

Clinical Experience with Direct-Bonded Labial Retainers

STEFAN AXELSSON, DDS
BJORN U. ZACHRISSON, DDS, PHD

Direct-bonded retainers are usually placed lingually,¹⁻⁵ since one of the chief advantages of such retainers is their invisibility. However, we began to experiment with labial bonded retainers several years ago to improve long-term results because of certain retention problems:

1. Short- or long-term inability to prevent some reopening of premolar extraction sites in adults.
2. A tendency for some lingual crown relapse of canines that had been palatally impacted.
3. Difficulty in holding premolars that had been severely rotated.
4. Various types of space reopening in cases where posterior teeth had been moved mesially, in young or adult patients with previously excessive spacing.

Common to these situations was the desirability of adding some support to the premolar areas for one or two years after treatment. It appeared preferable to bond the retainer wires labially, based on earlier experience with bond failures at the enamel-adhesive interface when bonding to the lingual surfaces of premolars.^{3,4}

Another alternative would be to bond the retainer in the occlusal fissure, which is usually successful if there is no contact with antagonists. In most cases, however, a groove has to be prepared with a bur to avoid such contact.⁵ This amount of enamel removal would not be acceptable in routine situations.

Study Design

The present study was designed to:

The present study was designed to:

1. Evaluate the bonding success rates of different types of bonded labial retainers.
2. Study the effects on the gingival tissues and enamel adjacent to such retainers.
3. Determine whether the labial retainers are effective, particularly in preventing the reopening of premolar extraction sites in adults.
4. Tabulate patient reactions to different types of labial and lingual retainers, compared with removable plates.

Materials and Methods

One group of 25 patients had received a total of 47 short (two-unit) labial retainers (Table 1). Most often the retainer was placed over a closed extraction site after removal of the upper or lower first or second premolar (Fig. 1), but retainers were also used in cases of palatally impacted maxillary canines (Fig. 2). The average observation period at the time of the follow-up examination was 2.3 years, and at that time the mean patient age was 34.5 years, with a range from 18 to 53 years.

In addition to the short labial retainer on one or both sides, these patients also received removable maxillary plates and/or standard lingual retainers bonded to the maxillary or mandibular incisors (Figs. 1,2,7).

Another group of 10 patients had received a total of 14 long (three- or four-unit) labial retain-



Dr. Axelsson



Dr. Zachrisson

Dr. Axelsson is an orthodontist in the Dental Unit, Plastic Surgery Department, University Hospital (Rikshospitalet), Pilestredet 32, N-0027 Oslo 1, Norway. Dr. Zachrisson is a Contributing Editor of the *Journal of Clinical Orthodontics*; Professor of Orthodontics, University of Oslo; and in the private practice of orthodontics. Send reprint requests to Dr. Axelsson.

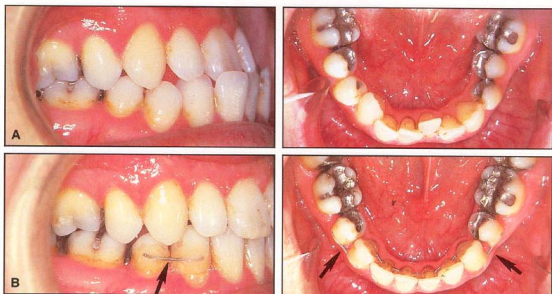


Fig. 1 Typical short labial retainer bonded over mandibular first premolar extraction site in Class III patient. **A.** Before treatment. **B.** Retainer in place (arrows) after first premolar extraction and orthodontic treatment.

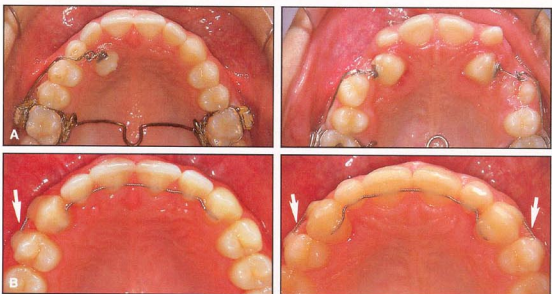


Fig. 2 Short bonded labial retainers in two patients with palatally impacted canines. **A.** Before treatment. **B.** Retainers in place (arrows) after treatment.

