Further Studies in Retention of the Orthodontic Band

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The retention of the conventional orthodontic band is a problem that has confronted the clinician for more than one hundred years.[1] The recent development of the direct attachment technique[2-11] over the last seventeen years has stimulated research aimed at establishing a more quantitative assessment of the retention of the conventional band. The orthodontist in practice is confronted with a choice of continuing the use of conventional orthodontic bands, of changing over to the direct bonding techniques, or of using both techniques. The advantages of "bandless" orthodontics such as improved aesthetics, less discomfort, etc., are well-known. However, one of the major basic problems still confronting the clinician is whether or not the retention on the tooth of the direct attachments throughout the duration of appliance therapy will be as good as, better, or worse than the retention of the conventional bands. As yet there is no statistically reliable answer to this problem; when more quantitative information is available with regard to the retention of the conventional band we will then be in a better position to start answering such problems.

The present paper is the second part of a clinical research project carried out to try to establish a quantitative assessment of the retention of the orthodontic band. In the first part it was reported that 21.2% of orthodontic bands cemented to the teeth of 102 patients receiving fixed appliance therapy over a period of over twenty-three months needed at some stage during treatment to be recemented.[12] This figure was an average value for the total sample from one particular practice. It was stressed that this value could be expected to vary in different orthodontic practices.

The only other figures available in the literature are those from a control group of patients used in a study on ultrasonic instruments by Wisth and Bergenkreutz.[13] Out of a group of 324 teeth, thirty loose bands were found over a period of twelve months, i.e., 9.3% failure rate. It is reasonable to assume that this value of 9.3% may be expected to rise had the survey been carried out over a period of twenty-three months rather than one year.

There are two main groups of factors that have an effect on the retention of the orthodontic band: factors which relate to the operator, and those which relate to the patient.

The first group of factors are those which are under the direct control of the operator, such as the cement selected, the type of band used, the efficiency of the cementing technique, the type of appliances fitted, and the motivation of the patient by the orthodontist and/or his staff. The expected variations in the previously mentioned failure rate of 21.2% which may be found in the different orthodontic practices will be as a result of variations occurring in this first group of factors. How large or how significant the extent of variation will be can be determined only by further research.

The second group of factors are those more directly related to the patient, cooperation, sex of the patient, and the particular malocclusion encountered. These factors are related to the patient rather than the operator and as such it is reasonable to assume that this second group of factors may be common to the general patient population of the aver-

age orthodontic practice. Therefore the relationship of factors in this second group to the retention of the orthodontic band should be common and applicable to most orthodontic practices.

The aim of this project was to try to establish the relationship of sex, age of the patient, and type of malocclusion to band recementation. Furthermore, in view of the material available, the relationship of band recementation to treatment duration and to the presence or absence of extraoral traction was also investigated.

Materials and Methods

As this study formed the second part of the overall project, the sample used was the same as described previously.[12] It consisted of 102 patients receiving fixed appliance therapy for a mean period of twenty-three months. The number of teeth banded in this survey was 1,976.

The following data were recorded on punch card layout form: 1) sex, 2) age to the nearest quarter year, and 3) classification of the incisor teeth based only on overjet: Class I, edge to edge up to 3 mm; Class II, Division 1, over 3 mm; Class II, Division 2, retroclined upper incisors, overjet less than 3 mm; and Class III, three or more incisors in crossbite; 4) presence or absence of Kloehn type extraoral traction, 5) date on which each band was first cemented, 6) date on which each band was recemented and 7) date on which all of the bands were removed.

The data were processed on a computer using standard programmes including the S.P.S.S.—Statistical Package for the Social Sciences. The cementing technique used and the variations associated with it were discussed in the first section of this project.[12]

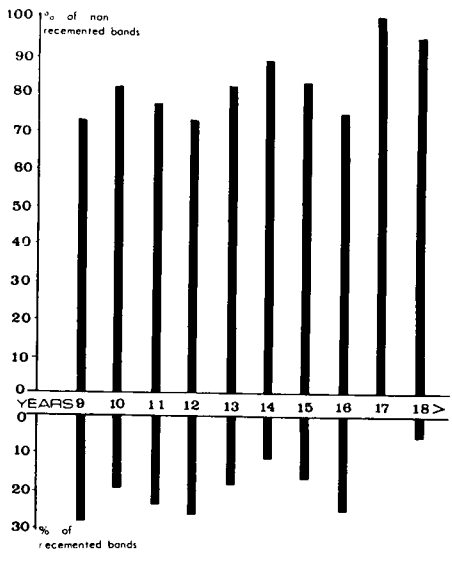

Fig. 1 The percentage of recemented to nonrecemented bands in ten different age groups.

