CLINICAL TRIAL

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# Upper removable appliance or Jones Jig for distalizing first molars? A randomized clinical trial

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**Abstract**

***Aim –*** To compare the effectiveness of two intra-oral methods of distalizing upper first permanent molars: an upper removable appliance (URA) and a Jones Jig.

***Sample –*** Twelve patients were randomly allocated to URA treatment and 11 patients to a Jones Jig.

***Methods –*** Upper study models were collected at the start of treatment and after 6 months of appliance wear. The amount of distal movement, tipping and rotation of the upper first permanent molars and mesial movement of the upper first permanent premolars was measured using a reflex metrograph.

***Results –*** There were no statistically significant differences between the two treatment methods for any of the outcome measures ($P < 0.05$). Distal movement obtained by both appliances was approximately 1 mm.

***Conclusions –*** The amount of distal movement obtained with both appliances was small and no differences were shown in the amount of molar tooth movement. It is suggested that there is no advantage in using the Jones Jig as a non-compliance appliance.

**Key words:** distal movement; first permanent molars; Jones Jig; randomized clinical trial; removable appliance

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## Introduction

The purpose of this study was to compare the effectiveness of an upper removable appliance (URA) (1) and a Jones Jig (2) as methods of distalizing upper first permanent molars as part of a course of orthodontic

treatment. A systematic review of the literature has revealed that the effectiveness of these methods have not been evaluated using randomized controlled trial (RCT) methodology (3).

## Sample

The sample size for each group was calculated as $n = 11$ based on an alpha significance level of 0.05 and a beta of 0.1. This gave a 90% power to detect a difference of 3 mm (±2 mm) distal movement between the URA and the Jones Jig groups. The patients were obtained from five orthodontic treatment providers after applying the following inclusion criteria:

- patient 10–16 years old at start of treatment;
- upper second premolars present and erupted (required for the Jones Jig).

#### Random allocation method

A restricted randomization method was used in blocks of 12 to ensure that equal numbers of patients were allocated to each of the two treatment groups.

The examiner measuring the models was blind until all the data were recorded.

#### Interventions and their timing

Distal movement of the upper first permanent was to be carried out at the start of treatment and no other appliances were placed at the same time. All patients were treated identically, apart from the named interventions.

#### Outcome measures

The outcome measures to be assessed in the trial were changes in the position of the upper first permanent molar in terms of:

- distal movement,
- distal tipping,
- disto-palatal rotation (molar straightening).

In addition we measured:

- mesial movement of the upper first premolars (loss of anchorage),
- reported discomfort.

#### Appliance design and data collection

##### Upper removable appliance

All patients received the same URA design which consisted of Adam's cribs on the upper first premolars, Southend clasp on the upper central incisors, occlusal stops on the upper canines and palatal finger springs to distalize the upper first molars.

##### Jones Jig

The Jones Jig or fixed molar distalizing assembly consisted of bands on the upper second premolars attached to a Nance palatal arch. The Jig mainframe was attached through the headgear and bracket slot to upper first molar bands. The NiTi coilspring was activated by a long ligature attached to the premolar bands on each side.

##### Patient records

At start and end of 6 months, the operator took the upper impressions and these were cast in dental stone. At each appointment, the patient indicated on a nine-point Likert scale how uncomfortable the appliance had been after the previous adjustment.

##### Measurement method

The start and the end of treatment movement of the molars were recorded from the study models using a reflex metrograph (4). The landmarks and measurements used in this study are shown in Figs 1, 2 and 3a,b.

In order to superimpose the digitized points of the serial models, we used identifiable points on the

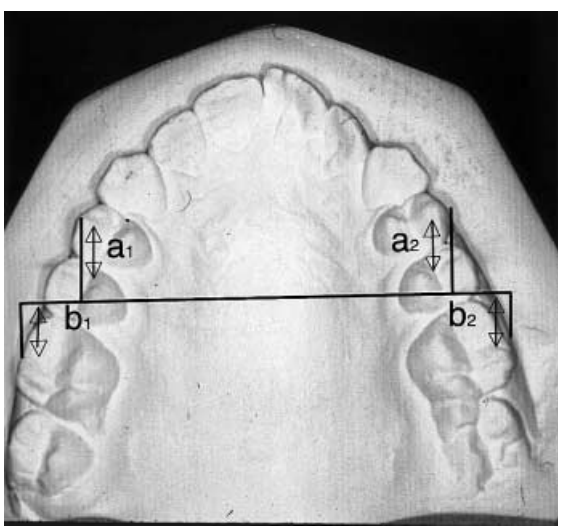


*Fig. 1.* Measurement of first premolar mesial position (a1 and a2) and first molar distal position (b1 and b2) from a rugae plane constructed from the lateral aspects of two anterior palatal rugae.

