

Effect of arch form on the fabrication of working archwires

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Introduction: Previous studies have shown that most practitioners plan to maintain intercanine and intermolar widths during orthodontic treatment with fixed appliances. The aim of this study was to determine whether this was put into practice by clinicians during the latter stages of orthodontic treatment with fixed appliances. **Methods:** This 2-part investigation was a laboratory-based measurement study at Bristol Dental Hospital, United Kingdom, from 2005 to 2007. Using standardized maxillary and mandibular study models with identical intermolar and intercanine widths but with differing degrees of tooth misalignment, 30 clinicians were asked to fabricate final working archwires according to their normal clinical practice. Then the intercanine and intermolar widths of the archwires were measured. In the second part of the study, the same intra-arch dimensions were measured directly from 50 pretreatment and posttreatment patient study models obtained from a subsample of 10 of the clinicians. **Results:** The intercanine and intermolar widths measured on the adapted archwires from the standardized study models showed wide variations in the results, even though the intercanine and intermolar widths of the models were identical. Data from 50 treated patients also showed that, in most, there were wide variations in intercanine and intermolar widths between the patients' pretreatment and posttreatment study models. **Conclusions:** Although most clinicians aim to maintain the pretreatment arch form, this study shows that this is often not transferred to clinical practice. (Am J Orthod Dentofacial Orthop 2010;138:257.e1-257.e8)

Changes in tooth position after orthodontic treatment are thought to be caused by either orthodontic relapse as a result of teeth being moved into inherently unstable positions or physiologic changes continuing throughout life. To minimize orthodontic relapse, several treatment conventions have been suggested, including maintenance of the mandibular incisors in their pretreatment position and preservation of the pretreatment arch form.¹

Arch form is the position and relationship of teeth to each other in all 3 dimensions. Many studies have suggested that, to increase posttreatment stability, the patient's original arch form should be preserved.²⁻⁴ No arch form fits all, and although attempts have been made to find a suitable all-encompassing arch

form—eg, Bonwill-Hawley arch, catenary curve, and trifocal ellipse⁵⁻⁸—arch forms differ, and therefore customization of archwires is required.^{2,4}

Maintenance of the original intercanine width, intermolar width, and arch length has been found to contribute significantly to a stable posttreatment result.³ Preservation of the mandibular intercanine width in particular is important because this tends to return, in most patients, to its original value after treatment.⁹

A previous study, with a questionnaire to assess clinicians' perceptions of the importance of arch form, showed that most clinicians thought it was important to consider and maintain intercanine and intermolar widths when adapting their working archwires.¹⁰ However, when asked what landmarks they routinely used to achieve this—eg, cusp tips or imagined bracket positions—there was no real consensus. Some used only the canines and first molars as landmarks, whereas others used premolars and second molars also when bending their working archwires. There was also considerable inconsistency about the use of study models and symmetry charts. The majority of those who used study models for arch form selection used the mandibular model and later conformed the maxillary archwire to the mandibular archwire (69%). Somewhat surprisingly, others used the maxillary study model to choose the arch form for both archwires (31%).

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Fig 1. Test study models with identical intercanine and intermolar widths.

Table I. Summary of intercanine and intermolar widths from formed archwires on the 3 sets of models

Code	n	Mean (mm)	Median (mm)	Maximum (mm)	Minimum (mm)	SD	95% CI of mean	Shapiro-Francia W'
1	30	29.12	29.01	34.00	24.23	2.11	28.33-29.92	0.769
2	30	49.63	49.53	52.24	46.70	1.32	49.14-50.13	0.874
3	30	37.90	37.91	40.63	32.89	1.49	37.35-38.46	0.013
4	30	54.90	54.98	60.76	52.30	1.56	54.32-55.48	0.001
5	30	30.92	30.92	34.40	25.29	2.03	30.16-31.68	0.400
6	30	49.69	49.48	53.54	46.09	1.94	48.96-50.41	0.960
7	30	39.65	39.54	42.73	37.32	1.49	39.09-40.21	0.399
8	30	55.23	55.15	58.00	50.70	1.53	54.66-55.80	0.129
9	30	28.76	28.68	33.09	25.05	1.93	28.04-29.48	0.943
10	30	48.42	48.08	51.54	45.75	1.44	47.88-48.96	0.427
11	30	38.97	38.82	42.48	34.41	1.62	38.37-39.58	0.326
12	30	55.32	55.23	60.84	52.21	1.63	54.71-55.93	0.020

From the results of the questionnaire study, it was clear that there was no uniformity in how arch form is preserved. So, even if clinicians are carefully adapting their working archwires to preserve arch form, are they actually choosing the correct arch form and dimensions?

The aim of this study was to assess clinicians' clinical practices when choosing an arch form.

MATERIAL AND METHODS

This study was divided into 2 parts, with the first part consisting of a practical component. Instructions consisted of asking clinicians to adjust working archwires as per their normal clinical practice for 3 sets of standardized study models. If they did not normally adjust their archwires, they did not alter them for the study. The resulting archwires were then measured to

Table II. Key to Table I

Code	Model set	Measurement
1	A	Mandibular intercanine width
2	A	Mandibular intermolar width
3	A	Maxillary intercanine width
4	A	Maxillary intermolar width
5	B	Mandibular intercanine width
6	B	Mandibular intermolar width
7	B	Maxillary intercanine width
8	B	Maxillary intermolar width
9	C	Mandibular intercanine width
10	C	Mandibular intermolar width
11	C	Maxillary intercanine width
12	C	Maxillary intermolar width

see whether they corresponded to a predetermined standardized arch form. In the second part of the study, pretreatment and posttreatment study models of a subset

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