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Variation in bracket slot sizes, ligation methods and prescriptions

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Variation in Bracket Slot Sizes, Ligation Method and Prescriptions Used By Specialist Orthodontists in the United Kingdom: UK National Survey

Abstract

This study investigated the use of fixed bracket slot sizes, ligation method and prescriptions in the UK using an online survey/questionnaire comprised of seven questions. The questionnaire link along with an explanation of its nature was circulated via the British Orthodontic Society (BOS) to all 978 Specialists in Orthodontics. Two subsequent email reminders were sent to non-responders. Chi-square analyses determined the statistical differences in the use of bracket slots and prescriptions according to the region of practise and years of experience. The respondents represented 31.2% of the UK specialist orthodontists. Most of the respondents practised in the South of England with experience between 11-30 years. The vast majority of the respondents routinely used brackets with the MBT prescription (81.6%) and 0.022-inch slot size (98.7%), which was statistically significantly higher for all geographical regions and experience levels ($P < 0.001$). The majority of the respondents reported either 100% or 90% use of conventional brackets when compared to self-ligating brackets. In conclusion, the vast majority of UK specialist orthodontists use conventional ligating MBT prescription brackets with the 0.022-inch slot size. This was primarily because they perceive this combination provides better treatment outcomes, whilst many respondents also indicated they were taught and trained using this combination and that there was not enough evidence to support a change in their clinical practice.

Keywords: British Orthodontic Society, bracket slot size, bracket prescription.

Introduction

Different types of bracket slots (0.018-inch and 0.022-inch), prescriptions (Andrews, Roth, MBT, or others) and ligation methods (conventional or self-ligating) are used in clinical practice and there are no logical reasons for appliance selection since there is insufficient published scientific evidence on this topic. Keim et al¹⁻⁶ have conducted a series of comprehensive surveys in the United States on orthodontic diagnosis and treatment procedures which show an increase in the popularity of the MBT bracket prescription and the 0.022-inch slot size with time, whilst older practitioners are more likely to use Roth prescription and 0.018-inch slot brackets whereas younger practitioners increasingly use the MBT prescription and 0.022-inch slot brackets.

A survey undertaken in the United Kingdom by Banks et al. (2010)⁷ is the first UK published data that documents service delivery for orthodontics in clinical practice. The study included a variety of settings, degree of experience and six different geographic regions in the UK. The results revealed that UK respondents expressed a preference for the MBT bracket prescription (46.9%) followed by Roth (41.0%) and only a few of the respondents used the Andrews prescription (9.0%). In regard to slot size, the overwhelming preference was for the 0.022-inch slot (91.2%). Regarding the influence of clinician experience on their preferences their results were similar to that of Keim et al,¹⁻⁶ where more senior clinicians (30+ years qualification) preferred the 0.018-inch bracket slot, whilst recently qualified clinicians tended to use the 0.022-inch slot and MBT prescription.

McNamara et al. (2010)⁸ found that 99% of UK respondents prefer the 0.022-inch bracket slot which is close to the finding from Banks et al. (2010).⁷ However, the number of participants was lower. Both of the UK surveys were at variance with the claim of Rubin (2001),⁹ who stated the slight majority of US clinicians use 0.022-inch slot, while the vast majority in Europe use the 0.018-inch slot.

As surveys have revealed a dynamic change in clinical practice over time, it is important to investigate how current orthodontic clinical practice in the UK is evolving. Therefore, the objective of this survey was to investigate the trends within routine orthodontic practice regarding the use of a particular bracket slot, ligation method and the variation in prescriptions among specialist orthodontists throughout the United Kingdom.

Method of Investigation

The survey was designed to identify the distribution of bracket slot, ligation methods and prescriptions used in routine orthodontic practice throughout the UK.

The survey was anonymous and sent to all 978 specialist orthodontists in the UK, with an explanation of the nature of the survey inviting them to participate (Figure 1). In order to maximise the response rate, two email reminders were sent.