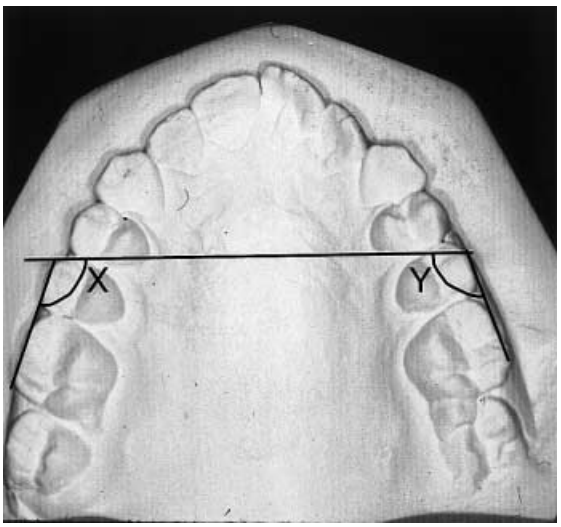


*Fig. 2.* Upper first molar rotation (angle *X* and *Y*) from a rugae plane between the lateral aspects of two anterior palatal rugae and a line of best fit between the mesial and distal buccal surfaces of the molars.

anterior palatal rugae. These have been shown to be stable in the short term (5) and have been used in similar investigations of mesio-distal tooth movement (6). As we used the rugae as landmarks, it was essential that the intra-oral appliances did not influence the shape of the rugae. Therefore, we relieved the fitting surface of the removable appliance and did not extend the acrylic of the nance button on the Jones Jig to the lateral aspect of the rugae.

#### Method error

Systematic error was reduced by ensuring that the examiner was blind to: 1) the treatment group; 2) whether the model was the start or the finish of the treatment. Measurements were carried out in a random order so that a patient's start and finish models were not looked at consecutively.

Random error of locating landmarks was reduced by taking each measurement three times and calculating an average. The error associated with the alginate impression technique and model preparation has been shown to have a 97% coefficient of reliability (7).

#### Examiner calibration and reliability

The examiner was calibrated for the reflex metrograph using four metal calibration cubes of different heights, widths and lengths. Reliability of the measurements

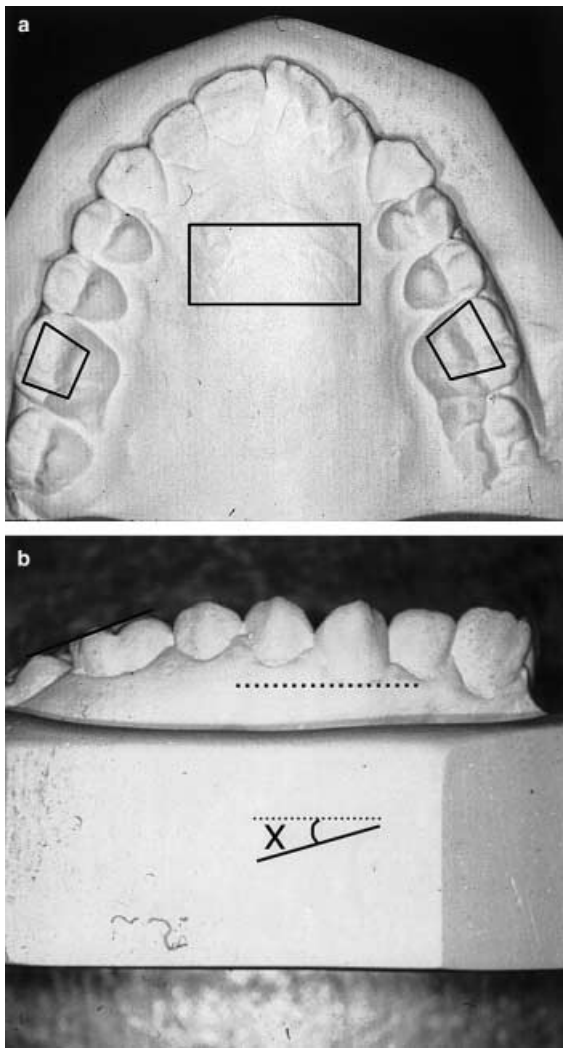


*Fig. 3.* Planes constructed to measure first molar tip: (a) Central rugae plane from four lateral anterior rugae points. Molar planes constructed from cusp tips of upper first permanent molar; (b) Molar tip calculated as the angle *X* between the constructed rugae plane (dotted line) and right and left molar plane (solid line).

was assessed by remeasuring all the models at least 1 week later and was shown to be adequate.

#### Statistics

The differences between the two methods of treatment and examiner calibration and reliability were evaluated with the Student's *t*-test. Examiner reliability was assessed using intra-class correlation coefficients.

## Results

A trial profile for the registered patients is shown in Fig. 4. This shows that for the 27 patients initially regis-

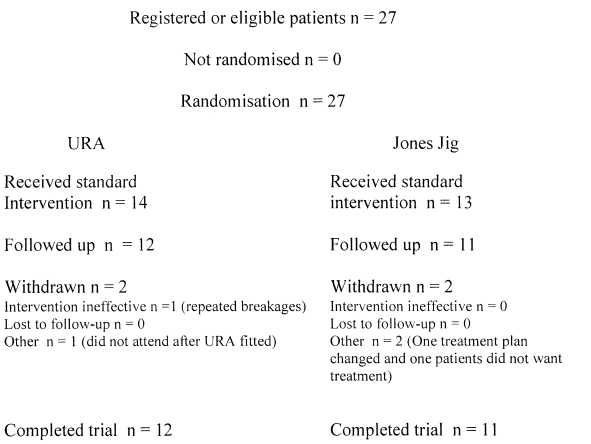


*Fig. 4.* Profile of randomized clinical trial to compare URA and a Jones Jig for distalization of upper first permanent molars.

