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A web-based survey on the use of bonded molar tubes among Iraqi orthodontists

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Aim: This study was conducted to investigate the pattern and reasons for use and protocol of placement of buccal molar tubes among Iraqi specialist orthodontists.
Materials and methods: The members of Iraqi orthodontic society were invited to fill a web-based questionnaire. Responses were collected and analyzed by statistical software to obtain the frequency and percentage for each question.
Results: The response rate was 82%. About 74% of respondents preferred single hole molar buccal tubes that were used either on both molars or first molars only. The use of buccal molar tubes was adopted by 74% of respondents in the preceding decade. Iraqi orthodontists preferred molar tube holder and the use of direct technique during bonding. Buccal molar tubes were used widely in favor of the molar bands.
Conclusion: Buccal molar tubes are preferred by Iraqi orthodontists over the bands. The participants preferred handling them with a specialized molar tube holder and bonding directly on the buccal surface of the first and second molars using etching and bonding technique with the same a light-cured primer and adhesive that used for bonding orthodontic brackets.

Key words: Bonded molar tubes, fixed orthodontic appliance, survey

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Introduction

The molar teeth, commonly the 1st permanent molar, are the teeth at which the fixed orthodontic appliance terminate posteriorly either in the form of cemented molar band or a bonded molar tube. [1] The advent of enamel bonding techniques and later on the emergence of indirect bonding method encouraged the use of bonded molar attachments. [1,2]

In order to reduce the treatment duration, orthodontic attachments should have a low failure rate, and because of that, the molar teeth are preferred to be cemented with bands particularly with using micro-etching method, progress in the band designs, and with less sensitive cementation technique. [1-5]

Recent advancements in adhesive science and improvements in the features of the buccal molar tube, such as the mesh designs [6-8] has led to improved survival rates and a more common application of bonding attachment. [1,2,9] Furthermore, patient age,[10] treatment mechanic [11] and occlusal stress [12] are considered as additional issues that may impact the attachments failure rate. [9]

Although the evidence [1,9] revealed that bands are more preferred than tubes, the clinician usually reported differently in regard to their preference the tubes over the bands. [2]

To the best of the authors knowledge, there is no study that assessed systematically the pattern and reasons of use of buccal molar tubes by Iraqi orthodontists specialists, hence this is the first study in Iraq and the second in the world that aimed to explore the reasons for the use and the protocol of bonding the buccal molar tubes by Iraqi specialist orthodontists.

Materials and methods

The procedure and protocol of the present study were approved by the scientific and ethical committees at the College of Dentistry, University of Baghdad and in accordance with the Helsinki Declaration for human research studies.

The target sample for this cross-sectional study was the members of the Iraqi orthodontic society. A web-based questionnaire (Google form) was designed, piloted, modified, and then re-piloted and sent to the registered members of the Iraqi Orthodontic Society via phone apps like Telegram, Messenger and WhatsApp during the period from the first of March to end of June 2023 when there were no further responses after recurring reminder. The questionnaire of this survey was adapted from an earlier study conducted by Murray et al. [2] in UK, and it was adjusted to include additional aspects.

The questionnaire included three sections with 18 questions involving tick-box options, comprising the following sections: demographics, pattern and reasons for use and techniques for their placement.

The size of the sample was measured using SurveyMonkey, where the population size was 150, representing the current total number of Iraqi orthodontists registered to the society, and with a confidence interval of 95% and a margin of error of 5, the estimated sample size was 109 participants. However, the final sample size who responded was 121 participants with represents approximately 82% of the total registered Iraqi orthodontists at the society.

Frequency distribution and percentage of the responses were obtained with the aid of SPSS software.

Results

The demographic data were presented in Table 1. The female participants were higher than males (54%) and the majority of them were above 30 years old. About 69% of the respondents had more than 5 years' experience in orthodontics. In terms of the duration for which the participants utilized buccal molar tubes, the findings revealed that

all respondents (except one) presently bond buccal molar tubes, with 74% of them having adopted this technique in the past ten years.

Table 1: Demographical data of the participants

Parameters		N	%
Gender	Males	56	46
	Females	65	54
	Total	121	100
Age	< 30 years	13	11
	30-40 years	60	50
	≥40 years	48	40
	Total	121	100
Year of practicing orthodontics	<5 years	38	31
	≥5 years	83	69
	Total	121	100
No. of years using molar tubes	0- 2	12	10
	2-4	33	27
	4-6	27	22
	6-8	15	12
	8-10	15	12
	> 10	19	16
	Total	121	100

The use of buccal molar tubes among the respondents was presented in Table 2.