Clinical Experience with Direct-Bonded Labial Retainers

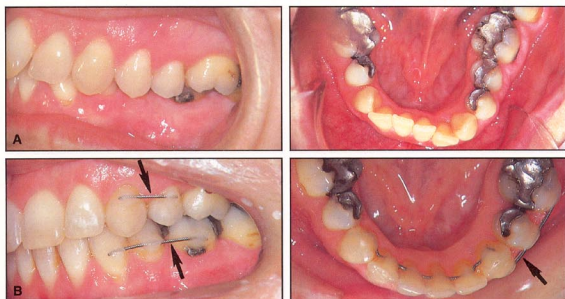


Fig. 3 Adult Class II scissor-bite patient with both short and long labial retainers. A. Before treatment. B. Retainers (arrows) after treatment involving extraction of maxillary first and mandibular second premolars.

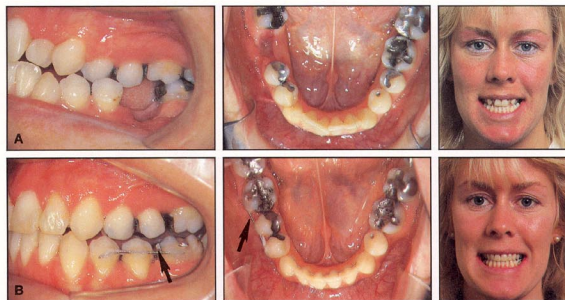


Fig. 4 Long labial retainer in adult patient. A. Before treatment. B. Retainer in place (arrows) after treatment involving extraction of mandibular left first molar.

ers (Fig. 3). These retainers were used particularly in minimum anchorage situations involving mesial movement of entire posterior segments, where the lower second premolars were congenitally missing (Fig. 10). They were also placed in first-molar extraction cases (Fig. 4). The average observation time was 2.5 years, with a mean patient age of 35.7 years at follow-up.

The patients had all undergone full, routine orthodontic treatment for a variety of malocclusions. Together they represented all the bonded labial retainers placed in Dr. Zachrisson's office before May 1989. Five of the patients moved and could not be located for the follow-up examination.

Each retainer was made of .0215" five-stranded spiral wire (Penta-One*, Fig. 5A).

After the labial surface was etched with 37% phosphoric acid for 30-60 seconds, the retainer was tacked in place on each end with a small amount of fast-setting composite⁶ (Concise**). Slippage was avoided by dipping both ends of the wire into the composite mixture on the plastic spatula (Fig. 5B,C) and then placing the wire in position (Fig. 5D).

No sealant was added after etching. After setting, the bulk of the composite was added with a plastic instrument,^{***} thus ensuring totally undisturbed setting of the bulk of the composite.

*Masel Orthodontics, 2701 Bartram Road, Bristol, PA 19007.

**3M Unitek, 2724 S. Peck Road, Monrovia, CA 91016.

***444-445 Si, LM-Dental, Turku, Finland.

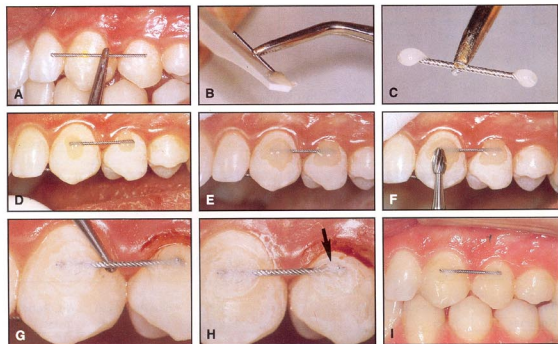


Fig. 5 Technique for bonding short labial retainer. A. Short segment of .0215" Penta-One wire marked and cut. B,C. Ends of wire dipped in mixture of fast-setting composite on plastic spatula. D. Wire tacked in place. E. Addition of bulk of composite. F. Contour trimming with tungsten carbide bur. G. Interdental trimming with small round bur. H,I. Finished retainer (arrow indicates cleaned area between adhesive and gingiva).

Contour trimming of the composite was done with tungsten carbide burs No. 7006 and 7408 (Fig. 5F), and interdental trimming with small round burs No. 1 and 2 (Fig. 5G). Care was taken to avoid contact between the composite and the gingival margin at the bonding sites (Fig. 5H), and between the interdental papillae and the retainer wire.

