

Commentary

Fixed functional appliances show definite skeletal and dental changes in the short term

Niall McGuinness

Department of Orthodontics, Edinburgh Dental Institute, Edinburgh, UK

Correspondence to: Niall McGuinness, Department of Orthodontics, Edinburgh Dental Institute, Lauriston Place, Edinburgh EH3 9HA, UK. E-mail: nialljmcguinness@gmail.com

Summary

A meta-analysis of the literature on fixed functional appliances found nine unique data sets ($n = 418$ patients, mean age = 13.2 years) that fulfilled the criteria. Small but statistically significant changes in SNA, SNB, and ANB occurred, with larger changes in the incisor angulations. The results are compared with a previous meta-analysis on the effects of removable functional appliances by the same team and discussed in regard to their implications for clinical practice.

Commentary

Functional appliances are well established as a means of correcting significant antero-posterior malocclusions. A mainstay of specialist orthodontic practice is the removable functional appliance but the issue of compliance remains a problem with some patients. Fixed functional appliances have been developed over the past two decades and show considerable promise in this area.

The meta-analysis by Koretsi *et al.* in this issue originally found 9115 papers, of which 6342 remained after duplicates were removed (1). The papers were assessed according to strict eligibility criteria, including one treatment arm with fixed functional appliances. Ten papers, with nine data sets, with a total of 418 patients (mean age 13.2 years) fulfilled these criteria. The results were pooled and summarized for the cephalometric hard and soft tissue measurements. Linear measurements could not be reported owing to the different magnifications between the various studies.

The results showed that the SNA angle decreased on average by 0.83 degrees/year, SNB increased by 0.87 degrees/year, giving a total ANB reduction of 1.74 degrees/year. When compared with the meta-analysis for removable functional appliances published by the same team in the EJO last year, the respective figures are -0.28 degrees, $+0.62$ degrees, and -1.14 degrees, respectively (see Table 1).

The effect on the upper and lower incisors was even more pronounced, with twice as much effect on the upper incisor angulation as the removables and almost six times the effect on the lower incisors.

When the different types of fixed functional appliances were considered, there was no difference between their effect on the ANB angle

Table 1. Comparison of skeletal and soft tissue changes in the current meta-analysis compared with those in a previous meta-analysis on removable functional appliances by the same authors.

	Current study	Meta-analysis on removable functional appliances (1)
SNA	-0.83°	-0.28°
SNB	$+0.87^\circ$	$+0.62^\circ$
ANB	-1.74°	-1.14°
U1 to MXP	-7.5°	-3.29°
L1 to MNP	$+7.99^\circ$	$+1.37^\circ$
Nasolabial angle	$+0.03^\circ$	$+2.78^\circ$
Mentolabial angle	$+14.99^\circ$	$+22.6^\circ$

change, but the Forsus® Fatigue Resistance appliance was associated with the greatest proclination of the lower incisors. Stepwise mandibular advancement was associated with greater retroclination of the upper and proclination of the lower incisors compared to single-step advancement.

The effect on the soft tissues showed that there was a minimal increase in the nasolabial angle of $+0.03$ degrees in the present study compared with an increase of $+2.78$ degrees in the removable appliance meta-analysis. The mentolabial angle also showed a lesser increase: $+14.99$ degrees compared to $+22.6$ degrees for the removable appliance study (Table 1).

Discussion

This meta-analysis has shown that there is a small but statistically and clinically important effect on the skeletal and dentoalveolar parameters of patients treated with fixed functional appliances. These changes may appear small, but such minor skeletal effects can be associated with a marked treatment effect and the success of the outcome. The incisor inclinations deserve particular attention: the lower incisors particularly show very marked proclination compared to that produced by removable functional appliances. Whether or

not such proclination is stable in the longer term is debatable, but over the course of a year, this change is certainly a large one.

The implications for clinical practice must be considered in the light of these findings. It is evident that significant clinical changes do occur and the skeletal changes in fixed functionals are greater than those produced in removable ones. The same is true for the incisor angulations. The changes for the soft tissues, most notably the nasolabial angle, showed almost no change while that for the labiomental angle was less than that produced in the removable appliances. The question is posited: should a wholesale move to the use of fixed functional appliances be recommended? It may be that such an approach would create more problems than anticipated: in all such matters, there is a 'learning curve' associated with

such changes, not to mention the technical and laboratory resource implications. Even very experienced clinicians will find themselves confronted with failures initially. The same could be said for any novel technique, but the incorporation of fixed functional treatment into one's armamentarium is one that should be done, and it should be taught to every new generation of specialist trainees together with the removable versions.

Reference

1. Koretsi, V., Zymperdikas, V.E., Papageorgiou, S.N. and Papadopolous, M.A. (2014) Treatment effects of removable functional appliances in patients with Class II malocclusions: a systematic review and meta-analysis. *European Journal of Orthodontics*, 37, 418–434.