# A survey on orthodontic retention procedures in the Netherlands

# Anne Marie Renkema\*, Elke Tilly Hélène Sips\*, Ewald Bronkhorst\*\* and Anne Marie Kuijpers-Jagtman\*

Departments of \*Orthodontics and Oral Biology and \*\*Community and Restorative Dentistry, Radboud University Nijmegen Medical Centre, The Netherlands

SUMMARY The objective of this study was to survey retention procedures used in orthodontic practices in the Netherlands.

A questionnaire was sent to all 279 orthodontists working in the Netherlands. The questionnaire consisted of six parts, mainly containing multiple-choice questions. Information as to background data on the individual orthodontist, retention in general, frequency of different types of removable or bonded retainers that were used, retention protocol, and the type and size of the wire used for bonded retainers was assessed. All statistical analyses were performed using Statistical Package for Social Sciences version 12.0.1. Tests for the relationship between two items were based on the chi-square test.

The overall response rate was 91 per cent. Most orthodontists placed a bonded retainer in the upper and lower arch, except when the upper arch was expanded during treatment or when extractions were performed in the upper arch, in which case they placed a removable retainer. Opinions varied with regard to how many hours the removable retainers should be worn and the duration of the retention phase. Contraindications for bonded retainers were given by 96 per cent of the orthodontists, with poor oral hygiene being the most commonly mentioned. As far as bonded retainers were concerned, 84 per cent of the orthodontists preferred permanent retention. Fifty-nine per cent of the orthodontists believed that a practice guideline for retention after orthodontic treatment needs to be developed, which was confirmed by the varied responses in this survey.

# Introduction

To minimize or even prevent relapse, almost every patient who has had orthodontic treatment is given some type of retainer. Two surveys on the type of retainer used by orthodontists have been published (Keim et al., 2002; Wong and Freer, 2004). The survey of Keim et al. (2002) among specialist practitioners in the United States of America (USA) showed that, although decreasing, the Hawley retainer remained the most commonly used retainer, while 'invisible' retainers had continued to gain popularity. In addition, the use of bonded had retainers increased with nearly one-third of the clinicians using them routinely in the mandibular arch. Compared with two prior surveys, conducted in 1990 and 1996, respectively, the respondents prescribed more permanent retention, 27 per cent in 2002 compared with 15 per cent in 1990 and 23 per cent in 1996 (Keim et al., 2002). However, the response rate in that survey was only 9 per cent, so no conclusions could be drawn. The second survey was carried out in Australia and New Zealand (Wong and Freer, 2004). The response rate was 59 per cent. The results showed that upper clear retainers and lower canine-to-canine bonded retainers were most commonly used. Half of the surveyed orthodontists used a specific retention period, with a median of 2 years. Orthodontists applied permanent retention in either a very high or a very low percentage of their cases. The conclusion of that study was that retention procedures were variable and depended largely on personal preferences. Wong and Freer (2004)

concluded that there does not seem to be any consistent pattern in the application of retention methodologies.

The purpose of the present investigation was to survey retention procedures used in orthodontic practice in the Netherlands.

# Materials and method

Full lists of the names and addresses of orthodontists were obtained from the Dutch Association of Orthodontists and the Dutch Dental Association. The questionnaire was sent to 279 orthodontists in October 2005. One month later a reminder was sent to 106 orthodontists who had not returned the questionnaire. In January 2006, the non-responding orthodontists were contacted by telephone. If requested, another copy of the questionnaire was sent. If the orthodontist was not willing to return the questionnaire, the reason for not responding was recorded.

The questionnaire consisted of six parts, mainly containing multiple-choice questions, which had been piloted on four orthodontists and subsequently modified. Background information on the individual orthodontist was assessed in part A. It contained questions concerning the type of practice in which the orthodontist was working. If the orthodontist was working as a locum only, or was retired, the questionnaire was excluded from the analysis. Part B consisted of questions on retention in general, for example 'What is the reason for choosing a specific kind of retainer?' and 'Do you provide the patient with information?'. Parts C and D consisted of questions on the frequency of different types of removable or bonded retainers that were used and the retention protocol. Part D contained questions about the type and size of the wire used for bonded retainers. Part E consisted of tables in which the orthodontist could tick which type of retainer was used in which specific situation. In the last part, the orthodontists could express their opinions as to the need for a clinical practice guideline (CPG) for retention after active orthodontic treatment.