Every patient was instructed in maintenance of oral hygiene with toothbrushes and floss threaders. Daily rinsing with a .05% neutral sodium fluoride solution was prescribed throughout retention.

At the follow-up appointment, impressions for study models were made, intraoral photographs were taken, and the retainers were checked. The number of teeth included in each retainer and any occurrences of loosening or wire fracture were recorded from the patient's records. By comparing the follow-up study models with the post-treatment models, notations could be made of any tooth movements within the

retained segments and of spaces that had opened adjacent to the retained segments.

To reduce examiner bias, all scoring was done by an orthodontist (Dr. Axelsson) who had not seen any of the patients. Standard techniques were used to score plaque accumulation,⁷ gingival inflammation⁷ and recession,⁸ and demineralization.^{9,10} Pocket depths were probed along the

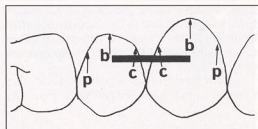


Fig. 6 Locations for scoring plaque, gingivitis, and pocket depth: peripheral to retainer (p), mid-buccal (b), and centrally within retainer (c).

TABLE 1
EXPERIMENTAL GROUPS

| Type of Retainer | No. Retainers | | No. Patients | | Mean Age at Follow-Up | Mean Observation Period (years) |
|------------------|---------------|-------|--------------|------|-----------------------|---------------------------------|
| | Total | U/L | Total | M/F | | |
| Short (2-unit) | 47 | 28/19 | 25 | 6/19 | 34.5 | 2.3 |
| Long (3-4-unit) | 14 | 4/10 | 10 | 1/9 | 35.7 | 2.5 |

TABLE 2
FAILURES OF LABIAL RETAINERS

| Type of Retainer | No. Retainers | | Enamel/ Adhesive/ | | | No. Removed | | No. Rebonded | |
|------------------|---------------|-------|-------------------|--------------|---------------|-------------|-----|--------------|-----|
| | Total | U/L | Adhesive Failure | Wire Failure | Wire Fracture | Total | U/L | Total | U/L |
| Short (2-unit) | 47 | 28/19 | 2 | 0 | 0 | 13 | 7/6 | 2 | 0/2 |
| Long (3-4-unit) | 14 | 4/10 | 5 | 3 | 1 | 3 | 0/3 | 6 | 0/6 |

retainer wire and gingival margin, as well as on all interdental surfaces of the teeth included in the retainer. For each rating, the average of two separate scores was used at each of three sites—peripheral, mid-buccal, and central—for each labial retainer (Fig. 6). Disclosing solution was not used.

Each patient anonymously answered a 16-point questionnaire at the follow-up examination. The first seven questions dealt directly with the labial retainers, including any embarrassment suffered when talking and smiling. Emphasis was placed on comparing the labial retainers to the lingual retainers and removable plates. The other nine questions were related to the overall orthodontic treatment experience, including the relationship between expectations and results, the value of the results compared to the time and

money spent and the cooperation and oral hygiene required, the degree of esthetic concern about visible appliances, and the most positive and negative aspects of treatment. A copy of the complete questionnaire is available from the authors upon request.

Results

Only two of the 47 short labial retainers came loose during the observation period (Table 2). The failure rate for the long retainers was significantly higher, with all the loosening occurring in the mandibular arch.

In most cases, the treatment result was well maintained. Of the 28 short upper labial retainers, two had spaces reopen distal to the retainer (Fig. 7) and two within the retained segment. Of

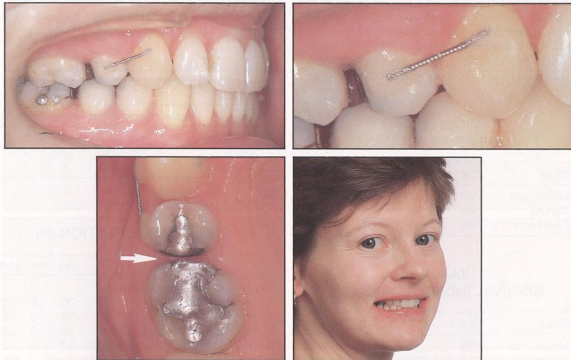


Fig. 7 Small space reopening distal to labial retainer in young adult after first-premolar extraction. Narrow lower second premolar and canine and molar occlusion indicate influence of tooth-size discrepancy in settling.

the 19 short lower labial retainers, two had spaces reopen distal to the retainer, four within the retained segment, and one mesial to the retainer. The space was generally about .5mm, and was greater than 1mm in only one case.

