

TABLE 1

## Summary Table

Reference	Patient Group	Study Type (Level of Evidence)	Methods	Key Results	Comments
Artun et al, 1997 <sup>7</sup>	N = 49; 11 patients with thick plain wire bonded only to the canines; 13 patients with thick spiral wire bonded only to the canines; 11 patients with thin spiral flexible wire bonded to each tooth; 14 patients with removable appliances	Longitudinal prospective cohort	The authors measured PI, CI, GI, and attachment level after 3 years of retention.  Attachment level was measured as the distance from the CEJ to the bottom of the gingival pocket.	There was no significant difference in periodontal measurements between the four groups.  The different types of retainers did not have any effect on clinical attachment.	These results may be due to the increased improvement of patient maintenance encouraged by the presence of the retainer.
Johnsson et al, 2007 <sup>8</sup>	N = 170 with fixed retainers after orthodontic treatment; 83 patients from a postgraduate clinic and 87 from a specialist clinic	Longitudinal prospective cohort	The authors clinically assessed presence of caries in the anterior region, calculus index, gingival recessions, and status of the retainer present after 5 years of retention. Intraoral photographs and models were also used. The participants were also given a questionnaire and an interview.	There was no significant effect of the fixed retainer on gingival recession.	The study's main focus was on the participant's reasons for pursuing orthodontic treatment and patient satisfaction of the outcome.  The study did not include a control group.
Pandis et al, 2007 <sup>9</sup>	N = 64; 32 patients with fixed retainers long-term (9-11 years) and 32 patients with fixed retainers short-term (3-6 months)	Prospective cohort study	The authors measured PI, CI, GI, PD, recession, and bone level.  Recession was measured in mm as the distance between the CEJ and the gingival margin.	A significantly higher prevalence of recession was found in the long-term group than in the short-term group.  Out of eight participants exhibiting recessions, only two exhibited lingual recessions while the others developed buccal recessions.	Due to the recessions being found buccally, there is a weak association between long-term use of fixed retainers and recession of the gingival margin. Buccal recession may have been caused by the proclination of mandibular incisors during treatment.  The study's sample groups did have a mean age difference of 9 years. This difference in age may have a discriminating effect on the periodontal results.
Levin et al, 2008 <sup>5</sup>	N = 92; 64 orthodontically treated patients with retainers and 28 with no orthodontic treatment  N = 120 arches; 48 with fixed retainers and 72 without fixed retainers	Observational cross-sectional study	The study measured PI, GI, BOP, gingival recession, and PD.  Gingival recession was measured from the retainer to the incisal edge and to the CEJ.	There was a statistically significant increase in presence of recession in the fixed retainer group than in the non-retainer group. The magnitude of the difference in recession was not clinically significant.	This study disagreed with all other previous studies about the effect of retainers on gingival recession. This study measured both labial and lingual recession and only found statistical difference in lingual recession.
Renkema et al, 2013 <sup>10</sup>	N = 220; 100 treated cases with retainer and 120 non-treated cases	Case control study	Casts were assessed at the age of 12 (T12), 15 (T15), 18 (T18), and 21 (T21) years. Gingival recession was scored as a "yes" if the CEJ was exposed.	The cases group developed more labial gingival recession than the control group.  The cases group had more recession sites than the control group.  The orthodontically treated and retained group were 4.8 times more likely to develop gingival labial recession than untreated patients.	The authors did not assess whether the cause of labial gingival recession was due to active orthodontic therapy or the fixed retainer.  Confounding variables such as PI, BOP, and smoking were not measured or analyzed.  The cases group and controls differed with their initial diagnosis and malocclusion.
Renkema et al, 2013 <sup>11</sup>	N = 302; 167 with bonded retainer only on mandibular canines and 135 with bonded retainer on all mandibular anterior teeth	Retrospective longitudinal cohort	Participants' cast models were used to assess gingival recession pretreatment (T0), end of treatment (T1), 2 years post-treatment (T2), and 5 years post-treatment (T5) by scoring "yes" if the CEJ was exposed. Assessment was made by two calibrated investigators.	There was no significant difference in gingival recession between the two types of retainers.  The fixed retainer did not influence the development of recession.  There was more recession with the increase of age at T0.	This study agrees with the Juloski study <sup>13</sup> that there is increased gingival recession with increased age.  This study assessed labial recessions and not lingual gingival recessions.