#### Statistical analyses

All statistical analyses were performed using the Statistical Package for Social Sciences (SPSS), version 12.0.1 (SPSS Inc, Chicago, Illinois, USA). Background information on the individual orthodontist was described in frequencies and the other results in percentages. All tests for the relationship between two items in the questionnaire were based on the chi-square test. For two-by-two cross-tables, Fisher's exact test was used. If necessary, for larger cross-tables, Monte Carlo simulation (Hope, 1968) was used to improve the estimate of the P value. For this simulation, default SPSS parameters were applied (i.e. 99 per cent confidence interval for P, 10000 replications).

# Results

# General

Questionnaires were completed by 254 (91 per cent) of the 279 orthodontists. Of the 254 orthodontists, 230 worked in an (associated) practice and 30 at a university; 12 worked as locums and nine were retired (partly or fully). Combinations were also possible. Working in an (associated) practice and at a university was the most common combination (20 orthodontists). Orthodontists who were only working as a locum (n = 7) and fully retired orthodontists (n = 6) were excluded from further analysis.

Of the remaining 241 orthodontists, 25 per cent had been trained abroad; 18 in Germany, 16 in the USA or Canada, 11 in Belgium, eight in Denmark, five in the United Kingdom, and five in other countries.

# Choice of type of retainer

Sixty-four per cent of the orthodontists used retention for almost every patient, independent of the situation prior to active orthodontic treatment.

The choice for a certain retainer was determined not only by the situation prior to treatment but also by other factors such as the occlusion post-treatment, the end result, and oral hygiene (Table 1). The intended treatment also influenced the choice of a specific retainer. Table 2 shows the percentages of orthodontists who, given a specific situation, generally used a bonded retainer, a removable retainer, or a combination 
 Table 1
 Percentage of orthodontists indicating that a certain factor influences their choice for a specific type of retainer.

Factors	%
Pre-treatment situation	74
Interdigitation after treatment	69
Poor oral hygiene	69
End result	65
Periodontal tissues	56
Motivation	48
Age	41
Myofunctional aspects	38
Anatomy of teeth	28
Third molars	7
Wish of patient/parents	3
Others	10

of both. Most orthodontists placed a bonded retainer in the upper and lower arch, except when the upper arch was expanded during treatment or when extractions were performed in the upper arch, in which case they placed a removable retainer. For the placement of bonded retainers, contraindications were given by 96 per cent of the orthodontists (Table 3). Eighty-five per cent reported poor oral hygiene, which might cause periodontal problems, caries, and the need for restorations, as a contraindication for the placement of bonded retainers. Contact with the retainer or the bonding material during occlusion and/or articulation was reported by 39 per cent of the orthodontists as a contraindication for placing a bonded retainer in the upper arch.

Of the practising orthodontists in the Netherlands, 95 per cent used one or more types of removable retainers. Bonded retainers were used by 97 per cent. The orthodontists who only use bonded retainers (5 per cent) did not want to be dependent on the co-operation of the patient. They considered that with the use of a removable retainer, relapse takes place during or after the retention period. These views differ significantly from those of the orthodontists who used both removable and fixed retainers (P < 0.001). The orthodontists who only used removable retainers (3 per cent) had the opinion that bonded retainers often break and come loose. They also stated that these retainers caused plaque accumulation, caries, and/or calculus. These views differed significantly from those of orthodontists who used both types of retainers (P < 0.001).

Table 4 shows that a Hawley-type retainer in the upper arch was the most often used removable retainer; the orthodontists indicated that they applied this type of retainer in 41 per cent of their patients. Noticeable is the large standard deviation (SD). The table shows that a clear retainer was also often used (16 per cent).

In the lower jaw, the most frequently used fixed retainer was the canine-to-canine retainer, bonded to all anterior teeth (70 per cent). The most used types in the upper arch were the canine-to-canine retainer and the lateral-to-lateral 
 Table 2
 Percentage of orthodontists who used fixed, removable, or both types of retainers in specific situations. The most often used retainers in a certain situation are given in bold.

