

CLINICAL
SECTION

Orthodontic retention patterns in the United Kingdom

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Objective: To determine whether retention patterns in the UK are influenced by operator gender, age or sphere of practice.

Design: Postal self-completed questionnaire.

Settings: Private practice, NHS practice, hospital practice and community practice.

Subjects: Two hundred and forty orthodontists out of 301 returned their questionnaires (80% response).

Method: Respondents were asked to report on their retention regimes for a hypothetical crowded class II division I case in the one or more practice settings they worked in.

Results: Most respondents (61%) worked in more than one practice setting. Vacuum retainers were the most commonly used type in NHS practice and hospital practice while Hawley retainers were frequently used in community practice. Vacuum retainers were also most popular in private practice though often used in conjunction with bonded retainers in both arches, particularly the mandible. Regression analysis revealed that there were no statistically significant associations between retainer preference and gender or age. However, trends were identified that suggested females were less likely to use bonded retainers in the maxilla than males, and older clinicians were more likely to use bonded retainers in the mandible than younger colleagues. Practice setting differences were found to be statistically significant ($P \leq 0.004$) with bonded retainers being more frequently used in private practice.

Conclusions: Vacuum retainers are popular in NHS, hospital and private practice. Bonded retainers are more commonly used in private practice than in other settings.

Key words: Orthodontic retention, Hawley retainers, vacuum retainers, bonded retainers, United Kingdom

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Introduction

Once active orthodontic treatment has been completed, a phase of retention is nearly always necessary to resist the tendency for teeth to return towards their original positions.^{1,2} Patients and practitioners alike are concerned about the degree of anticipated stability at the end of this stage of treatment.³ This concern is nothing new: Angle⁴ in 1907 stated that ‘the problem involved in retention is so great as to test the utmost skill of the most competent orthodontist, often being greater than the difficulties being encountered in the treatment of the case up to this point’. This challenge has led to the recommendation of ‘retention for life’.³

Methods for bonded retention have been described^{5,6} with some advocating a preference for fixed over removable retainers.⁷ The advantages and disadvantages of bonded versus removable retainers have also been studied,⁸ as have those comparing Hawley and vacuum

retainers.^{9,10} The type of retainer is now considered just as important as retention duration.⁷

Regimes for either removable or fixed retainers and for combinations of the two have been suggested by numerous authors.^{1,7,11,12} Arvystas¹³ has emphasised the importance of customising the techniques and appliances to be used for retention to the needs and expectations of patients, and recommends that both the practitioner and the patient determine the frequency of wear and duration.

Many factors have been reported as playing a role in post-treatment crowding¹⁴ but there remains a lack of evidence-base in retention strategies.¹⁵ It comes as no surprise therefore that the Cochrane Collaboration review on retention procedures² concluded ‘there are insufficient data on which to base our clinical practice on retention at present’.

Data have been published on retention procedures in Australia and New Zealand,¹⁶ and in the United

States¹⁷⁻¹⁹ but little information exists for the United Kingdom. Scant attention has been paid in the literature to other parameters such as the regimes used in different spheres of practice in the United Kingdom.

This survey aims to investigate whether retention patterns are influenced by operator gender or age, or by sphere of practice.

Method

This study adopted a postal self-completed questionnaire distributed to orthodontists practicing in the UK.

The questionnaire requested the following information:

1. in relation to participant's socio-demographic characteristics, information was collected on gender, age (option of four age groups, up to 39, 40-49, 50-59, 60+) and type of practice setting (NHS practice, private practice, hospital practice and community practice). Each respondent was also asked to state the number of hours spent working in each setting;
2. in relation to retention regime, a hypothetical crowded class II division 1 case was presented in the questionnaire to enable participants to focus on a particular type of case. Respondents were asked, 'What retainers are you most likely to use after treating a crowded class II division 1 case'. No additional information was given. It was thought that all orthodontists, regardless of any of the variables, would be treating substantial numbers of crowded class II division 1 cases. Respondents were asked about the type of retainer they would use (bonded, vacuum, Hawley type or a combination of these) in both the maxillary and the mandibular arches. They were also asked about the likely period of retention and its supervision.

Pilot testing was performed prior to the main study to ensure clear understanding of the questions included in the questionnaire. Ten orthodontists known to the authors participated in the pilot study and were excluded from the main study.