Survey Design

The survey was divided into seven questions as follows:

1. *Location of Practice*: the options were subdivided according to the main geographic regions within the UK; North of England, Midlands, South of England, Scotland, Wales, and Northern Ireland.
2. *Number of Years in Orthodontic Practice*: the options were subdivided into four categories; 1-10, 11-20, 21-30, and 30+ years.
3. *Specialist List for Orthodontics*: the options determined whether the participant was registered on the UK Specialist List for Orthodontics or not.
4. *Bracket Prescription*: this question reflected the orthodontist's preference for bracket prescription. The options were; Roth, MBT, and other.
5. *Bracket Slot Size*: this question identified the bracket slot size routinely used by the orthodontist. The options were; 0.018-inch and 0.022-inch slots.
6. *Reason for Use of the Bracket Slot Size*: this question was designed to determine the reason for using the specific bracket slot. The options were; shorter treatment time, better outcomes e.g. overbite/torque control, ease of wire bending, reduced biological side effects, and the last option was an open-ended question 'other (please specify)' in case there is an additional reason not mentioned in the list.
7. *Proportion of Conventional versus Self-ligating Cases*: this question was designed to identify the percentages of conventional versus self-ligating cases undertaken and the answers ranged from 0% conventional/100% self-ligating to 100% conventional/0% self-ligating.

Statistical Analysis

The data were analysed using the Statistical Package for Social Sciences for Windows, version 22.0 (SPSS Inc., Chicago, Illinois, USA). Descriptive statistics and percentages were calculated for the whole survey. Chi-square analyses were used to determine the statistical differences in the

use of bracket slots, ligation methods and prescriptions according to the regions and years of experience.

Results

The total number of respondents was 305, which represents 31.2% of the of specialist orthodontists in the UK.

Location of Practice

The majority of the respondents practised in the South of England (45.1%) followed by respondents from the North of England (22.7%), Midlands (13.5%), Scotland (10.5%), Wales (4.3%), and Northern Ireland (3.9%) (Table 1, Figure 2). The total number of respondents that answered this question was 304, while one failed to answer this.

Number of Years in Orthodontic Practice

Orthodontists with 11-20 years of orthodontic practice represented the highest percentage of respondents (36.4%), followed by orthodontists with 21-30 years (25.9%), 1-10 years (20.0%), and 30+ years of practice (17.7%). All the 305 respondents answered this question (Table 1).

Bracket Prescription

The survey revealed that 81.6% of the respondents used the MBT prescription, while the Roth prescription represented 14.1% and other prescriptions accounted for 4.3% of routine practice use. No respondent failed to answer this question (Table 1).

Bracket Slot Size

The vast majority of the respondents (98.7%) used the 0.022-inch slot bracket, whereas only four respondents (1.3%) used a 0.018-inch slot bracket system. Two respondents did not answer this question (Table 1).

Rationale for Bracket Slot Size Use

More than half of the respondents (59.5%) reported that they used a particular bracket slot because of perceived improved outcomes e.g. overbite/torque control. Within this group, only one was a user of the 0.018-inch slot, while the 0.022-inch slot users totalled 178 orthodontists. Ease of wire bending was a reason for using 0.022-inch slot systems for 4.3% of the respondents. A reduction in biological side effects was a reason for 3.7% of respondents. Of these, three respondents were users of the 0.018-inch slot and eight respondents were 0.022-inch slot users. Shorter treatment time was only a reason for using 0.022-inch slot bracket by one respondent (0.3%) (Table 1). Ninety seven respondents who used 0.022-inch slot brackets, comprising 32.2%, chose the 'other reason' option which is an open-ended question, thereby their answers were collected and categorised into four main reasons (Table 1). The most common reason was 'Taught and Trained' and it represented 56.7% of the answers. The second group of answers was categorised as 'Better Control' and represented 27.8%. Ten of the respondents (10.3%) used the 0.022-inch slot because there was no other option available in their workplace, so they were categorised as 'No Choice'. While 5.2% did not specify their reason when they chose the 'other reason' option and thus they were categorised as 'No Specific Reason'. Four respondents did not answer this question.

Proportion of Conventional Versus Self-Ligating Brackets

The majority of the respondents reported either 100% (47.5%) or 90% (33.8%) use of conventional brackets. A smaller group (2.3% and 2.0%, respectively) of the respondents used 100% and 75% self-ligating brackets (Table 1).

