impaction on mesial drifting was the most frequently selected, but only by about a quarter of the respondents. Only age and gender (both P<0.05) were found to have a significant influence on respondents' answers (Table 1).

For the question asking whether type of impaction plays a role in determining whether third molars affect CAT, the respondents were fairly evenly split across the answers agree, neutral, disagree, and strongly disagree, with relatively few choosing the strongly agree response. Age, gender, and year of graduation were significant factors in the responses to this question (all P < 0.05) (Table 1). For the associated question asking which impaction type is the most consequential, a majority of the study participants who felt that impaction type mattered selected horizontal impaction, followed by mesio-angular impaction. None of the five examined factors had a

significant influence on the responses to this question (all $P < 0.05$; Table 1).

Nearly three quarters of the respondents indicated that they did not believe that the width of third molars and its relation to the ramus were related to CAT, and none of the examined five factors had a significant influence (all $P > 0.05$) (Table 1). Regarding the decision-making with respect to whether to recommend prophylactic TME to prevent CAT, about one third of the sample, indicated that they do not make this recommendation in their practices (Table 1). A similar percentage indicated that they base such recommendations on scientific evidence. Only specialty ($P < 0.001$) was found to have a significant influence on respondents' answers (Table 1). As shown in with Figure 3, orthodontists (41.9%) were far more likely than oral surgeons (23.9%) to indicate that they do not recommend prophylactic TME to prevent CAT. Conversely, oral surgeons (19.7%) were far more likely to proceed with recommending TME than orthodontists (1.2%) on the basis of a referral (Figure 3).

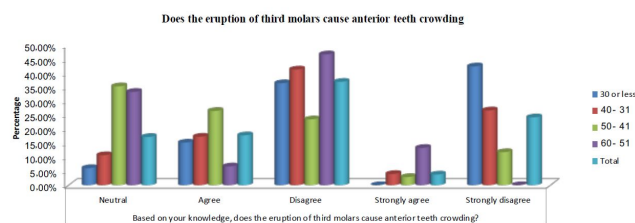


Figure 1: Summary of respondents' answers to the question "Based on your knowledge, does the eruption of third molars cause anterior teeth crowding?" according to age group. Age was found to have a significant influence on this belief ($P < 0.001$).

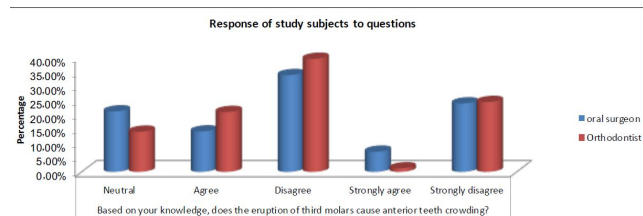


Figure 2: Summary of respondents' answers to the questions "Based on your knowledge, does the eruption of third molars cause anterior teeth crowding?" according to specialty. Specialty was not found to have a significant influence on either of these questions (both $P > 0.05$).

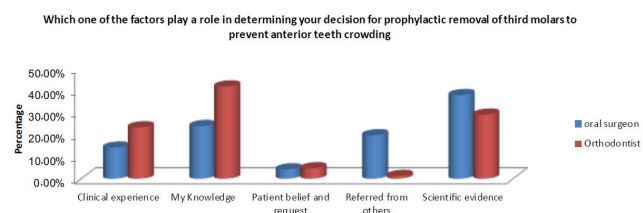


Figure 3: Summary of respondents' answers to the question "Which one of the factors play a role in determining your decision for prophylactic removal of third molars to prevent anterior teeth crowding?" according to specialty. Specialty was not found to have a significant influence on this question ($P > 0.05$).

DISCUSSION

According to the present results, the opinions of oral surgeons and orthodontists in city of Riyadh were in agreement with guidelines provided by NICE and SIGN (Scottish Intercollegiate Guidelines Network) with respect to not favoring asymptomatic TME to prevent CAT [15,19].

Regarding the principal question as to whether third molar eruption causes CAT, age, gender, title, and graduation year were all found to be significant factors, whereas specialty was not. Indeed, specialty was not found to be a predominant factor in decision making related to prophylactic TME in our sample overall, with the exception of oral surgeons being more likely to make such judgments based predominantly on referrals.

The present findings showing pronounced effects of age on oral surgeons' and orthodontists' opinions regarding prophylactic TME to reduce risk of CAT fit well with Gavazzi et al. [16] suggestion that older practitioners were more likely to believe in and recommend prophylactic TME. This trend was dramatic in our analysis of percentages of dental professionals that recommend prophylactic TME, which included 26.7% of respondents who were 51 years old or older.