A total of 301 questionnaires were distributed to orthodontists in the United Kingdom. These were mailed by the British Orthodontic Society to a random sample of members from three of the specialist groups – the Orthodontic Specialists Group (OSG), Consultant Orthodontists Group (COG) and Community Group (CG). Every fourth name from an alphabetical list of OSG members and every second name from the list of COG and the CG members were sent a questionnaire. After 6 weeks a reminder was sent to

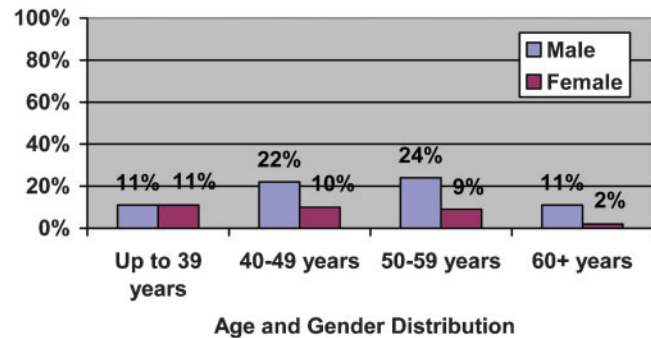


Figure 1 Distribution of gender by age groups in the sample of 240 respondents

the non-responders. The Training Grades Group, University Teachers Group and the non-specialist Practitioners Group were excluded from the study.

Data analysis included descriptive and analytical statistics using the Statistical Package for the Social Sciences Programmes (version 15.0; Chicago, IL 60606, USA). Descriptive statistics included frequency distribution and proportions. Univariate and multivariable logistic regression taking into account all the explanatory variables in the study were performed in order to investigate the role of gender, age and practice setting on the prediction of retention choice. Crude (unadjusted) and adjusted odds ratios and 95% confidence intervals were calculated. An adjusted odds ratio is used to compare the odds for two groups when results are adjusted by the other explanatory variables and is calculated by dividing the probability of an outcome to occur for the first group by the probability of this event to occur for the second group. For example, the adjusted odds ratio estimated by the logistic regression investigating the role of gender on the retention choice tells us how likely it is for female participants to prefer a specific retention choice as compared to male participants independently of their age and practice setting. A 95% confidence interval for the odds ratio is obtained by multiplying 1.96 standard errors on each side of the estimate of the odds ratio. The level of statistical significance was set at 0.05.

Results

The response rate in the study was 80% with 240 out of 301 potential participants taking part. Seventy-seven (32%) were female and 163 (68%) were male, the age and gender distribution being shown in Figure 1.

More than half of the respondents (61%) worked in more than one setting, the most common combination being NHS practice and private practice (33%). For those participants working in just one setting, the most

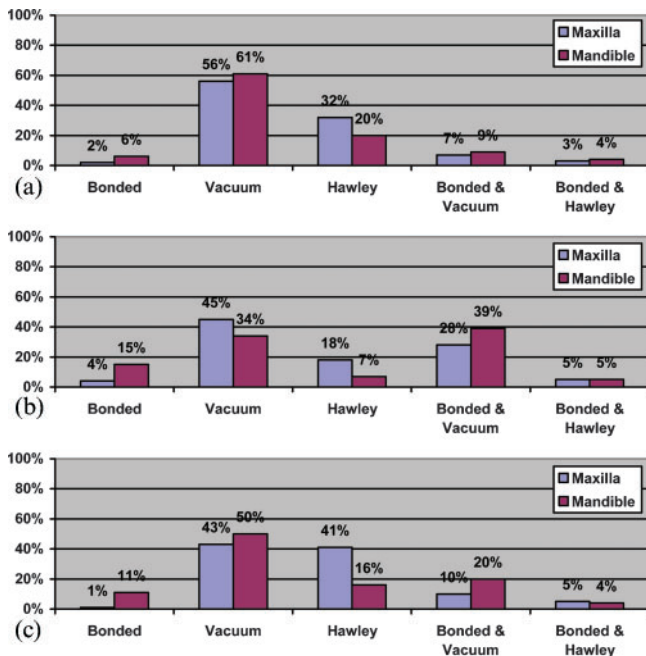


Figure 2 Retainer choice distribution by maxilla and mandible in participants working in: (a) NHS practice ($n=133$); (b) private practice ($n=148$); (c) hospital practice ($n=120$)

common was hospital practice (23%). The practice settings in which the 240 respondents worked are shown in Table 1.

The retainer choices of participants in NHS, private and hospital practice settings are illustrated in Figure 2(a)–(c). In NHS practice ($n=133$), and in hospital practice ($n=120$), vacuum retainers were the most popular choice for both the maxilla (56 and 43% respectively) and the mandible (61 and 50% respectively). In private practice ($n=148$), vacuum retainers were also the most popular choice in the maxilla (45%)

Table 1 Frequency distribution of practice setting in the sample of 240 respondents.

