terms of their effect on the facial vertical dimension. The Begg technique relies heavily on the use of anchor bends in archwires with inherent use of Class II elastics for correction of the presenting malocclusion. Such mechanics can cause significant extrusion of the molars, resulting in the possible alteration of the facial vertical dimension.

Canine retraction is frequently performed (Shpack *et al.*, 2007; Burrow, 2010) on a 0.018 inch steel archwire and it does not seem unusual to us to do the same. However, during canine retraction an iatrogenic deep bite is created due to deflection of the wire under the influence of a retraction force (Gjessing, 1994; Upadhyay and Nanda, 2010). This may have been the cause for bite deepening and therefore the intrusion arches were used wherever it was deemed necessary.

Dr Sivakumar brings out an interesting point that the Begg technique has an inherent differential anchor support as it pits bodily movement of the anchor unit against tipping and uprighting movements of the anterior teeth. However, despite this, we observed no difference between the two groups indicating that probably the uprighting phase had a significant strain on the anchor unit during torqueing, resulting in posterior anchor loss. However, this is just a theoretical assumption which makes perfect mechanical sense. In order to generate evidence for such an effect, lateral cephalograms taken before and after the uprighting phase of the incisors will have to be analysed.

'Residual growth' is often used to describe any changes occurring in the skeletofacial characteristics of the face after majority of the intended growth is completed. These changes might occur even after the removal of orthodontic appliances. Growth of the face in the vertical dimension is generally considered to finish the last amongst the three spatial planes. Therefore, we mentioned that it might be interesting and worthy to observe the long-term changes that occur with these two different techniques.

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European Journal of Orthodontics 34 (2012) 789–790
doi:10.1093/ejo/cjs039
Advance Access publication 5 September 2012

Cautious use of thread shape factor

Sir,

Recently, Migliorati *et al*. (2012) evaluated the correlation between thread depth, thread pitch and thread shape factor (TSF), and maximum insertion torque (MIT) and found the strongest correlation between TSF and MIT (r = 0.902, P = 0.001) with a 2.2-mm cortical thickness of experimental bone. The article is interesting and among few studies in Orthodontics evaluating the prediction power of TSF for clinical decisions. I have some comments on the way they applied the Chapman equation.

Originally, Chapman *et al*. (1996) introduced an equation to correlate various characteristics to predict pull out strength of cancellous screw for orthopaedics application. The equation was as follows:

$$ {}_{\text{pull out}} = {}_{\text{shear}} \times \pi \mathrm{LD}_0 \times \left(\frac{1}{2} + \frac{1}{\sqrt{3}} \quad / \quad \right) $$

where F, S_{shear}, L, D_0, d, and p was pull out strength (N), shear strength of the bone (MPa), length of engaged intraosseous part (mm), external diameter of miniscrew (mm), thread depth (mm), and thread pitch, respectively. They introduced $\left(\frac{1}{2} + \frac{1}{\sqrt{3}} d / p \right)$ as the thread shape factor. It is noteworthy that this formula was designated for cylindrical screws, in which cross-sectional area of osseointegrated part is equal through the length of engaged part. More recently, Tsai *et al*. (2009) modified the original formula to be applicable in conical and tapered forms that are used with growing interest in routine practice of various disciplines of medicine and dentistry.

The modified Chapman formula is

$$ dF_{\text{pull out}} = S^{*}_{\text{shear}} \times \left[\pi D_0 \left(x \right) dx \right] \times \left[\frac{1}{2} + \frac{1}{\sqrt{3}} \frac{D_o(x) - D_i(x)}{2p} \right] $$

$D_o(x)$ and $D_i(x)$ are outer-diameter and inner-diameter function through the engaged part to compensate for variation through the cross-sectional area along the shaft. Besides pitch and depth characteristic of threads, there are several other properties that have influence effect on the screw and the peripheral bone stresses such as flutes, degree of taper, thread type, top radius curvature, flank angle, bottom radius of curvature, length of the straight part at the bottom of the thread, and length of threaded part (Hansson and Werke, 2003; Wu *et al*., 2011). Hence, the modified version still lacks considerations for many of these designation variations. The miniscrews that Migliorati *et al*. used in their work were not all cylindrical, in addition to other dissimilarities; therefore the original formula would not be the best option. I believe that according to such dissimilarities between applied materials, the results may not be feasibly generalized. Moreover, controlling for other variables would better elucidate the pure effect of a specific miniscrew character in both numerical and experimental studies.

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European Journal of Orthodontics 34 (2012) 790–791
doi:10.1093/ejo/cjs056
Advance Access publication 5 September 2012

Reply

Sir,

We would like to thank A and M Poorsattar Bejeh Mir for their comments on our article. We appreciated the appropriate and consistent comments on the use of Chapman formula (1996) and the modifications suggested by Tsai *et al.* (2009) later.

The aim of our research (Migliorati *et al.*, 2012) was to evaluate if orthodontic miniscrew geometrical characteristics can affect primary stability. In particular, we measured and analysed three components of the thread of the screws: the depth of the thread, the pitch and the relationship between these two components, also called Thread Shape Factor (TSF). The setting of the *in vitro* test was designed to avoid as much as possible bias due to heterogenous parameters, such as organic bone, external conditions, length of the threaded part of the screw within the bone. We found a statistical correlation between TSF and both maximum insertion torque and pull out value. This correlation underlines how geometrical features of miniscrews plays a key role in the mechanical interlock with the bone. Thus the aim of our research was not to validate the TSF as predictable factor to predict experimental pull out strength. Tsai's research provided an experimental test to compare six different pedicle screws pull out value, verify the accuracy of Chapman's formula, and finally produce a new formula that resulted in more correlation with experimental test values. Two significant aspects should be underlined: 1) the synthetic bone sample was homogenous: no stratification of cortical and marrow bone was provided, in fact, Tsai *et al.* (2009) stated: 'the applicability of the new formula should be further investigated for predicting the pullout strength of the inserted screw within the cancellous bone. For