***Table 1.*** **The amount and type of tooth movement produced by the upper removable appliance (URA) and the Jones Jig (means with standard deviations in parentheses)**

| | Appliance | | |
|---|---|---|---|
| Tooth movement | Jones Jig | URA | *P*-value |
| Tipping (degrees) | 4.56 (3.31) | 3.18 (5.12) | 0.47 |
| Mesial premolar movement (mm) | 0.18 (2.30) | 0.18 (2.26) | 0.70 |
| Rotation (degrees) | 5.16 (4.31) | 2.92 (3.63) | 0.19 |
| Distal molar movement (mm) | 1.17 (1.94) | 1.30 (1.34) | 0.85 |
| Reported discomfort (1 = no pain, 9 = severe pain) | 2.39 (1.0) | 2.80 (1.54) | 0.47 |

tered in the trial, four patients withdrew from the study and the reasons for the withdrawal were as follows:

- patient did not want treatment after registration ($n = 1$),
- repeated breakages ($n = 1$),
- patients failed to attend after appliance fitted ($n = 1$),
- treatment plan subsequently changed ($n = 1$).

This resulted in a final sample of 23 subjects who were divided into 16 girls and 7 boys. The mean age at the start of treatment was 14 years 9 months [standard deviation (SD) 21 months] in the Jones Jig group and 13 years 6 months (SD 19 months) in the URA group. The mean duration of treatment with both appliances was 6 months and the total tooth movements in this time period are shown in Table 1. There were no statistically significant differences between the two methods of treatment.

# Discussion

The results of this investigation revealed that the amount and type of tooth movement from using these two types of appliance was small. Importantly, both appliances were equally effective. It is not possible to make comparisons with previous literature because of lack of randomized clinical trials. Nevertheless, a systematic review of the literature has revealed that even when we consider the evidence derived from retrospective investigations, the amount of distal molar movement that may be achieved is approximately 2.5 mm. Furthermore, it is also established that the results of retrospective investigations overestimate the effects of a treatment. Therefore, we would like to suggest that this investigation may be showing that the true effect of distalizing appliances is small.

It is also relevant to consider that correction of the molar relationship is occurring not by distal movement of the upper molar but by mesial movement of the lower molar. In this respect, the amount of distal movement of the upper molar is not an important issue as both the appliances may be simply 'holding' the upper molar in its original position.

As neither appliance seems to have an advantage over the other, the choice is based upon the clinician preference and cost. While cost was not evaluated in this investigation, it is obvious that the construction of the removable appliance requires laboratory technician time and the Jones Jig requires clinical time. It is the individual clinician's decision, as to whether they wish to construct an appliance in the dental chair or reduce chairside time at the expense of laboratory time.

### Deficiencies of this investigation

In any RCT, it is important that the characteristics of any drop-outs are accounted for. As the number of drop-outs was small, the loss of information was thought unlikely to bias the remaining data.

In addition, if the analysis of the study results in a negative result with no treatment being better than another, it is necessary to consider the power of the study. When we calculated power, we set a meaningful difference between treatment methods at 3 mm. This may be considered to be rather high; however, we also did not wish to carry out an investigation that reveals

statistical but not clinical significance. As a result, we feel that this study had sufficient power to reveal a meaningful difference in the effects of the two treatment methods. Importantly, this difference was not detected.

## Conclusions

The amount of distal molar movement with a Jones Jig or URA was small. There were no differences in molar tooth movement or reported discomfort between the two appliance systems that we tested. Thus, there does not seem to be any advantage in using the Jones Jig as a non-compliance appliance.

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### References

1. Lewis DH, Fox N. Distal movement without headgear. The use of an URA for the retraction of upper first permanent molars. *Br J Orthod* 1996;**23**:305–12.
2. Jones RD, Jones WM. Rapid class II molar correction with an open coil jig. *J Clin Orthod* 1992;**26**:661–4.
3. Atherton G, Glenny A-M, O'Brien KD. Methods of distalizing maxillary molars: a systematic review of the literature. *J Orthod*, in press.
4. Butcher G. The reflex optical plotter. *Br Dent J* 1981;**151**:304–5.
5. Van der Linden P. Changes in the position of posterior teeth in relation to rugae points. *Am J Orthod* 1978;**74**:142–61.
6. Hoggan BR, Sadowsky C. The use of palatal rugae for assessment of antero-posterior tooth movements. *Am J Orthod Dentofac Orthop* 2001;**119**:482–8.
7. O'Brien KD, Lewis DH, Shaw WC. A clinical trial of aligning archwires. *Eur J Orthod* 1990;**12**:380–4.