Type of treatment/situation	Type of retention					
	Upper arch			Lower arch		
	Bonded	Removable	Bonded and removable	Bonded	Removable	Bonded and removable
Extractions	24	43	33	79	11	10
Closing a diastema in the anterior region	64	13	23	90	5	5
Crowding in the anterior region	62	23	15	94	4	3
Expansion of the respective arch	13	61	26	73	20	7
Impacted anterior teeth	60	25	15	92	7	1
Intrusion of the anterior teeth	50	35	15	90	6	4
Extrusion of the anterior teeth	65	23	12	91	6	3
Severe rotations of the anterior teeth	79	8	13	94	3	3
Root resorption of the anterior teeth	69	18	13	90	8	2
Anterior open bite	68	18	14	88	9	3
Remaining overjet	37	36	27	79	12	9
Re-treatment in the upper and lower arch	73	13	14	90	4	6
Adult patient, in the upper and lower arch	49	30	21	86	12	2
Only fixed appliances in the upper arch	55	20	25	88	3	9

 Table 3
 Percentage of orthodontists who stated contraindications for the placement of bonded retainers.

Contraindications	% Orthodontists	
Poor oral hygiene, periodontal problems, caries	85	
Occlusion (deep bite)	39	
Incomplete treatment result (i.e. diastema)	14	
Motivation	12	
Anatomy	4	
Type of treatment	3	
Expected relapse	1	
Side-effect torque	<1	
Others	3	

incisor retainer, both bonded to all anterior teeth (Table 4). These canine-to-canine retainers were used either frequently or almost never.

#### Retention period

The situation before active treatment predetermined the duration of retention for 40 per cent of the orthodontists. Opinions about the hours the removable retainers should be worn and the duration of the retention phase varied. During the first period of retention (duration average 5.7 months, SD = 7), the patient should wear the removable retainer for an average of 18 hours a day (SD = 7.5) 7 days a week (SD = 0.07). The total duration of the retention period for removable retainers differed considerably: 6 per cent of the orthodontists ended the retention period within 6 months, while 80 per cent continued for more than 1 year. When bonded retainers were used, 84 per cent of the orthodontists used permanent retention. The other 16 per cent removed

the retainers at a specific time, which was determined by several factors such as the eruption of the third molars, growth of the patient, or individual determination of the time period.

#### Check-ups

After placement of a removable retainer, 87 per cent of the orthodontists checked their patients two to four times during the first year of retention, visits for repairs not included (Table 5); 1 per cent did not see their patients subsequently. After the first year, the removable retainers were checked again by 72 per cent of the orthodontists. Table 5 also shows that the patients with bonded retainers had fewer check-ups compared with those with removable retainers (P < 0.001). Orthodontists who undertook fewer removable retainer check-ups during the first year also tended to carry out fewer fixed retainer check-ups, and *vice versa*; orthodontists who undertook more removable retainer check-ups carried out more fixed retainer check-ups as well (P < 0.001). There was a difference in the number of check-ups between orthodontists trained in different countries (P = 0.02).

#### Information and instructions

After placement of a removable or bonded retainer, all orthodontists gave written information concerning the retainer to their patients. Two per cent of the orthodontists never gave any oral instruction to the patient after placement of a bonded retainer. The other orthodontists provided the patient with a variety of instructions (Table 6). Instructions on the use of toothpicks were given more often by orthodontists who listed poor oral hygiene, **Table 4**Average percentages of patients who are given a specifictype of removable or bonded retainer.

	Upper arch (% patients)	Lower arch (% patients)
Removable retainers		
Hawley-type retainer	$41 \pm 35.9$	$5 \pm 16.4$
Clear retainer	$16 \pm 26.1$	$7 \pm 17.5$
Spring retainer	<1 ± 2.2	$1 \pm 8.1$
Headgear	$<1 \pm 4.0$	
Positioner	3 ±	12.7
Functional appliance	$2 \pm 6.3$	
Upper canine retainers		
Bonded to the canines only	$<1 \pm 2.6$	$16 \pm 32.7$
Bonded to all anterior teeth	$34 \pm 37.8$	$70 \pm 38.0$
Incisor bonded retainer	$2 \pm 10.1$	$<1 \pm 6.5$
Bonded to all incisor teeth	$25 \pm 33.7$	$2 \pm 11.5$
Bonded to all teeth from the first premolar to the first premolar	1 ± 6.6	2 ± 9.1

 Table 5
 Number of check-ups during the first year after placement of a removable or bonded retainer.

Number of check-ups during first year	Removable (% orthodontists)	Bonded (% orthodontists)
0	1	3
1	5	20
2	22	32
3	38	28
4	27	15
>4	7	2

caries, and periodontal problems as a contraindication (P = 0.003). When placing the retainer, the majority of the orthodontists gave extra oral hygiene instructions (91 per cent) and instructions as to what to do in the case of failure of the retainer (97 per cent). The latter instructions involved telling the patients that they should make an appointment with the orthodontist (92 per cent) or dentist (35 per cent) as soon as possible if the retainer caused a problem. In general, there was communication with the dentist about checking and repairing bonded retainers (78 per cent). Half of the orthodontists requested the dentist to check the bonded retainer during every periodic check-up and if the retainer was loose or broken, to refer the patient to the orthodontist. Nearly a quarter of the orthodontists did not communicate with the dentist about this subject.