Results

Sex

The sample of 102 patients consisted of sixty-four girls (62.7%) and thirty-eight boys (37.3%). In terms of cemented bands, out of a total of 1,976 bands, 1,235 bands were cemented on girls, while 741 were cemented on boys. In the group of girls, 79.9% of the bands were not recemented while 20.1% were recemented; in the group of boys, 76.9% of the bands were not recemented while 23.1% were recemented. There is no significant difference between the ratios of recemented to nonrecemented bands for both sexes (χ^2; $p > .05$).

Age

The mean age of the sample was 12.41 ± 1.7 years. The ratio of recemented to nonrecemented bands was calculated for the ages 9-17, and over 18 years old. The ratios are presented graphically in Figure 1. The percentage of bands recemented varies from a maximum of 27.3% in the 9 year-old group to 0% in the 17 year-old group. The

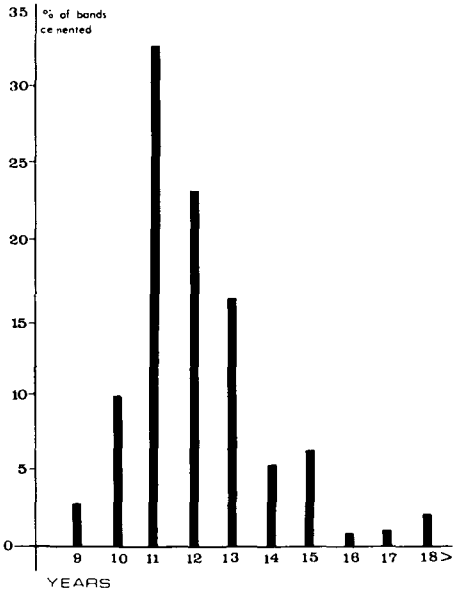

Fig. 2 The percentage of cemented bands (sample size) in each age group.

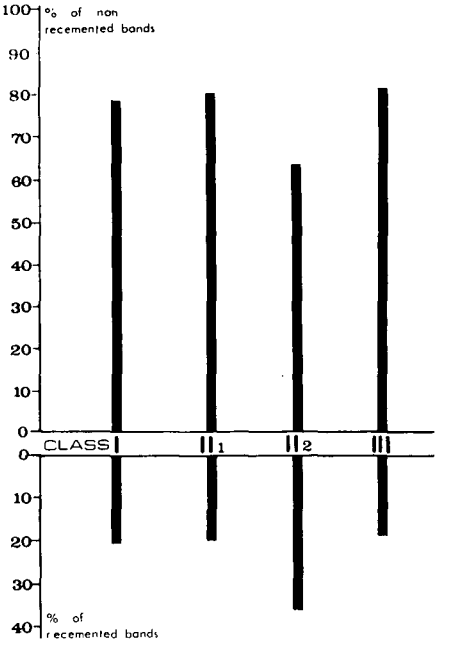

Fig. 3 The percentage of recemented to nonrecemented bands in Class I, Class II (1), Class II (2), and Class III malocclusions.

chi squared test showed a significant interdependence between age and rate of recementation of orthodontic bands (χ^2; $p < .001$). To relate this statistic to the clinical situation, Figure 2 gives the percentage of bands cemented on in each group; this shows the sample size of each group in relation to the total number of bands.

Classification of malocclusion

The classification was based only on the overjet of the incisor teeth. The ratio of recemented to nonrecemented bands for each malocclusion group is presented in Figure 3. The percentage of bands recemented ranges from a maximum of 36.7% in the Class II, Division 2 group to a minimum of 19.6% in the Class III group. There is a very slight variation in the percentage of bands recemented in the Class I, Class II, Division 1, and Class III malocclusion groups. However, according to the chi squared statistic there is a significant interdependence between the different groups of malocclusions and the recementation of orthodontic bands (χ^2; $p < .01$). Therefore to relate this to the clinical situation, Figure 4 is presented to show the percentage of bands cemented on in each malocclusion group, i.e., the sample size. Class I and Class II, Division 1 malocclusions accounted for 88% of all cemented bands, while only 4% and 8% were cemented onto Class II, Division 2, and Class III cases, respectively.

Duration of treatment

As part of the recorded data, the dates of initial band cementation, recementation, and final removal were noted for each band. It was therefore possible to produce a computer print out of a graph relating the frequency of band recementation to time. The curve rose steeply from the start of treatment to 20 months and then started to level.