Distribution of Bracket Slot Size

According to the results of this survey, the number of users of 0.022-inch slot bracket system was significantly higher in all the regions of UK than users of 0.018-inch slot bracket system. Orthodontists who used the 0.018-inch slot were two in South of England, one in the Midlands, and one in Scotland. Additionally, there was significantly higher number of orthodontists using a 0.022-inch slot system compared to those using 0.018-inch slot brackets in all categories of orthodontic experience. The users of 0.018-inch slots were divided as two respondents with 11-20 years and two with 30+ years of orthodontic practice. The results showed that three of the 0.018-inch slot bracket users (1.0%) used the MBT bracket prescription, while only one (0.3%) used the Roth prescription. There were no respondents in the 'other bracket prescription' users group who preferred the 0.018-inch slot system. All other respondents used the 0.022-inch slot bracket; 80.8% MBT, 13.5% Roth, 4.3% other prescriptions (Table 2).

Distribution of Bracket Prescription According to Location of Practice

In all the six regions within the UK the MBT system was the dominant prescription used by the respondents compared to the Roth and other prescriptions. The highest percentages of Roth and other prescriptions users were in the South of England (Table 3, Figure 3). The MBT prescription had the highest percentages of users in all categories of orthodontic experience (11-20, 21-30, 1-10, and 30+ years, respectively). The highest percentage of Roth users was in the 21-30 years of experience group followed by 11-20 years, 30+ years, and 1-10 years groups, respectively. Other prescriptions were used mainly by orthodontists who had 30+ years of experience (Table 3, Figure 4).

Statistically significant higher percentages of the 0.022-inch slot and MBT bracket systems in different locations of practice and years of experience were found ($P < 0.001$).

Discussion

This survey was conducted to provide a current view of the clinical orthodontic practice within the UK in order to determine if this is evolving in a similar manner to the USA. Two reminders were sent to maximise the response rate. Whilst this was reasonable at 31.2% for an online survey and substantially higher than that by Keim et al. (2002a, 2008a, and 2014a)^{1,3,5} with response rates of 9.0%, 7.7%, and 1.9%, respectively, it was lower than 66.3% by Banks et al. (2010)⁷ and 92.6% by McNamara et al. (2010).⁸ This may be related to the difference in the method of administration and the number in the included sample. Keim et al. (2002a, 2008a, and 2014a)^{1,3,5} and Banks et al. (2010)⁷ sent their survey by post to 8,812; 10,523; 10,688 and 935 potential participants, respectively. The high response rate achieved by McNamara et al. (2010),⁸ is likely to be due to the questionnaires being personally handed to only 108 clinicians, followed by telephone calls to those who did not respond. The current survey was sent as an email which might be easily overlooked by the respondents reducing the response rate.

The pattern of response rate from the highest was; South of England, North of England, Midlands, Scotland, Wales, and Northern Ireland. The pattern in the survey by Banks et al.

(2010) was; South of England, North of England, Scotland, Midlands, Northern Ireland, and Wales. These patterns were comparable and might reflect the distribution of orthodontists within the UK. All the respondents in the current survey were specialist orthodontists and the highest proportion had 11-20 years of experience (36.4%), while the lowest had been working for 30+ years (17.7%).

The results revealed that the MBT prescription is the most popular bracket in routine clinical use (81.6%) followed by the Roth (14.1%) and other prescriptions (4.3%). This finding was in contrast to that of Keim et al. who found the most commonly used brackets in the US were the Roth prescription followed by standard edgewise brackets, while the preference for the MBT prescription was only 6.6% in 2002 and 19.6% in 2008.^{1,3} However, the results were in line with the recent survey by Keim et al. (2014a)⁵ where the MBT prescription has now become the most commonly used prescription used in the US (41.0%) followed by standard edgewise (32.0%), whereas the Roth prescription was the least commonly used (31.0%). Likewise, this survey was in agreement with the UK survey by Banks et al. (2010)⁷ who found that the MBT prescription was the most popular in use (46.9%) closely followed by Roth (41.0%), whilst Andrews (9.0%) and other prescriptions (3.4%) were in the minority. Nevertheless, the percentage of MBT brackets in the survey by Banks et al. (2010)⁷ was close to that of the Roth prescription, which is different to the current survey where the difference between them is considerable. This indicates that MBT system usage is increasing.