# The need for a practice guideline

Fifty-nine per cent of the orthodontists agreed that a practice guideline on retention procedures after orthodontic treatment should be developed. Thirty per cent considered a protocol necessary, 7 per cent did not, and 4 per cent remained **Table 6** Percentage of orthodontists who provide the patient with instructions after the placement of a bonded retainer.

Instructions	Orthodontists
With regard to breakage/loosening	97
Extraoral hygiene	91
With regard to nutrition	59
Toothpicks	47
Floss	38
Interdental brushes	22
Electric toothbrush	20
Others	2

neutral. A larger number of the orthodontists educated in the Netherlands have the opinion that it would be useful to develop a protocol compared with orthodontists who had their orthodontic training abroad (P = 0.002).

# Discussion

# General

A very high percentage of the orthodontists working in the Netherlands participated in this survey; 25 per cent of these orthodontists had their orthodontic training abroad. The group of non-responding and excluded orthodontists was so small that it could not bias the outcome of the respondent group. Compared with the two previous surveys conducted in the USA and Australia/New Zealand (Keim *et al.*, 2002; Wong and Freer, 2004), the response rate to this survey was excellent.

# Choice of type of retainer

In both previous surveys in the USA and Australia/New Zealand, removable retainers were mostly used in for the upper arch, whereas in the present study most orthodontists placed fixed retainers in the upper arch. However, there were some orthodontists who used removable retainers most of the time. Individual orthodontists used removable retainers either very often or rarely. That is the reason why Table 4 shows large SDs. Most respondents preferred the use of bonded retainers in the lower arch. A minority of the orthodontists (3 per cent) never use bonded retainers and stated that bonded retainers often break and become loose. However, the failure rates vary widely in the literature. Bearn (1995) reported overall failure rates for bonded retainers in the upper and lower arch from 10.3 to 47.0 per cent. Rogers and Andrews (2004) reported a failure rate in the mandible at less than 0.1 per cent during 3 years of study. It was stated that the low failure rate could be ascribed to their bonding protocol and the fact that the retainer was bonded only to the mandibular canines. The findings of Störmann and Ehmer (2002) corroborate this; retainers in the mandible bonded on the canines only displayed an 18 per cent detachment rate, a value significantly lower than the 29 to 53 per cent

determined for retainers bonded to all anterior mandibular teeth. It is difficult to compare these failure rates since the studies were performed with different wire materials, bonding procedures, and follow-up periods.

Very few prospective studies have evaluated the effectiveness of retention. A Cochrane review revealed only two randomized clinical trials and three pseudorandomized clinical trials that evaluated the effectiveness of different retention strategies used to stabilize tooth position after orthodontic treatment (Littlewood *et al.*, 2006). No reliable evidence could be taken from the data on which to base clinical practice of retention.

# Contraindications

The view held by 3 per cent of the orthodontists, who only used removable retainers because they assume that bonded retainers cause plaque accumulation, calculus, and caries, is not supported by evidence available from the literature. The presence of a bonded retainer can cause plaque accumulation, but it has no influence on gingiva inflammation (Heier et al., 1997). Gorelick et al. (1982) did not find white spots on the lingual surfaces of mandibular canines and incisors after prolonged use of a canine-to-canine bonded retainer. Pandis et al. (2007) found higher calculus accumulation, greater marginal recessions, and increased probing depth, but no difference with respect to the plaque and gingival indices and bone level in a group of patients with mandibular retention for a long period of time compared with an equal number of patients retained for a period between 3 and 6 months. Of course, poor oral hygiene may lead to caries and periodontal problems but not necessarily to a higher degree in the region of a bonded retainer than elsewhere in the oral cavity. Nonetheless, poor oral hygiene, which can cause periodontal problems, caries, and the need for restorations, was reported as a contraindication for placing a bonded retainer by 85 per cent of the orthodontists in the present study.