Although not as strongly significant an influence as age, we found a similar trend in relation to graduation year, with recent graduates (especially 2010–2019) giving less credence to the precept that third molar eruption leads to CAT and being less likely to recommend (11.5%) prophylactic TME than those that graduated decades ago. These trends may reflect younger dentists responding to the emergence of guidelines that counsel against prophylactic TME and the publication of more recent studies that have not supported a cause-and-effect relationship between third molars and CAT.

Lindauer et al. [14] found that the portion of dentists who recommended prophylactic extraction was the highest amongst graduates in the 1980s, with lower portions of respondents doing so among both earlier and later graduates.

However, these differences were not statistically significant. Furthermore, they reported similar percentages of dentists who believe that third molar eruption leads to CAT and who recommend prophylactic CAT across gender groups [14]. However, the pattern of results related to gender in our study did not reflect clear differences in views per se.

In agreement with Gavazzi et al. [16], both specialist groups in our sample tended to not agree that third molar eruption causes CAT; however, unlike Gavazzi et al. [16], we did not find significant separation between oral surgeons' and orthodontists' views related to prophylactic TME. In a 2019 study conducted in India, Kannan et al. [20] found that a sizable majority of dental professionals (~73%) in their sample recommend TME in the mandible to reduce the risk of CAT, with no significant differences among eight specialties. On the contrary, in a 2007 study conducted in the USA, Lindauer

et al. [14] found that oral surgeons were significantly more likely than orthodontists to believe that forces generated by erupted third molars cause CAT, especially in the mandible. In 2009, Fekci et al. [21] found that American and Swedish orthodontists did believe that erupting lower third molars exert an anterior force, but even so, they simultaneously believed that they “rarely” or “never” cause CAT and thus did not recommend prophylactic TME.

A majority of those who felt that impaction type was a determining factor, indicated that horizontal impaction was most consequential for causing CAT, followed by mesio-angular impaction. The evidence in the literature regarding this question remains inconclusive. Both Gökçe et al. [22] and Hasegawa et al. [23] did not find significant associations of lower third molar angulation with severity of CAT. In contrast, Selmani et al. [24] described a strong relationship of the angulation and positioning of third molars with lower arch crowding. Meanwhile, Wei et al. [25] reported findings suggesting that third molar impaction of all orientations could lead to mandibular CAT, with the mesio-angular orientation being associated with the highest percentage of impaction. A substantial majority of respondents in our sample indicated that they did not believe that risk of CAT was related to the third molar width-to-ramus relationship, and to the best of our knowledge, such a relationship is not supported in the literature.

Most of the respondents in the present study sample indicated that they had seen scientific evidence that supports their opinions related to prophylactic TME. It bares underscoring that when asked what circumstances justify proceeding with prophylactic TME to prevent CAT, about half as many (26.1%) indicating that they believed that the presence of impacted third molars may exert mesial pressures that favors crowding, as was originally postulated in 1962 by Vego². In the last decade a study have indicated that although teeth do tend to drift mesially over time naturally, third molars play only a very minor part in this movement in late adolescence, with other factors, such as residual growth, being far more important factors in this movement [26,27]. A review study examining multiple variables indicated that mandibular CAT was associated with numerous factors, including dental factors (tooth crown size, primary tooth loss, and periodontal condition), skeletal factors (malocclusion, soft tissue growth, and jaw growth), and general factors (age, gender, race, and opposite teeth) [27]. The authors of the review concluded that third molars do not cause CAT, but rather that they represent one potential factor among many that together influence CAT [27].

This study has the notable limitation of having a relatively small sample size. A larger sample size may provide more accurate results. Accordingly, it is possible that statistically significant differences between the views of oral surgeons and orthodontists would emerge in a study with more power. Secondly, all of the respondents had practices in Riyadh. Thus, it is unknown

whether these findings would generalize to other regions of Saudi Arabia or to other countries.

CONCLUSION

The vast majority of oral surgeons and orthodontists in Riyadh do not favor prophylactic TME to prevent CAT, though nearly a quarter do recommend prophylactic TME, especially oral surgeons who have received a referral for this purpose. Referral for prophylactic TME is a subjective health practice. The authors of the present study suggest that efforts should be made to improve regular patient check-ups wherein TME is recommended principally in response to the development of symptoms. Furthermore, oral surgeons and orthodontists should evaluate indications for asymptomatic TME carefully, weighing the potential benefits and risks.

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