Most of us are surely familiar with Orthodontic braces. They’ve been around for a long time, in fact since the late 1800’s. We’ve either had the experience as a patient or know someone who has. Simply put, they are comprised of brackets and/or bands bonded to the teeth with an archwire interconnecting these brackets to move the teeth in three dimensions. They are very efficient but in today’s fashion conscious world, for some, they are just plain ugly, especially for adults. There are alternatives to standard metal labial bonded braces and these include clear ceramic or plastic brackets or a series of invisible aligners such as Tru-Line™, but these articles will focus on the development of and some of the laboratory procedures of lingual orthodontics.

Lingual orthodontics is exactly as the name suggests - orthodontic brackets placed on the lingual surfaces of the teeth and connected by special archwires. The advantages aesthetically are immediately evident, but other advantages include the labial enamel is not etched, bonded or scarred during debonding. Braces do not have to be removed early for social events and people with highly visible social jobs can still continue without embarrassment.

The disadvantages of lingual Orthodontics include speech interference and patient adaptation is not always predictable. Tongue irritation is common and patients with narrow arches or tongue thrust may not adapt well. The technique is clinically more time consuming and patients tend to be more demanding. Some traditional labial mechanics cannot be used due to the smaller interbracket distances and smaller arch radius. Delving into the details of most of this is beyond the scope of the article but suffice to say there are differences between the two modalities.

The lingual bracket had to be specifically designed for the lingual surface of the teeth and a...
method of positioning these brackets had to be invented as direct bonding of lingual brackets is virtually impossible, hence an indirect method had to be developed.

These days, there are many different types of lingual brackets on the market but the positioning of these brackets in relation to the teeth is really the critical factor common to all. So the real trick to get lingual orthodontics to work in the real world was to devise a method so the brackets could be placed onto the tooth with the correct torque and angulation in relation to the tooth already determined. This is much easier to do with labial braces but a real challenge for lingual braces.

Lingual braces were invented in the 1970’s when a Playboy model wanted to know if she could have some type of “invisible” orthodontic treatment so she could keep working. The first attempts were crude but lead to more interest in lingual orthodontics. In 1984, theOrmco company devised the TARG (Torque Angulation Reference Guide) device for more precise bracket positioning, especially for the lingual technique. The first of these machines had a wooden base which proved to impede precision. Over the years, various improvements to the TARG device were made. Adding thickness compensation and height determination in a digital measuring environment were some of the advances.

In 1997, a new TARG Professional by Dr Weichmann from Germany - the Transfer Optimised Positioning System (TOPS) was released, but still used the Torque blades of the TARG. He also invented the first CAD/CAM Incognito system, which uses customized gold brackets. Various other inventions were introduced over the years but none with significant merit.

In 2004, a real breakthrough in lingual orthodontics arrived. The Torque Angulation Device (TAD) prototype was first introduced. This device was unique as it had the ability to survey and measure the torque and angulation of individual teeth in a different way than previous devices and with great accuracy. With the prepared study model in position, the surveyor base is set to horizontal and then the TAD is adjusted to give the best fit for angulation and torque. The operator thereby receives precise digital measurement data for the mal-occluded teeth in the mouth so that you can make a suitable prescription for treatment.

The laboratory uses it in the opposite way by pre-setting the angulation and torque then orientating the survey base to the best fit, thus giving a reference to transfer the work over and allow correct bracket placement. The invention of the TAD finally provided the orthodontist with the tools to accurately measure existing torque and angulation on models of mal-occluded teeth. After the prototype TAD was finished, intensive lab work was carried out testing and cross-referencing with the old TARG to find the differences in Angulation and Torque given. The Torque differences were significant, leading the researchers to believe the old TARG had an inaccuracy of + or - 3 degrees! Again the inventors concentrated one ease-of-use
and speed for the technician. The accuracy was already there. In 2006, the first production TAD is finished and the world had the first digital TARG accurate to 0.1 degrees!

To make bracket placement easy, the Bracket Placement Device BPD was devised and is used in conjunction with the TAD. It is reliable, strong, compact and easy to use, as well as being very low maintenance. Increased accuracy in controlled bracket placement allows the operator to work faster and smarter. After the model is measured with the TAD, these measurements are transferred to the BPD and the brackets are placed onto the model before a custom tray is fabricated. This process will be fully detailed in part 2 of this article.

Acknowledgement
The author wishes to thank Peter Sheffield from Hexa Ceram Dental Laboratory for his assistance with this article.

About the author
Terry Whitty is the technical editor of eLABORATE and also runs a successful orthodontic laboratory in Sydney’s eastern suburbs where he produces innovative appliances using the latest techniques and technologies including laser welding. He has also lectured throughout Australia and New Zealand on a variety of subjects.