Stability of orthodontic treatment outcome in relation to retention status: An 8-year follow-up

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Introduction: Our aim was to evaluate the stability of orthodontic treatment outcome and retention status 7 or more years after active treatment in relation to posttreatment or postretention time, type of retention appliance, and duration of retainer use. **Methods:** The subjects were former patients who completed orthodontic treatment with fixed appliances from 2000 to 2007. The pretreatment eligibility criteria were anterior crowding of 4 mm or more in the maxilla or the mandible and Angle Class I or Class II sagittal molar relationship. Acceptable pretreatment and posttreatment dental casts were required. A total of 67 patients participated, 24 men and 43 women, with a mean age of 24.7 years (range, 20.0-50.0 years). All participants had a follow-up clinical examination, which included impressions for follow-up casts, and each completed a questionnaire. Data were obtained from pretreatment, posttreatment, and follow-up (T2) casts as well as from the patients' dental records. Treatment stability was evaluated with the peer assessment rating (PAR) index and Little's irregularity index. **Results:** The participation rate was 64%. The average posttreatment time was 8.5 years (range, 7.0-11.0). All participants had received a retainer in the mandible, maxilla, or both after active treatment. At T2, the PAR score showed a mean relapse of 14%. The majority (78%) of participants still had a fixed retainer at T2 (retainer group), and 22% had been out of retention for at least 1 year (postretention group). The relapse according to the PAR did not differ significantly between participants with and without a retainer at T2. From posttreatment to T2, the irregularity of the mandibular incisors increased almost 3 times more in participants with no retainer in the mandible compared with those with an intact retainer at T2 ($P = 0.001$). In the maxilla, no corresponding difference was found. **Conclusions:** Our results suggest that occlusal relapse can be expected after active orthodontic treatment irrespective of long-term use of fixed retainers. Fixed canine-to-canine retainers seem effective to maintain mandibular incisor alignment, whereas in the maxilla a fixed retainer may not make any difference in the long term. (Am J Orthod Dentofacial Orthop 2017;151:1027-33)

Maintaining the stability of orthodontic treatment outcome in the long term is a challenge. Studies have shown that even when a good, well-functioning occlusion is achieved, there is a tendency toward relapse.[1-4]

The influence of different occlusal characteristics on treatment stability has been widely studied. High quality of the orthodontic finishing does not seem to prevent relapse.[5,6] The evidence indicates that intercanine and intermolar widths tend to decrease during the postretention period, especially if these widths were expanded during treatment.[7-9] One recommendation to obtain the best treatment stability has been to maintain patients' pretreatment arch form.[10] Although early arch expansion in the mixed dentition has shown better long-term treatment stability, the arch form still tends to return to its pretreatment shape.[11] Mandibular intercanine and intermolar arch widths have been considered accurate indicators of a patient's muscle balance, thus dictating the limits of arch expansion during treatment.[12]

According to the evidence, a good interincisal contact angle may prevent the relapse of overbite corrections, and good posterior intercuspidation can help to prevent relapse of both crossbite and sagittal corrections.[7,13]

When evaluating postretention changes in occlusion, it is important to consider natural growth changes.

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A longitudinal study by Thilander[14] showed continuous changes, with individual variations, in the dental arches from the deciduous dentition until the end of growth and to some extent even into adulthood. These changes could be interpreted as a biologic migration of the dentition, often resulting in anterior crowding, especially in the mandible, even in subjects with congenitally missing third molars.[14]

The peer assessment rating (PAR) index was developed to assess occlusal and dental changes from pretreatment to posttreatment and has proven to be a reliable and reproducible method to evaluate orthodontic treatment outcome.[15-18] The PAR index can also be used to measure treatment stability, since it objectively measures changes in the occlusion.[3,19] However, the PAR index does not give specific information about the alignment of the incisors; this is the major concern of many patients. To describe the displacement of incisors and to quantify anterior crowding, the index introduced by Little[20] has been largely used.

After treatment with fixed appliances, fixed retainers in the mandibular and maxillary anterior teeth are commonly used. If the maxillary arch has been expanded or the treatment included extractions, a combination of fixed and removable retainers is a common choice in the maxilla.[21,22] In Norway, fixed retainers were reported to be the most commonly used in the mandible, and a fixed retainer combined with a removable retainer appeared to be the most commonly used retention method in the maxilla.[23]

The aim of this study was to evaluate the stability of orthodontic treatment outcome and retention status 7 or more years after active treatment in relation to posttreatment or postretention time, type of retention appliance, and duration of retainer use.

MATERIAL AND METHODS

The study population consisted of former patients who completed active orthodontic treatment with fixed appliances at the Public Dental Service Competence Centre of Northern Norway from 2000 to 2007. To be eligible, patients had to fulfil the following pretreatment criteria: crowding of the anterior teeth of 4 mm or more in the maxilla or mandible and an Angle Class I or Class II sagittal molar relationship. All patients had to have acceptable pretreatment and posttreatment dental casts available. Patients with anterior open bite and Angle Class III molar relationship were excluded due to small numbers. The eligible patients (n = 105) were first sent a letter that included information about the study and an invitation to a follow-up examination; later, they were contacted by phone (J.S., G.J.). A total of 67 former patients participated, 24 men and 43 women, with a mean age of 24.7 years (range, 20.0-50.0 years).

The follow-up examinations, including impressions for follow-up dental casts, were performed by 2 orthodontic postgraduate students between October 2013 and June 2014 at the Public Dental Service Competence Centre of Northern Norway.

Pretreatment (T0) and posttreatment (T1) data, including treatment start, treatment end, type of retention appliance, and retention control visits, were collected from the patients' dental records. Data from the follow-up examination (T2), including presence and type of retention appliance, instructions given after treatment, patient's compliance with retention appliance use, and satisfaction with treatment, were obtained via a questionnaire administered at T2. Occlusal and dental information at T0, T1, and T2 was obtained from dental casts.

Treatment outcome (difference between T0 and T1) and treatment stability (difference between T1 and T2) were evaluated with the PAR index and Little's irregularity index (LII) on dental casts. The PAR index scores 7 traits in the occlusion: alignment of maxillary and mandibular anterior segments, right and left buccal occlusions, overjet, overbite, and center line.[15,16] A PAR score of 0 indicates ideal occlusal alignment, and increased scores (rarely beyond 45) indicate increased deviations from the ideal occlusal alignment. All PAR scores were weighted with the British weighing factors. A PAR reduction at T1 (T0-T1) greater than 70% was considered greatly improved, 70% to 30% was considered improved, and less than 30% was considered not improved or worse. LII describes crowding and displacement of the maxillary and mandibular anterior teeth.[20] The linear distances between anatomic contact points of 2 adjacent anterior teeth were measured from canine to canine, and the index was the sum of the 5 measurements. The index was used for both mandibular and maxillary anterior teeth.

All dental casts were measured by 2 examiners (J.S., G.J.) to the nearest 0.1 mm using a caliper. The examiners were calibrated in the use of the PAR index and LII before the study, both with each other and with an experienced orthodontist certified in the use of the PAR index. In cases of disagreement, the measurements were repeated by both examiners together until agreement was reached. To determine the intraexaminer and interexaminer agreement values for the PAR and LII, both examiners measured 10 randomly selected pairs of casts twice, with a minimum of 2 weeks between measurements.