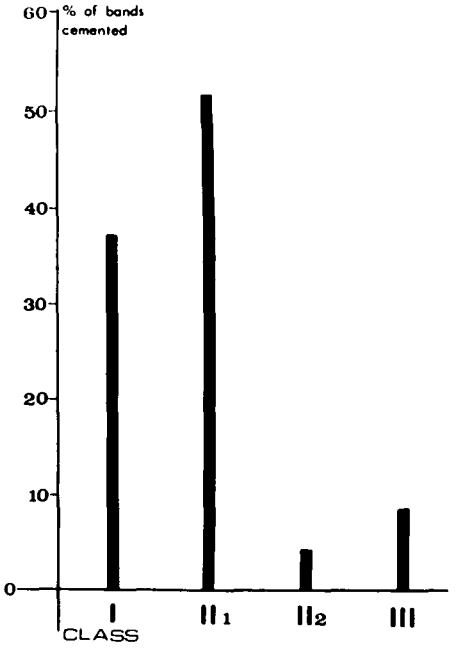

Fig. 4 The percentage of cemented bands (sample size) in each malocclusion group.

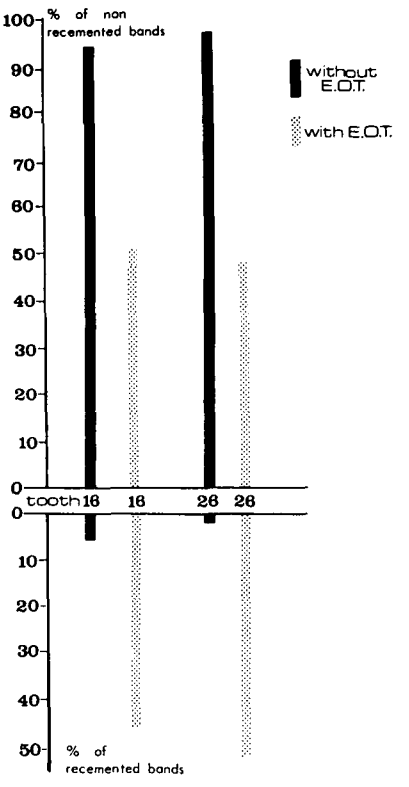

Fig. 5 The percentage of recemented to nonrecemented bands on maxillary molars in cases with and without extraoral traction (E.O.T.).

Extraoral traction

Extraoral traction was fitted on 19% of cases. This involved 375 bands out of a total of 1,976. Of the patients fitted with extraoral traction, 34.4% of bands were recemented whereas only 18.1% of bands were recemented in the group not supplied with extraoral traction. There was a significantly greater frequency of bands recemented in the group fitted with extraoral traction (χ^2; $p < .001$).

Examination of the ratio of recemented to nonrecemented bands on the individual teeth in these two groups indicated that there was a generalised increase in the percentage of bands recemented on all teeth in the group fitted with extraoral traction. This increase was most marked on the upper left and right molar teeth. The percentage increase was 41.4% on the upper left and 51.4% on the upper right molar (Fig. 5).

Discussion

Sex of the patient

It is not unreasonable to assume that the retention of the orthodontic band is to a certain extent related to the degree of patient cooperation with particular regard to eating habits and general appliance care. The results indicate that there is no significant difference in the percentage of bands recemented in males and females. This suggests that there is no real difference in the way girls and boys care for their appliances.

According to the findings of Allan and Hodgson,[14] who studied a group of orthodontic patients ranging from twelve to eighteen years of age, there was no significant difference in patient

cooperation on the basis of sex. The present results tend to corroborate their findings. It is interesting to note that in this sample the ratio of girls to boys under active treatment was approximately 2:1, i.e., 64 girls to 38 boys. Surveys that have been carried out on the prevalence of malocclusions in children ranging from six to eighteen years have indicated that there was no significant difference in the prevalence of malocclusion between boys and girls.[15-19] The difference between the ratio of girls to boys (2:1) receiving treatment and the ratio of girls to boys (1:1) exhibiting malocclusions can probably be explained on the grounds of motivation.

Research work carried out on the motivation of families seeking orthodontic treatment showed that it was the parents rather than the child who were usually motivated for orthodontic treatment of the child.[20,21] This conclusion is also borne out by personal clinical experience. Furthermore, Baldwin et al. found that an aesthetic dentition was seen as more desirable for girls than for boys by all parents, regardless of the sex of their own children.[22]

In spite of this parental bias toward the daughter rather than the son receiving treatment, which probably resulted in the 2:1 ratio evident in the sample, girls did not care for their appliances any better than the boys.

Age of the patient

Allan and Hodgson[14] related a large number of variables to patient cooperation and found that age was the only one of twenty-nine correlations to reach significance. They considered a cooperative patient to be one under the age of 14 years who was enthusiastic and trusting. An uncooperative patient was generally over the age of 14 years, independent and temperamental. A graphic representation of the ratio of recemented to nonrecemented bands for the 10 age groups of this sample is given in Figure 1. The chi square test shows a significant interdependence between age and band recementation. However, this statistic takes into consideration the range of values for band recementation from a maximum of 27.3% (9 year age group) to a minimum of 0% (17 year age group). If one examines Figure 2, it is evident that only a very small percentage, 3.8% (75 bands), of the total number of bands were cemented to the teeth of patients in these two groups. In fact, 82.0% (1,618 bands) of the total number of bands were cemented to the teeth of patients ranging from 10 to 13 years of age. Figure 1 shows that there is little difference in the percentage of bands recemented in these four groups (10-13 years of age). In view of the small sample sizes of the youngest and oldest age groups, it would be unwise at this stage to state categorically that patients 17 years of age and over care more for their appliances than younger patients. The present work tends to suggest that this may be the case. As the sample size increases with future surveys, a more statistically reliable pattern should emerge.