Setting	Frequency	%
NHS practice	18	8
Private practice	12	5
Hospital practice	56	23
Community practice	7	3
NHS & private practice	79	33
NHS & hospital practice	6	2
NHS & community practice	2	1
Private & hospital practice	29	12
Hospital & community practice	3	1
NHS & private & hospital practice	26	11
NHS & private & community practice	2	1
Total	240	100

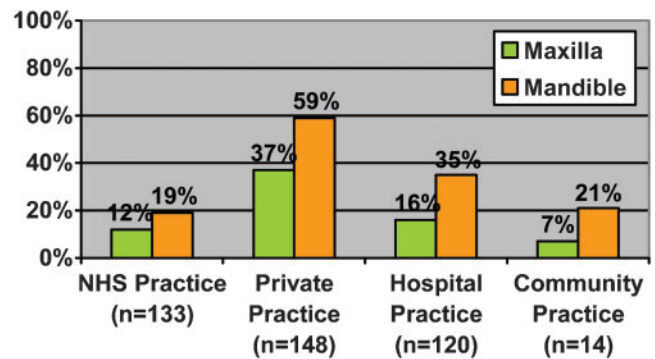


Figure 3 Use of bonded retainers, either alone or in combination with vacuum or Hawley retainers

while, in the mandible, bonded retainers in conjunction with vacuum retainers were most frequently used (39%). Finally, in community practice ($n=14$), Hawley type retainers were the most commonly used in both the maxilla (57%) and the mandible (43%). The second most popular choice in community practice was a vacuum retainer in both the maxilla (36%) and the mandible (36%).

The use of bonded retainers according to practice setting is less easily identifiable as they were frequently backed up by vacuum or Hawley retainers. Figure 3 shows that bonded retainers are far more frequently used in private practice than in other settings in both arches.

The duration of retention according to type of retainer, irrespective of practice setting, was also examined. Bonded retainers were used indefinitely in 84% of cases and between 1 and 9 years in the remainder. Full-time wear of vacuum retainers was not advocated in 51% of cases and used for 6 months or less in 45% and more than 6 months in 4% of cases. Part-time wear was indefinite in 80% of cases and between 3 months and 8 years in the remainder. Full-time Hawley type retainer wear was not prescribed in 26% of cases and was used for 6 months or less in 68% and more than 6 months in 6% of cases. Part-time wear was indefinite in 72% of cases and between 3 months and 6 years in the remainder.

Due to the large number of categories for practice settings (Table 1), the participants' responses were further examined according to their principal work settings. This was necessary as it would not be appropriate to carry out more detailed statistical analysis according to practice setting when data from individual participants (61% of the whole sample) would be included in either two or three settings. The sample now consisted of 103 respondents primarily in NHS practice (43%), 24 in private practice (10%), 102 in

hospital practice (43%) and 11 in community practice (4%). Due to the small number primarily practising in the community setting, this group was excluded from further statistical analysis.

The outcome measure of the study, retainer choice, was grouped into two main categories, fixed and removable retainers. Fixed retainers included fixed retainers alone, or in combination with vacuum or Hawley retainers in the same arch. Removable retainers were those cases in which only vacuum or Hawley retainers were used.

Results from the multivariable logistic regression revealed that females did not significantly differ statistically in their retainer choices compared to males. This was observed in both the maxilla ($P=0.108$) and the mandible ($P=0.460$). The frequency distribution of gender by retainer choice and the corresponding P values are shown in Table 2. Although not statistically significant, the adjusted odds ratio of 2.04 may indicate a possible trend that females are less likely to fit maxillary bonded retainers (11.1%) than their male colleagues (21.7%).

In order to extrapolate the effect of age on the retention choice, the four age groups were re-categorized into two broadly equal sized groups: participants aged up to 49 years and those 50 years and over. No significant difference was found in Table 2 between younger and older orthodontists and retainer choice in either the maxilla ($P=0.709$), or the mandible ($P=0.076$). However, the results indicated a possible trend with older responders more likely to use bonded retainers in the mandible than younger colleagues.