Table 2: Frequency and percentage of responses regarding the pattern and reasons for using buccal molar tubes among participants

Usage of buccal molar tubes		N	%
What is/are the types of the most commonly used molar tubes in your practice?	Single tube bonded molar tubes	90	74
	Multiple tubes bonded molar tubes	13	11
	Convertible bonded molar tubes	7	6
	Non-convertible bonded molar tubes	9	7
	Never use molar tube	1	1
	Not stated	1	1
	Total	121	100
On which molar you usually use bonded tube?	1st molar	28	23
	2nd molar	4	3
	Both	88	73
	Not using bonded molar tube	1	1
	Total	121	100
When did you bond 2nd molar?	Always	44	36
	Arch expansion	11	9
	Deep bite cases	26	21
	When using inter-maxillary elastics	13	11
	Rotated or malposed 1st molar	24	20
	Never bonded it	3	2
	Total	121	100

The most commonly type used was single hole tube (74%), followed by multiple holes tubes (11%), and nearly equal percentage in using the convertible and non-convertible one.

Bonded molar tubes are preferred by almost all the respondents, with the majority (73%) using them on both 1st and 2nd molars, while 23% prefer to bond only the 1st molar. The most clinical situations in which bonding 2nd molars were preferred including deep bite correction (21%) followed by managing rotated or malposed 1st molar (20%), and then cases where inter-maxillary elastics were used (11%).

Bonding techniques of the buccal molar tubes were presented in Table 3. A direct bonding technique was used by almost all clinicians (96%) for placing buccal molar tubes, with the low suction saliva ejector as the preferred method for isolation control during bonding (50%), followed by high volume suction (28%) and cotton wool rolls (20%). Approximately half of the respondents (55%) favored to bond the buccal molar tubes firstly before the brackets, and the upper right side was preferred to begin with before the other sides. The majority of clinicians used light cured primer (81%) and the same composite used for brackets bonding (89%).

Molar tube holder was the preferred tool for holding the molar tubes (73%) followed by the bracket holder instrument (25%). To guide their placement in vertical plane, most of clinician used the mid vertical point of buccal surface (44%), while others depended on occlusal plane (28%) or marginal ridge height (21%). In mesio-distal dimension, 54% of the clinician depends on mid-point of the buccal groove, followed by cup tips (23%) and fitness of base pad (17%). Concerning the angulation, the long axis of clinical crown was used by the majority (60%), followed by occlusal plane (26%) and marginal ridge (12%). Placement of molar

bands took more time (>90 sec) compared with bonding molar tubes (<60 sec).

Placing bite turbo was the preferred method (58%) for avoiding the occlusal interferences with the tubes, followed by the placement them more gingivally (31%). The bonding failure occurs most commonly at leveling and alignment stage (56%) followed by space closure (18%) and overbite reduction (17%) stages.

Table 3: Frequency and percentage of responses regarding the bonding protocol of the buccal molar tubes

Protocol of bonding buccal molar tubes		N	%
Which technique you commonly used for bonding molar tube?	Direct bonding technique	116	96
	Indirect bonding technique	0	0
	Both	4	3
	Never use it	1	1
	Total	121	100
What is your preferred isolation method during molar tube bonding?	Cotton wool roll	24	20
	High volume suction	34	28
	Low suction saliva ejector	60	50
	Never use molar tube	1	1
	Not stated	2	2
	Total	121	100
What is your usual protocol of bonded attachment placement?	Bonding the brackets firstly	26	21
	Bonding the tubes firstly	67	55
	Never use it	1	1
	Not specific	27	22
	Total	121	100
What is your usual protocol of bonded tube placement?	Beginning with the lower arch firstly	24	20
	Beginning with the upper arch firstly	70	58
	Never use it	1	1
	Not specific	26	21
	Total	121	100
What is your usual protocol of bonded tube placement?	Beginning from the left side	32	26
	Beginning from the right side	49	40
	Never use it	1	1
	Not specific	39	32
	Total	121	100
What is the composite type you using for bonding molar tube?	Same Light cured composite used for brackets bonding	108	89
	Light cured composite different from that used for bracket bonding	10	8
	No mix composite	2	2
	Never use molar tube	1	1
	Total	121	100
What instrument do you use for holding molar tube during placement?	Bracket holder	30	25
	Dental tweezers	1	1
	Molar tube holder	88	73
	Mosquito	1	1
	Never use molar tube	1	1
	Total	121	100
What is your guide for placement of bonded tubes in the vertical plane?	Marginal ridge height	26	21
	Mid vertical point of the buccal surface	53	44
	Never use molar tube	1	1
	Not stated	7	6
	Occlusal plane	34	28
	Total	121	100
What is your guide for placement of bonded tubes in the mesio-distal dimension?	Best fit of the base pad	21	17
	Cusp tips	28	23
	Mid-point of the buccal groove	65	54
	Never use molar tube	1	1
	Not stated	6	5
	Total	121	100
What is your guide for angulation/tip of bonded tubes?	Long axis of the clinical crown	73	60
	Marginal ridges	14	12
	Occlusal plane	31	26
	Not stated	2	2
	Never use molar tube	1	1
	Total	121	100
How much time did you approximately expend on placement of individual molar tube?	< 30s	24	20
	30s - < 60s	62	51
	60s - 90s	32	26
	> 90s.	2	2
	Never use it.	1	1
	Total	121	100
How much time did you approximately expend on placement of individual molar band?	<30s	6	5
	30s - < 60s	34	28
	60s - 90s	31	26
	> 90s	44	36
	Never use it	6	5
	Total	121	100
In case of the presence of occlusal interference to the bonded tube, how do you usually manage it?	Changing position of molar tube more gingivally	37	31
	Placing bite turbo	70	58
	Postponed its bonding to the subsequent appointments	8	7
	Not stated	3	2
	Ignore it	1	1
	Never use molar tube	2	2
	Total	121	100
At which stage of treatment do molar tube failure most commonly occurred?	Leveling and alignment	68	56
	Space closure stage	22	18
	Over bite reduction	21	17
	Finishing stage	9	7
	Never use molar tube	1	1
	Total	121	100