# Duration of retention

It has been shown that it takes on average a minimum of 232 days for fibres around the teeth to remodel to the new tooth position (Reitan, 1967). Other authors found a half-life of collagen fibres around rat teeth varying from 1 to 12 days in the periodontal ligament and 2 to 152 days for dento-gingival fibres (Orlowski, 1978; Rippin, 1978; Imberman et al., 1986; Sodek and Ferrier, 1988). In addition, even if the teeth are held in position during this period, studies have shown that, in the long term, some relapse will take place (Little et al., 1988; Al Yami et al., 1999). A retention period with removable retainers of more than 1 year was employed by 80 per cent of the orthodontists in the Netherlands. Wong and Freer (2004) found that a regular retention period of more than 2 years was preferred, but they did not distinguish between removable and fixed retainers. The respondents in the present investigation used a longer period of retention

with bonded retainers. Eighty-four per cent of the orthodontists had a preference for permanent retention. This is a very high percentage compared with the survey by Keim *et al.* (2002): 27 per cent of their respondents used permanent retention. However, the response rate in the latter study was only 9 per cent. It is possible that bonded retainers might be unnecessary in a number of patients. The problem is that it is not known in which patients a limited period of retention can be used. The extended duration of the retention period with fixed retainers substantially increases the number of patients under supervision. The long-term consequences of permanent retention with bonded retainers have not been well documented (Aasen and Espeland, 2005).

# Check-ups

The number of check-ups during the first year after placement of a removable or a fixed retainer varied from none to more than four.

It seems that the orthodontists who do not check the retainer at all during the first year (1-3 per cent) give the responsibility for the retention phase completely to the patient and the dentist. Since these orthodontists communicated with the patient's dentist about checking and repairing fixed retainers, it might be the case that they hand over the supervision of the retention phase to the dentist directly after placement of the retainers.

Most of the orthodontists (87 per cent) carried out two to four check-ups during the first year of the retention phase, which seems to be appropriate. With more than four checkups, the question arises whether this is really necessary. It certainly is cost and time consuming.

# Information and instruction

Prolonged or even permanent retention with a bonded retainer leads to the need for regular check-ups, for example once a year. An unnoticed bonding failure can result in an irregularity in the anterior region. Unexpected complications with bonded lower retainers as described by Katsaros et al. (2007) are another reason to perform regular check-ups. For the orthodontist, it is impossible to supervise every patient with bonded retainers for years and years. It is inevitable that the patient and the patient's general practitioner are both responsible for regular check-ups. When delegating this responsibility to the patient and the dentist, it is necessary to inform them about the problems that might occur and that the retainer therefore needs regular check-ups. Nearly a quarter of the orthodontists in the present study did not communicate with dentists about this subject. This shows that more communication with the dentists in this area is needed.

# Guideline development

Over the past 20 years, quality of care and CPGs have gained increased interest in many areas of health care (Van der

Sanden et al., 2005). The development of evidence-based CPGs appears to be one of the most promising and effective tools for improving the quality of care (Grol, 2001). An assessment of the view of Dutch general practitioners on CPGs showed that about half of Dutch general dental practitioners were in favour of the development and implementation of CPGs (Van der Sanden et al., 2003). In the present study, almost 90 per cent of the orthodontists agreed or considered that a practice guideline for retention procedures after orthodontic treatment should be developed. This high percentage can be explained by the fact that retention and relapse are problems explicitly perceived in daily practice. Guidelines for these daily practice problems will probably be more easily accepted than CPGs on topics that are not deemed as relevant by practitioners (Grol, 2001). However, there is less knowledge of the attitudes, expectations, and views of orthodontists with regard to the development and use of CPGs. Confidence in the quality of the guidelines and the credibility of the developers are essential aspects for their acceptance (Van der Sanden et al., 2003).

Orthodontists who were trained abroad stated that they would not find a retention guideline as advantageous as those who were educated in the Netherlands. This was an unexpected result as CPGs in countries such as the United Kingdom, USA, Canada, and Finland have been used for many decades, while in the Netherlands CPGs have only been produced on a very limited scale.

#### Conclusions

This survey provides an insight into the retention procedures used in orthodontic practices in the Netherlands. These procedures are mainly experience based as evidence-based information is not yet available.

The varied responses in this survey indicate the need to develop an evidence-based practice guideline for retention procedures after orthodontic treatment.

#### Address for correspondence

Professor A. M. Kuijpers-Jagtman Department of Orthodontics and Oral Biology Radboud University Nijmegen Medical Centre 309 Tandheelkunde P.O. Box 9101 NL 6500 HB Nijmegen The Netherlands E-mail: orthodontics@dent.umcn.nl

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