Finally, the role of practice setting upon orthodontists' retainer choice was examined (Table 2). Both in the maxilla and mandible, the retention choice differed significantly according to practice setting. More specifically, in the maxilla, participants working in NHS practice were 8.73 times more likely to use a removable retainer on its own compared to their colleagues working in private practice ($P<0.001$). Similarly, participants employed in hospital practice were 5.57 times more likely to prefer the removable type of retainer compared to the orthodontists working in private practice ($P=0.001$). For the mandible, those in NHS practice were 6.96 times more likely to use a removable retainer on its own ($P<0.001$) and those in hospital practice were 4.03 times more likely to prefer this retainer type compared to private practice ($P=0.004$).

Follow up of retention was also investigated in the survey for the four practice settings. The majority of participants in each practice setting were following up the supervision of retention for up to 12 months with

Table 2 Frequency distribution of fixed and removable retainers in the sample by gender, age and practice setting together with crude and adjusted odds ratios in the sample ($n=229$).

	Maxilla						Mandible					
	Fixed n (%)	Removable n (%)	Crude odds ratio (95% c.i.)	Adjusted odds ratio (95% c.i.)	Adjusted P value		Fixed n (%)	Removable n (%)	Crude odds ratio (95% c.i.)	Adjusted odds ratio (95% c.i.)	Adjusted P value	
Male	34 (21.7%)	123 (78.3%)	1	1		54 (33.4%)	103 (65.6%)	1	1			
Female	8 (11.1%)	64 (88.9%)	2.21 (0.97, 5.06)	2.04 (0.84, 4.88)	0.108	19 (26.4%)	53 (73.6%)	1.46 (0.79, 2.72)	1.28 (0.66, 2.46)	0.460		
≤49 years	21 (16.8%)	104 (83.2%)	1	1		33 (26.4%)	92 (73.6%)	1	1			
≥50 years	21 (20.2%)	83 (79.8%)	0.80 (0.41, 1.56)	0.87 (0.42, 1.79)	0.709	40 (38.5%)	64 (61.5%)	0.57 (0.33, 1.01)	0.58 (0.32, 1.58)	0.076		
Private practice	13 (54.2%)	11 (45.8%)	1	1		16 (66.7%)	8 (33.3%)	1	1			
NHS practice	12 (11.7%)	91 (88.3%)	8.96 (3.29, 24.45)	8.73 (3.17, 24.04)	<0.001	23 (22.3%)	80 (77.7%)	6.96 (2.65, 18.30)	6.96 (2.61, 18.51)	<0.001		
Hospital practice	17 (16.7%)	85 (83.3%)	5.91 (2.27, 15.39)	5.57 (2.11, 14.70)	0.001	34 (33.3%)	68 (66.7%)	4.00 (1.56, 10.27)	4.03 (1.05, 10.49)	0.004		

the exception of orthodontists working in the community setting (Table 3).

Discussion

The overall response rate of 80% was very satisfactory. This high response rate may be a reflection of the questionnaire being entitled '3 minute survey on orthodontic retention'. The 80% figure was higher than the 67% response rate from a survey on retention procedures in Australia and New Zealand¹⁶ and considerably higher than the 11% response from a survey on diagnosis and treatment procedures in the United States.¹⁹

The gender divide with approximately one-third female and two-thirds male was very similar to that found in the 2005 Orthodontic Workforce Survey²⁰ and the 2006 gender and ethnic balance orthodontic workforce survey.²¹ Gender distribution by age revealed that equal numbers of males and females were in the youngest age bracket (up to 39 years) while males outnumbered females in all other age groups. As more and more females enter dentistry and embark on orthodontic training programmes,²² we may see a reversal in gender domination.

More than half of the respondents (61%) practiced in more than one setting which is in agreement with the Workforce Survey of 2005.²⁰ However, the proportion of respondents in the various practice settings in this study does not reflect the workforce distribution in the UK. This is because of the sampling of one in four members of the Orthodontic Specialists Group and one in two members of the Consultant Orthodontists Group and Community Group of the British Orthodontic Society.

When the effect of practice setting on retention choice was investigated, it was found that vacuum retainers were the most popular in NHS practice and hospital practice. In private practice, vacuum retainers were also the most popular choice although, in the mandible, this was frequently supplemented with a bonded retainer. However, the findings could also be interpreted to indicate that more orthodontists in private practice opt for bonded retainers to maintain alignment and, in

many cases, supplement these with vacuum retainers. This view is further supported by the finding that, when using just one mandibular retainer, those in private practice use more bonded and fewer vacuum retainers than orthodontists in any of the other three settings. In the 1986 survey by Gottlieb *et al.*¹⁷ in the United States, Hawley retainers were being used routinely, clear slipover retainers never being used by 76% of respondents. In the 1990 survey by the same authors,¹⁸ there had been a marked increase in the use of slipover retainers and, by the time of the 1996 survey,¹⁹ only 32% of respondents were not using this type of retainer. The findings of the current study are similar to those of Wong and Freer who investigated retainer choice in Australia and New Zealand.¹⁶ Although they made no distinction between practice settings, they found 'invisible' retainers to be the most popular choice in the maxilla for both countries. For the mandible, a canine to canine bonded retainer was most frequently used in New Zealand while an 'invisible' retainer remained in common use in Australia.