Regarding bracket slot size, it was found that 98.7% of the respondents used the 0.022-inch slot and only 1.3% used the 0.018-inch slot. The previous surveys in the US also found the same trend (Keim et al. 2002a, 2008a, and 2014a).^{1,3,5} The percentages of use for the 0.022-inch slot brackets in the UK surveys were 91.2% (Banks et al., 2010)⁷ and 99.0% (McNamara et al. 2010)⁸. The latter is similar to the result of the current survey. The reasons for using a particular bracket slot size (which were mainly for the 0.022-inch slot) were as follows:

- *Better outcomes e.g. overbite/torque* (179 respondents): Only one of the 0.018-inch slot bracket users selected this reason as most of the respondents believed that the 0.022-inch slot brackets produce better results.
- *Taught and trained* (55 respondents): as orthodontists are mostly trained using 0.022-inch slot brackets, this has resulted in familiarity with the 0.022-inch slot and no requirement to change.
- *Better control* (27 respondents): This may be due to ease of adding auxiliaries with the 0.022-inch slot brackets and a wider range of wire sizes being available e.g. small diameter flexible wires in the initial stages and larger cross section rigid rectangular wires for surgical cases.
- *Ease of wire bending* (13 respondents): the reasoning is illogical for the 0.022-inch slot brackets as the archwires used with 0.018-inch slot bracket systems are easier to bend.
- *Reduced biological side effects* (11 respondents): although three of the four orthodontists who used the 0.018-inch slot brackets selected this option, which may be due to the lower number and lighter wire dimensions used in 0.018-inch compared to 0.022-inch slot brackets, whilst the remaining eight users of the 0.022-inch slot bracket did not explain their selection further.
- *No choice* for using different bracket slot (10 respondents): only 0.022-inch slot brackets were available.

- *No specific reason* (5 respondents): the orthodontists who selected this option did not specify why they used 0.022-inch slot brackets or they were awaiting evidence to favour one slot against the other.
- *Shorter treatment time* (1 respondent): this was selected by one orthodontist as a reason for using the 0.022-inch slot bracket.

Despite the higher preference for 0.022-inch slot bracket systems and the various reasons to justify the responses, some clinicians stated there was still insufficient evidence to support one system over the other, so they continued to use the system on which they were trained or they had not found a convincing reason to change from the 0.022-inch bracket system. Moreover, it is obvious from the results of this survey that specialty training programmes and universities in the UK mainly use 0.022-inch slot bracket systems.

The survey also found that about half of the orthodontists who participated (47.5%) use conventional brackets and did not use self-ligating brackets. Of those who did use self-ligating brackets the number of respondents decreased as the proportion of self-ligating bracket use increased. This is explainable by the fact that no scientifically-based evidence is available to favour one system against the other. Therefore, clinicians tend to maintain their 'taught and trained' method of work.

Regional Variations

The significantly higher numbers of orthodontists who used the MBT and 0.022-inch slot brackets across all six geographical regions of the UK may reflect the widespread popularity of the MBT prescription which is increasing noticeably with time. This is in accordance with Banks et al. (2010).⁷

Influence of Years of Experience

The finding that the majority of orthodontists using the 0.022-inch slot brackets is in accordance with the findings of Banks et al. (2010)⁷ and Keim et al. (2002b, 2008b, and 2014b).^{2,4,6} However, the overwhelming use of the MBT prescription at all levels of experience disagreed with previous surveys. Banks et al. (2010)⁷ mentioned that the most senior orthodontists tried to maintain their traditional way of training by using more 0.018-inch slot brackets, Andrews or Roth prescriptions, while the recently qualified orthodontists preferred the 0.022-inch slot and MBT prescription. Keim et al. (2014b)⁶ found that the routine use of Roth and Alexander prescriptions, as well as 0.018-inch slot brackets, were significantly increased with the number of years in orthodontic practice in the United States, whereas the MBT system and 0.022-inch slot brackets had generally shown the reverse trend.

Survey findings with contemporary evidence based studies

The survey findings regarding slot size revealed that clinical practise is not based on clinical research, as a recently published clinical trial has showed that both bracket slot sizes are similarly effective in terms of duration of treatment, quality of outcomes, and biological side effects.¹⁰⁻¹²

Weakness of the Study

The low response rate may have resulted in non-response bias. However, two reminders were sent to optimise the response rate.

Conclusions

This survey indicates that conventional ligating MBT prescription 0.022-inch slot size brackets are most popular in the UK. This was mainly because orthodontists perceive this combination provides better treatment outcomes, whilst many respondents also indicated they were taught and trained using this combination and that there was no evidence to support a change in their clinical practice.

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Figure Legends:

Figure 1: The online survey used in this study

Figure 2: Location of practice of the respondents

Figure 3: Bracket prescription according to location of practice