No caries or white spot lesions were noted with the short retainers; two patients with long retainers showed surface demineralization. The plaque index scores were all either 0 or 1 on a scale from 0 to 3 (Table 3). Gingival index scores were all 0 or 1 at the mid-buccal locations, but occasionally 2 (bleeding upon probing) at the interdental sites (Table 4, Figs. 8,9).

The pocket depths were all measured at 1-2mm buccally, but in about half the cases they exceeded 2mm interdentally (Table 5, Fig. 9). The plaque and gingival scores and pocket depths were significantly greater (p less than .01) for the central sites than for the peripheral sites.

Patient satisfaction with the labial retainers was surprisingly high. Only 31% of the patients said they were "not much affected" or "somewhat affected" by the visibility of the retainers when talking or smiling, and 69% said they were "not affected at all". When patients with both labial and lingual retainers were asked which one

they would prefer to keep for another year, only 59% preferred the lingual retainer. Given a choice between the labial retainer and the removable plate worn at night, 49% of the patients said they preferred to wear the labial retainer, 28% preferred the plate, and 23% were undecided.

Of the 35 patients who responded, only one was "somewhat dissatisfied" with the overall treatment result as compared to expectations on a five-point scale. Five were "very satisfied", and 29 were "completely satisfied". Nearly all the patients also felt the treatment was worth their time, money, cooperation, hygiene efforts, and esthetic appearance (Table 6).

Discussion

The results of this study show that labially bonded .0215" wires can be a useful supplement to conventional retention in certain situations, including adult premolar extraction cases (Figs. 1,3,7,9,11) and cases involving orthodontic cor-

**TABLE 3
PLAQUE INDEX SCORES (%)**

| Sites | 0 | 1 | 2 | 3 |
|------------|----|----|---|---|
| Mid-buccal | 96 | 4 | 0 | 0 |
| Central | 69 | 31 | 0 | 0 |
| Peripheral | 88 | 12 | 0 | 0 |

**TABLE 4
GINGIVAL INDEX SCORES (%)**

| Sites | 0 | 1 | 2 | 3 |
|------------|----|----|----|---|
| Mid-buccal | 98 | 2 | 0 | 0 |
| Central | 66 | 28 | 6 | 0 |
| Peripheral | 81 | 9 | 10 | 0 |

**TABLE 5
POCKET DEPTHS (%)**

| Sites | 1mm | 2mm | 3mm | 4mm | 5mm | 6mm |
|------------|-----|-----|-----|-----|-----|-----|
| Mid-buccal | 84 | 16 | 0 | 0 | 0 | 0 |
| Central | 4 | 28 | 43 | 23 | 0 | 2 |
| Peripheral | 7 | 38 | 49 | 4 | 2 | 0 |

**TABLE 6
PATIENT SATISFACTION (N)**

| | Yes | No | Undecided |
|--|-----|----|-----------|
| <i>Is the treatment result worth:</i> | | | |
| The time needed? | 35 | 0 | 0 |
| The money spent? | 33 | 0 | 2 |
| The cooperation required? | 33 | 0 | 2 |
| The extra oral hygiene needed? | 33 | 0 | 2 |
| The strain of having had visible appliances? | 33 | 0 | 2 |

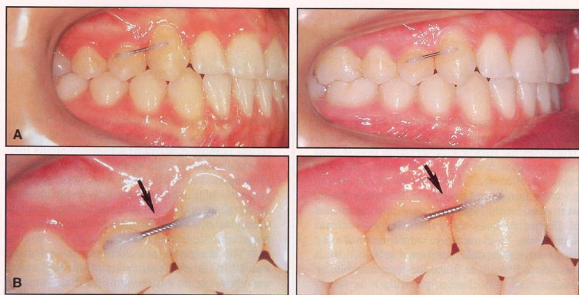


Fig. 8 Improvement in gingival condition (arrows) after placement of labial retainers. A. Immediately after placement. B. Nearly two years later.

