How long does treatment with fixed orthodontic appliances last? A systematic review

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Introduction: There is little agreement on the expected duration of a course of orthodontic treatment; however, a consensus appears to have emerged that fixed appliance treatment is overly lengthy. This has spawned numerous novel approaches directed at reducing the duration of treatment, occasionally with an acceptance that occlusal outcomes may be compromised. The aim of this study was to determine the mean duration and the number of visits required for comprehensive orthodontic treatment involving fixed appliances. **Methods:** Multiple electronic databases were searched with no language restrictions, authors were contacted as required, and reference lists of potentially relevant studies were screened. Randomized controlled trials and nonrandomized prospective studies concerning fixed appliance treatment with treatment duration as an outcome measure were included. Data extraction and quality assessment were performed independently and in duplicate. **Results:** Twenty-five studies were included after screening: 20 randomized controlled trials and 5 controlled clinical trials. Twenty-two studies were eligible for meta-analysis after quality assessment. The mean treatment duration derived from the 22 included studies involving 1089 participants was 19.9 months (95% confidence interval, 19.58, 20.22 months). Sensitivity analyses were carried out including 3 additional studies, resulting in average duration of treatment of 20.02 months (95% confidence interval, 19.71, 20.32 months) based on data from 1211 participants. The mean number of required visits derived from 5 studies was 17.81 (95% confidence interval, 15.47, 20.15 visits). **Conclusions:** Based on prospective studies carried out in university settings, comprehensive orthodontic treatment on average requires less than 2 years to complete. (Am J Orthod Dentofacial Orthop 2016;149:308-18)

It is accepted that comprehensive orthodontic treatment is lengthy; the time frame is largely dictated by the biologic principles underpinning optimal tooth movement.[1,2] There has been a lack of clarity concerning the typical duration of treatment. In a previous review that included observational studies, the authors were unable to arrive at an overall estimate of treatment duration.[3] In spite of this lack of a clear yardstick, there has been a seemingly relentless drive among orthodontists and general dentists to reduce the duration of orthodontic treatment. Modern adjuncts directed at hastening treatment include newer technologies and novel surgical procedures, but some clinicians also resort to eschewing integral treatment phases in an effort to reduce treatment times.[4,5]

Excessive treatment duration has been linked to a greater susceptibility to iatrogenic consequences of appliance therapy, primarily root resorption and plaque-induced conditions, including demineralization.[6] Moreover, patient compliance and oral health–related quality of life may be impaired by longer treatment, particularly in adults.[7] Shorter treatment times may, therefore, theoretically offer advantages to both treatment providers and patients, although shorter treatment is not without significant potential disadvantages.

For providers of care, there may be financial incentives in delivering more efficient treatment, most likely associated with fewer visits and shorter chairside times.[8] However, potential financial gain may be tempered by the necessity for prolonged and diligent retention associated with the placement of teeth in inherently unstable

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positions with limited torque expression when the objectives of treatment are confined to the alignment of anterior teeth in isolation.[5]

Novel approaches, involving various degrees of financial outlay and theoretical risk, have included expensive vibratory appliances[9] and adjunctive surgical procedures to expedite tooth movement.[10] Both, however, appear to be largely unproven; a randomized trial failed to identify an increase in the rate of orthodontic alignment in conjunction with a well-marketed, nonsurgical adjunct involving vibratory stimulation.[11] Moreover, a recent Cochrane review highlighted a lack of evidence to support the use of surgical adjuncts at this stage, with only 4 clinical trials incorporating a total of just 57 patients.[12] Furthermore, patient perceptions of surgically assisted orthodontics are not all favorable, especially when given the alternative of other noninvasive techniques.[13]

It is therefore increasingly important that there is an appreciation of the expected length of orthodontic treatment before routinely embarking on treatment involving compromised objectives or adjunctive procedures, particularly with the lack of evidence underpinning these approaches. The aim of our review was to determine the duration of orthodontic treatment with fixed appliances.

MATERIAL AND METHODS

The protocol for this systematic review was registered on PROSPERO international prospective register of systematic reviews (www.crd.york.ac.uk/prospero; protocol, l CRD42014014983). The following inclusion and exclusion criteria were used.

1. Study design. Randomized and prospective nonrandomized studies carried out in primary or secondary care or in the community were to be included. Studies with short follow-up periods not including the duration of orthodontic treatment and retrospective studies were excluded.
2. Participants. Patients of any age with complete-arch, fixed, bonded orthodontic appliances followed until the end of treatment were to be included. Patients with craniofacial syndromes and cleft lip or palate were excluded.
3. Interventions and comparators. Any treatment intervention involving comprehensive, complete-arch, fixed orthodontic appliances without adjunctive use of removable or functional appliances was included. Patients undergoing treatment involving fixed appliances with surgical interventions including surgical exposure of ectopic teeth were excluded. Interceptive orthodontic interventions were also excluded. Since this was an epidemiologic review, no between-group comparisons were planned.
4. Outcome measures. These were the duration of orthodontic treatment (months) from appliance placement to removal and the number of visits.

Search strategy for identification of studies

Comprehensive electronic database searches were undertaken without language restrictions as follows: MEDLINE via OVID (to November 2014, Appendix), the Cochrane Oral Health Group's Trials Register (November 2014), and the Cochrane Central Register of Controlled Trials (CENTRAL, the Cochrane Library Issue 3, 2014). Unpublished literature was accessed electronically through ClinicalTrials.gov (www.clinicaltrials.gov) and the National Research Register (www.controlled-trials.com) using the term *orthodontic*. In addition, efforts were made to obtain conference proceedings and abstracts, with authors contacted to identify unpublished or ongoing clinical trials. Reference lists of included studies were screened for additional relevant research.

Assessment of relevance, validity, and data extraction

Data were extracted independently and in duplicate by 2 authors (A.T., S.Y.C.) using prepiloted data extraction forms. The investigators were not blinded to the authors or the results of the research, and any disagreements were resolved by discussion with a third author (P.S.F.). The following information was recorded where available: (1) year of publication and study setting; (2) participants: sample size, age, and sex; (3) type of intervention; (4) type of control; and (5) outcomes: treatment duration (including means and standard deviations in months, where available) and number of visits (means).

Authors were contacted to clarify data as required, including information on treatment duration.

The quality of the eligible trials was assessed independently and in duplicate by 2 authors (A.T., S.Y.C.), and any disagreements were resolved by discussion with a third reviewer (P.S.F.). The Cochrane Collaboration's risk of bias tool was used to assess risk of bias for randomized controlled trials (RCTs),[14] and the Newcastle-Ottawa scale was used for the nonrandomized studies.[15] The following domains were assessed as being at low, high, or unclear risk of bias for the RCTs: sequence generation (selection bias), allocation concealment (selection bias), blinding of participants and personnel (performance bias) and outcome assessors (detection bias), incomplete outcome data addressed