Classification of malocclusion

The horizontal relationship of the incisor teeth was the only criterion used for classifying the sample into different groups. It was considered that variations in the overjet of the incisor teeth may have an effect on the retention of bands on these teeth. Variations in the anteroposterior relationship of upper and lower buccal teeth were considered unlikely to have an effect on the stability of bands cemented on teeth in either the anterior or posterior segments.

The statistical analysis indicates that there is a significant relationship between classification and band recemen-

tation (χ^2; $p < .01$). It appears from Figure 3 that bands are recemented nearly twice as frequently in the Class II, Division 2 group than in the other three groups. However, examination of Figure 4 shows that this group made up only 4% (79 bands) of the total sample. It is important that this finding be interpreted with caution. The percentage of bands recemented in the remaining three groups, i.e., Class I. Class II, Division 1 and Class III, showed little variation (19.6%-21.7%). At this stage one can only say that there appears to be a tendency for bands to be recemented more frequently in cases having a reduced overjet and retroclined upper incisor teeth.

Duration of treatment

One of the striking features of a number of previous studies related to success and failure rate of the direct attachment technique has been the large variation in the time period of each investigation.[6,8-11,23,24] In these studies the time period varied from a minimum of four months to a maximum of eleven months. From our work it becomes apparent that the success or failure rate that may be quoted for a study lasting four months should not be compared with the results of an investigation lasting eleven months or perhaps even twenty-four months. It is important when assessing success or failure rates for either the direct attachment or the conventional band that notice be taken of the duration of the survey.

If the comparisons of the results of different studies are to have any significance, it is essential that the time periods should be the same. By virtue of the nature of orthodontic treatment, it is reasonable to require that the direct attachment or the conventional band should remain fixed to the tooth for a period of at least two years.

Extraoral traction

The type of headgear used in this survey was the cervical Kloehn facebow and neck strap. This was generally used in the early stages of treatment prior to full banding when it was considered possible to change a cusp-to-cusp or mild Class II molar relationship into a Class I by means of a combination of distal force on the upper molars and good horizontal growth potential of the mandible. Extraoral traction was seldom used in the full-fixed appliance stage of treatment. Only 19% of patients in this sample received extraoral traction. The results indicate that there is a significantly higher incidence of band recementation occurring in the group fitted with extraoral traction than in the group without. It is reasonable to expect that this difference is due to a large extent to the higher rate of band recementation occurring on the maxillary molars as shown in Figure 5.

There are three possible factors that may be responsible for the increased rate of recementation of bands on the maxillary molars. The first is that, as this appliance was used in the early stages of treatment, it was generally placed on a younger patient. These patients are not quite so gentle with the fitting and general handling of their appliances. Norton and Markowitz[25] warn against the use of removable appliances in the young child (6-9 years old). It has been the author's experience that young children are able to manage a removable appliance better than a facebow.

Secondly, bands on the maxillary molars in this group were subjected to greater stress irrespective of patient age or cooperation. The leverage produced by the facebow on the bands during normal movement of the head, both during the day and while the patient is asleep, must be considerable.

Thirdly, the bands on the maxillary molars in this group were cemented considerably earlier than the rest of the bands. Consequently they were in the mouth for a much longer period of time, thus increasing their chances of becoming dislodged.

It would be interesting to establish what effect other forms of headgear therapy such as high pull to the incisors and to molars would have on the stability of the band.

Summary and Conclusions

A statistical analysis of 1,976 conventional orthodontic bands cemented to the teeth of 102 patients was carried out to try to establish the relationship of sex of the patient, age of the patient, and the type of malocclusion to the retention of the orthodontic band. The effect of treatment time and the presence or absence of extraoral traction on band recementation were also considered. The results obtained from the study led to the following conclusions:

1) There is no significant difference in the degree of band recementation occurring during orthodontic treatment between girls and boys.

2) There appears to be a tendency for bands to be recemented less frequently in patients 17 years of age and over. A larger sample would be necessary before being more definite.

3) The Class II, Division 2 type of incisor relationship may predispose to a higher rate of band recementation. Once again a greater sample size would be essential to be more categorical.

4) The percentage of bands recemented increased as the duration of treatment increased.

5) The use of early Kloehn cervical facebow therapy leads to a higher rate of band recementation on the maxillary molars.

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