Discussion

To the last ten years ago, molar bands were more popular than molar buccal tubes. This study was considered the first in Iraq and the second in the world that evaluate the pattern and reasons of use of buccal molar tubes by Iraqi specialist orthodontists. The response rate of was 82% which considered higher than reported by Murray et al. [2] Among 121 orthodontists participated, only one orthodontist did not use buccal molar tubes. This could be explained by the availability of different brands of buccal molar tubes last years and to decrease the incidence of white spot lesions and gingivitis associated with the use of molar bands.

The majority of the respondents (74%) used the single hole buccal molar tubes against 11% used the double one. This may

be attributed to the availability of double holes tubes or the nature of malocclusion that not required an auxiliary tube and archwire. The same is true for the type i.e. convertible and non-convertible.

About 73% used buccal molar tubes on the first and second molars. This percentage was higher that reported in the previous study. [2,13] Bonding the second molars tubes was used mostly in deep bite correction followed by managing rotated or malposed 1st molar and to a little extent where inter-maxillary elastic was indicated. However, they may not always be included in treatment due to difficult access, variable angulation and crown morphology in addition to the variation in treatment mechanics [14].

In accordance with other studies, [2,13] direct bonding was the principle method of bonding molar tubes. This method is easy, teeth can be accessed easily and dry field can be gained via low suction saliva ejector. As a sequence in bonding orthodontic attachments, 55% preferred bonding the buccal tubes before the brackets as orthodontists may feel tired and may lose concentration when postponed the bonding of the tubes after the brackets. Moreover, starting from the right side of the maxillary arch was mostly apparent among the participants.

Light-cured composite, the same that used in bonding orthodontic brackets, was used by the majority of respondents as it had fast setting time and good strength against debonding. This comes in agreement with Murray et al. [2]

Just like the findings of Murray et al. [2] study, holding (grasping) buccal tubes was done by molar tube holder that facilitate the grasping and bonding of these tubes specially in less accessible areas in patients with fatty cheeks or small mouth opening.

Regarding the correct positioning of the buccal tubes vertically and mesio-distally, the mid-vertical point of the buccal surface and occlusal plane for the vertical positioning and the cusp tips and the mid-point of the buccal groove for mesio-distal positioning were mostly used by the orthodontists.

Concerning the angulation/tip positioning, in contrary to Murray et al. [2] study findings who found that the marginal ridges were used by the majority of their respondents, the preponderance in the current study used the long axis of the clinical crown and the occlusal plane for this purpose applying the MBT guidelines of bonding the molar tubes.

Analyzing the time of bonding molar tubes and cementing molar bands revealed that bonding the molar tubes took less time and did not need different sizes to fit all molars.

To solve the problem of occlusal interference, the responses were just like Murray et al. [2] study preferred either applying bite turbo or changing the position of the tube gingivally. The latter needs adjusting wire bending to prevent further extrusion of the molars.

In a recent clinical trial, adding a layer of compomer adhesive at the molar/tube interface did not reduce the bonding failure of the buccal tubes. [15] Changing the design of the mesh pad, bonding technique, adhesive types and patients' cooperation may reduce the bond failure. [16] Moreover, using special bond like Assure-plus or other adhesive may enhance the bond strength and decrease the bond failure even with non-enamel surface. [17]

The highest bonding failure reported by the participants was in the aligning and leveling and space closure stages as the patients are not familiar with the appliance and may eat hard food that debond these tubes or heavy force may be exerted by the heavy gauge stainless steel arch wire if the alignment was not good.

This investigation validates the prevailing trend among specialized orthodontists to choose buccal molar tubes over molar bands. Therefore, it offers valuable data for making comparisons in future studies on these connections. Improving the failure rate and

developing technologies to facilitate easier placement are expected to increase the use of them in routine fixed appliance orthodontic treatment.

Conclusions

Iraqi orthodontists favored buccal molar tubes over bands, handled with a specialized molar tube holder and bonded directly on the buccal surface of the first and second molars using the same light-cured primer and adhesive that used for bonding orthodontic brackets.

The mid vertical point of the buccal surface, mid-point of the buccal groove and the long axis of the clinical crown were used as indicators in positioning the buccal tubes.

Ethics approval: It was gained from the ethical committee at the College of Dentistry, University of Baghdad with reference number 73 in 10-1-2023.

Competing interest: The authors declare that there is no conflict of interest.

Data availability: The data are available on request from the corresponding author.

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