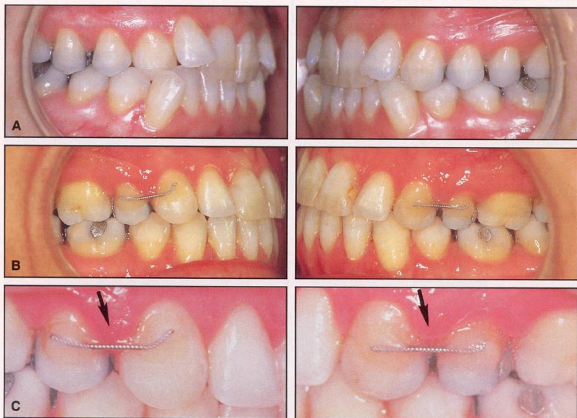


Fig. 9 Gingival hyperplasia associated with increased interdental pocket depths during observation period. A. Before treatment. B. After placement of labial retainers over first-premolar extraction sites. C. Gingival hyperplasia (arrows) two years later.

rection of impacted canines (Figs. 2,5,8). More than 95% of the short labial retainers remained intact over the two-year observation period, and patient acceptance was much better than we expected.

The longer retainers, on the other hand, were considerably less successful. A combination of factors such as the patient's age, occlusal interference, and moisture contamination may have been responsible. As shown in Figure 10, it was often difficult to place the long mandibular retainers out of occlusion, particularly in young patients with short clinical crowns. When bonding close to the gingival margin, there is an increased risk of seepage of gingival crevicular fluid, which would be detrimental to bond strength.

Several studies have presented methods of

preventing relapse in extraction cases.¹¹⁻¹⁴ It is generally agreed that stabilization of orthodontic results is more difficult to achieve in adults than in children, and that special precautions and prolonged retention may be indicated in adults.^{15,16} This is at least partially due to changes in the metabolic status of bone, collagen, cells (fibroblasts), and blood flow or vascularity that occur with increasing age.¹⁵

The retainer wire used in our investigation was .0215" Penta-One five-stranded wire, which was shown in an earlier study of direct-bonded lingual retainers to have optimal properties for stabilizing segments of teeth splinted together, while allowing physiological mobility of the individual units.⁵ The most notable side effect was the opening of small spaces distal to the retainer wires in a few patients. In these cases, it is likely

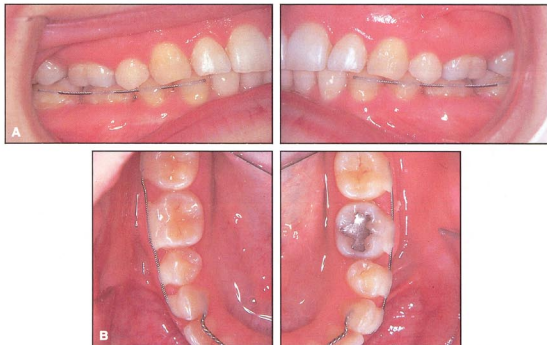


Fig. 10 Problems found with long lower labial retainers. A. Interference with occlusion. B. Possibility of moisture contamination from gingival crevicular fluid, particularly when teeth are not fully erupted.

that tooth-size discrepancies played a role during settling of the occlusions (Fig. 7).

The question of when to remove the bonded retainers is easier to answer for the labial version than for the lingual.⁵ The labial retainers were intended only to gain an extension of the stabilization and remodeling process during the first year after orthodontic treatment. Therefore, they may be removed on an individual basis, depending on the retention problem and the patient's age, motivation, and hygiene. In our sample, retention with conventional removable plates continued when the labial wires were removed one to two years after treatment.

The visibility of the retainer wire varied among the patients because of variations in personality and smiles (Fig. 11). Still, for nearly all of them the short retainer caused little esthetic concern. Tooth-colored wires could be used in short labial retainers, but at present we do not believe they are necessary. Even more visible labial wires are routinely used in removable retainers that are worn day and night during the

initial period after fixed-appliance removal.

It should be emphasized that although our sample was small, it represented a consecutive series of adult patients who had undergone full orthodontic treatment and a specific form of retention. Few unbiased studies of such samples have been published. That nearly all of them were satisfied with the results and their efforts is in accordance with the experience of other clinicians,¹⁸⁻²⁰ who have found that adult patients are relatively easy to satisfy. It is somewhat surprising, however, that more than 90% of the patients believed the time needed for correction was worthwhile, since most of them seemed to become more eager to have appliances removed as they approached the end of active treatment.