The increasing popularity of vacuum retainers can be attributed to a number of factors that may include low manufacturing cost, ease of fabrication and better aesthetics.^{10,16} A relationship between comfort level and compliance in wearing upper removable retainers has been reported in certain parts of the world.²³ Comfort and aesthetics have also been proposed as being relatively important for the choice of retainer selected by clinicians.²⁴

The finding that Hawley retainers remain the most popular in community practice has to be interpreted with caution as this setting had only 14 respondents. These retainers have often been used because they are thought to allow relative vertical movement of the posterior teeth.⁹ A popular view among orthodontists is that Hawley type retainers are more effective at maintaining transverse expansion in the maxilla and this may explain why they remain relatively popular in the maxilla in all practice settings.

Bonded retainers alone remain relatively unpopular. This may in part be due to conflicting evidence on their failure rates. Whilst Zachrisson²⁵ reports very low failure rates, other audit reports reveal unacceptably

Table 3 Duration of retention supervision by practice setting.

	<i>n</i>	Up to 12 months	More than 12 months	Until retention complete	Maximum supervision
NHS practice	133	81%	14%	5%	3 years
Private practice	148	62%	33%	5%	8 years
Hospital practice	120	69%	28%	3%	5 years
Community practice	14	36%	50%	14%	2 years

high failure rates.^{26,27} In the present survey, bonded retainers were used most frequently in the mandible in combination with a vacuum retainer for patients treated in a private practice setting. In hospital practice, this was the second most common method of retention in the mandible. The increasing use of bonded retainers has been predicted as techniques develop and their aesthetic acceptability improves.⁶ As more knowledge is acquired on the long-term instability of the lower labial segment,³ clinicians may be taking increasing precautions to reduce the likelihood of this undesirable phenomenon. Also an increasing trend toward non-extraction treatment may lead to an increased use of bonded retainers.

The low use of bonded retention alone in the maxilla could also be explained on the basis that the present survey was focused on a hypothetical class II division 1 case where there is a need to maintain overjet reduction and a new archform. The responses would most likely have been different for other types of malocclusion.

The shift towards 'retention for life'³ was borne out in the findings of retention duration. Respondents indicated intentions for indefinite retention with bonded retainers in 84% of cases, with vacuum retainers in 80% of cases, and Hawley type retainers in 72% of cases. This is perhaps not surprising given the inherently unstable nature of much of orthodontic treatment. However, evidence is lacking on long-term survival or continual use of retainers, particularly for those that are removable. This lack of data is also due to the majority of orthodontists discharging their patients whilst still in retention.

Indeed, few practitioners in this survey supervised retention until it was completed with the vast majority supervising for a period of 12 months or less (with the exception of the community group). Twice as many responders in private practice and the hospital setting were supervising for a period greater than 12 months compared to NHS practice. The mechanisms for remunerating NHS practice may partly explain these findings.

Statistically, as expected, no statistically significant association was found between retainer preference and either gender or age. However, the data may indicate clinical trends that males use more bonded retainers in the maxilla than females and that older orthodontists use more bonded retainers in the mandible than younger colleagues.

The preferences between practice settings and retainer choice were found to be the most marked in both the maxilla and the mandible. For both arches, removable retainers on their own were far more likely to be used in NHS practice and hospital practice compared to private practice.

A further variation between settings which was not investigated is the possibility or even the likelihood that the types of cases treated are different. However, the survey being based on a specific malocclusion type should minimise the impact of this type of variation.

Conclusions

For a hypothetical crowded class II division 1 case:

1. Vacuum retainers are most commonly used in NHS practice and hospital practice for both the maxilla and the mandible.
2. Vacuum retainers are most commonly used in private practice in both arches but this is frequently in conjunction with mandibular bonded retainers.
3. No statistically significant differences were found for retainer preference between male and female orthodontists or between younger and older orthodontists.
4. Retainer preferences were found to be significantly different in the three practice settings (private, NHS and hospital) when results were adjusted for orthodontists' age and gender, with bonded retainers being used more frequently in private practice compared to either NHS practice or hospital practice.

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