Corbett et al, 2015 <sup>12</sup>	N = 74; 35 with fixed straight retainer (SR) and 39 with fixed wave retainer (WR)	Observational cross-sectional study	PD, BOP, PI, CI, recession, and GCF volume were assessed and compared.  Recession was measured to the nearest mm from the CEJ to the free gingival margin labially and lingually.  Intraoral photographs were taken and evaluated. The participants were also given an oral hygiene survey.	There was no statistically or clinically significant difference in PI, recession, GCF volume, BOP, and PD found between the two retainer groups.	Participants of the study did not match with regard to age and retention period.  The WR was found to increase frequency of flossing in patients.  This study did not include a control group.
Juloski et al, 2017 <sup>13</sup>	N = 144; 96 orthodontically treated and 48 untreated. Of the 96 treated, 48 with bonded fixed retainer and 48 with no retainer	Retrospective longitudinal cohort	Participants' records (casts, intraoral photographs) were used to assess overjet, overbite, LII, calculus index, and presence of gingival recession before orthodontic treatment (T0), 4-6 weeks after debonding (T1), and 5 years after debonding (T5).  Presence of gingival recession was measured with "yes" or "no" if the CEJ was exposed.	All groups showed higher prevalence of gingival recession at T5 than T0.  There was no significant difference in presence of recession between the groups.  The mandibular left central incisor in the fixed retainer group was significantly more affected than the two other groups.  The mandibular central incisor in the non-retained group never showed recession.  The mandibular lateral incisors showed similar recession in all groups.  Recession at T5 was not influenced by fixed lingual inter-canine retainer.	This study, unlike other studies, included a control that was orthodontically treated but not given any retainer.  This study agrees with other studies in that gingival recession increases with age.  Confounding variables such as hygiene and diet were not evaluated.
Al-Moghrabi et al, 2018 <sup>14</sup>	N = 42; 21 participants with fixed retainers and 21 with removable retainers	Blinded randomized controlled trial	Periodontally the authors clinically measured GI, calculus and plaque level, BOP, and clinical attachment level, after a 4-year follow-up.	No statistical difference was found between the removable retainer group and the fixed retainer group.  There was a slightly higher statistical significance on the clinical attachment in the fixed retainer group.  There was no clinical significance of removable and fixed retainers on clinical attachment levels.	Patients wearing removable retainers wore them for a decreased duration through the 4 years starting at full time and ending with alternate nights only. Patients wearing non-removable retainers showed high levels of noncompliance at 67%.  This study had a small sample size that may have led to false-negative results.
Gökçe et al, 2019 <sup>15</sup>	N = 100; 20 with 0.0215" fixed retainer directly bonded; 20 with 0.0215" fixed retainer indirectly bonded; 20 with 0.0175" fixed retainer directly bonded; 20 with 0.0175" fixed retainer indirectly bonded; 20 with removable Essix retainer	Non-randomized prospective cohort	The study measured PI, GI, BOP, PD, and marginal recession after 6 months of retention.  Marginal recession was measured at three different sites of each of the six mandibular anterior teeth in mm from the CEJ to the gingival margin.	No significant differences were observed regarding marginal recession in any of the five groups.  Fixed and removable retainers had no effect on gingival recession.  Different types of fixed retainers had no effect on marginal recession.	Limitations of the study are the short-term follow-up duration of 6 months and lack of knowledge about Essix users' compliance.
Arn et al, 2020 <sup>16</sup>	N = 29 studies; 11 randomized controlled trials, four prospective cohorts, one retrospective cohort, and 13 cross-sectional studies	Systematic review		Fixed retainers do not have significant effects on periodontal health or recession.  High-quality research is needed to establish a definitive conclusion.	This systematic review evaluated the effect of fixed retainers only on periodontal health.  Periodontal evaluation of fixed retainers was not included in all the studies.  All the studies included had a moderate to serious risk of bias.

BOP = bleeding on probing, CEJ = cemento-enamel junction, CI = calculus index, GCF = gingival crevicular fluid, GI = gingival index, LII = Little's irregularity index, PD = pocket depth, PI = periodontal index