Conclusion

Bonding success rates and patient acceptance appear to be excellent for labial retainers bonded to two adjacent teeth. Such retainers may therefore be recommended for improved stabili-



Fig. 11 Variable visibility of short labial retainers in two patients during talking and smiling.

zation of extraction sites in adults, and for added retention of palatally impacted canines.

On the other hand, the results obtained with three- or four-unit bonded labial retainers were unsatisfactory, particularly in the mandibular arches of young patients. Further technical improvements will be required before these retainers can be routinely used on long buccal spans.

ACKNOWLEDGMENT: The authors gratefully acknowledge the word processing by Ms. Marit Sulander of the Norwegian Police Data Processing Service.

REFERENCES

1. Zachrisson, B.U.: Bonding in orthodontics, in *Orthodontics: Current Principles and Techniques*, ed. T.M. Graber and B.F. Swain, C.V. Mosby Co., St. Louis, 1985, pp. 485-563.
2. Zachrisson, B.U.: Clinical experience with direct bonded orthodontic retainers, *Am. J. Orthod.* 71:440-448, 1977.
3. Zachrisson, B.U.: Adult retention: A new approach, in *Orthodontics: State of the Art, Essence of the Science*, ed. L.W. Graber, C.V. Mosby Co., St. Louis, 1986.
4. Zachrisson, B.U.: Finishing and retention procedures for improved esthetics and stability, in *Fourth International Orthodontic Symposium*, ed. R. Nanda, University of Connecticut, Hartford, in press.
5. Dahl, E.H. and Zachrisson, B.U.: Long-term experience with direct-bonded lingual retainers, *J. Clin. Orthod.* 25:619-630, 1991.
6. Artun, J. and Zachrisson, B.U.: Improving the handling properties of a composite resin for direct bonding, *Am. J. Orthod.* 81:269-276, 1982.
7. Loe, H.: The gingival index, the plaque index, and the retention index systems, *J. Periodont.* 38:610-616, 1967.
8. Andlin-Sobocki, A.; Marcusson, A.; and Persson, M.: 3-year

observation on gingival recession in mandibular incisors in children, *J. Clin. Periodontol.* 18:155-159, 1991.

9. Artun, J.: Caries and periodontal reactions associated with long-term use of different types of bonded lingual retainers, *Am. J. Orthod.* 86:112-118, 1984.
10. Artun, J. et al.: Hygiene status associated with different types of bonded, orthodontic canine-to-canine retainers, *J. Clin. Periodontol.* 14:89-94, 1987.
11. Edwards, J.G.: The prevention of relapse in extraction cases, *Am. J. Orthod.* 60:128-141, 1971.
12. Ronnerman, A.; Thilander, B.; and Heyden, G.: Gingival tissue reactions to orthodontic closure of extraction sites: Histologic and histochemical studies, *Am. J. Orthod.* 77:620-625, 1980.
13. Kuroi, J.; Ronnerman, A.; and Heyden, G.: Long-term gingival conditions after orthodontic closure of extraction sites: Histologic and histochemical studies, *Eur. J. Orthod.* 4:87-92, 1982.
14. Rivera Circuns, A.L. and Tulloch, J.F.C.: Gingival invagination in extraction sites of orthodontic patients: Their incidence, effects on periodontal health, and orthodontic treatment, *Am. J. Orthod.* 83:469-473, 1983.
15. Melsen, B.: Limitations in adult orthodontics, in *Current Controversies in Orthodontics*, ed. B. Melsen, Quintessence Publishing Co., Chicago, 1991, pp. 147-180.
16. Alexander, R.G.; Sinclair, P.M.; and Goates, L.J.: Differential diagnosis and treatment planning for the adult nonsurgical orthodontic patient, *Am. J. Orthod.* 89:95-112, 1986.
17. Rippin, J.W.: Collagen turnover in the periodontal ligament under normal and altered functional forces, II: Adult rat molars, *J. Periodont. Res.* 13:149-154, 1978.
18. Berg, R.: Postretention analyses of treatment problems and failures in 264 consecutively treated cases, *Eur. J. Orthod.* 1:55-68, 1979.
19. Myrberg, N. and Thilander, B.: An evaluation of the duration and the results of orthodontic treatment, *Scand. J. Dent. Res.* 81:85-91, 1973.
20. Espeland, L. and Stenvik, A.: Perception of personal dental appearance in young adults: Relationship between occlusion, awareness and satisfaction, *Am. J. Orthod.* 100:234-241, 1991.