

## A Clinical Longitudinal Comparative Study of the Orthodontic Treatments of Triplets Utilizing Three Different Fixed Orthodontic Techniques

By Ricardo Medellin F. DDS, MS

*Abstract: This is a progressive, longitudinal study of the treatment of triplets each with a different orthodontic technique. The opportunity was seized to compare the treatment times, number of adjustments and results when simultaneously treating three identical individuals with very different treatment philosophies and brackets—Tweed, MBT and Tip-Edge.<sup>®</sup> This is a once-in-a-lifetime comparison.*

**I**ntroduction  
Among the options the orthodontist must consider to solve malocclusions exists an infinity of systems, brackets, and philosophies of movement. Although all may achieve satisfactory results, it is interesting to consider which of these offer the best advantages to consider adopting as the system of choice in a busy practice.

The purpose of this study is to compare three different systems of fixed appliances in the treatment of triplets where the malocclusions were almost identical. This includes evaluation of such variables as treatment times, number of adjustments and archwires used, quality of results and stability of results up to 7 years posttreatment.

### Method

Female triplet patients appeared at the division of postgraduate studies at the Universidad Tecnológica de Mexico (Mexico City) seeking orthodontic treatment (Figures 1-6). Because of the similarity of their occlusions it was decided to treat each with a different edgewise technique—one with Kesling archwire slots and two with Angle slots.

The treatments were carried out under the supervision of an experienced instructor for each system and the operators were postgraduate students.

All three patients are identified by first names only and different colored frames when appropriate to properly identify each and their particular edgewise treatment system or appliance, (Figures 7-9):

1. Ingrid - Red - Tip-Edge<sup>®\*</sup> (Preadjusted, Kesling slots)
2. Montserrat - Yellow - Tweed<sup>\*\*</sup> (Non-adjusted, Angle slots)
3. Pamela - Green - MBT<sup>\*\*\*</sup> (Preadjusted, Angle slots)

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### Diagnosis

By their facial characteristics, dental malocclusions and cephalometric analyses, all triplets were diagnosed as Class I malocclusions with severe upper and lower crowding and slight patterns of vertical growth.

Tracings were made of lateral head x-rays which revealed similar cephalometric measurements.

### Treatment

The treatment plans for all triplets included the extraction of four first premolars and initiation of treatment utilizing fixed appliances (Figure 10).

Montserrat and Pamela initiated their treatments on the same day in January of 2002. Montserrat received edgewise brackets with .022" non-adjusted Angle archwire slots from Ormco Corporation and the Tweed technique was followed. Pamela was treated using MBT<sup>™</sup> Versatile (.022" preadjusted Angle archwire slots) brackets by 3M Unitek and the associated appliance system. Unfortunately, Ingrid was unable to begin at this time because there wasn't yet a clear decision as to which appliance system would be utilized to treat her (Figure 11).

Finally, in July 2002 it was decided to treat Ingrid with the Tip-Edge<sup>®</sup> appliance and brackets with .022" preadjusted, Kesling archwire slots.<sup>5</sup> At that time the beginning of stage one of Tip-Edge<sup>®</sup> treatment can be observed in Ingrid while the other two sisters are completing their alignment and leveling phases (Figure 12).

In March of 2003 Ingrid is nearly edge-to-edge and with all teeth engaged on .022" stainless steel archwires. Montserrat and Pamela continue in phases of retraction and closing of spaces with round and rectangular archwires respectively (Figure 13).

In August of 2003 Ingrid is in the uprighting and torquing stage of treatment with full-size, .0215" x .0275" steel archwires and Side-Winder springs.

Spaces are being closed for Montserrat with .019" x .026" archwires in place. Pamela is in the leveling phase with round archwires (Figure 14).

In October of 2003 Ingrid has finished, Montserrat has a double Class II elastic in order to improve the cuspid relations and Pamela still presents a slight bilateral Class II relationship (Figure 15).

An evaluation was made of progress to date which revealed Ingrid has completed treatment in 15 months. Her sisters have already undergone 22 months of treatment and may require up to an additional 8 months.

In relation to the archwires placed until this time Ingrid required a total of 6, while Montserrat and Pamela have received 13 and 14 archwires respectively.

Finally, in November 2005 after 47 months of treatment, both Montserrat (non-adjusted edgewise) and Pamela (MBT) are finished (Figure 16). Meanwhile Ingrid has already been out of treatment for over 2 years (Figure 17). The duration of treatment and number of archwires used for each technique are shown graphically (Figure 18).

## Results

Triplets with similar malocclusions were treated with the extraction of the four first premolars. Three different edgewise systems and brackets were compared including the variables of treatment time, number of archwires, quality of the results and posttreatment stability.

Each instructor evaluated the results and retention at the end of treatment through clinical evaluations.

## Stability and Retention

Figures 19-21 show the results of long term (up to seven years) occlusal stability, cephalometric changes and facial maturation of all triplets.

## Conclusions

Triplet patients were treated in the Universidad Tecnologica de Mexico by postgraduate orthodontic students directed by instructors with experience in

handling each different orthodontic system. The diagnosis and treatment plan were officially approved for each patient by the clinical director and the instructor. It has been shown in summary the clinical procedures in each of the system phases, the number of archwires placed, the duration of the treatment, the quality of results as well as the stability after 5 and 7 years in retention.

All three clinical instructors and postgraduate operators rated the three sisters' cooperation as 8 to 9 on a scale of 1 to 10. Therefore, differences in treatment times between the triplets cannot be related to this possible variable.

However, the relatively rapid and efficient progress of Ingrid with the Tip-Edge® appliance was not unexpected as it corresponds to similar treatments reported by Ramos et al<sup>6</sup> and Richard Parkhouse.<sup>7</sup>

This unique opportunity to treat triplets with differing archwire slots and edgewise techniques offers insights and the ability to compare/evaluate the treatments and results as never before.

## References

1. Tweed CH. The application of the principles of the edgewise arch in the treatment of malocclusions. *Angle Orthod* 1941; 11:5-67.
2. Andrews LF. The straight-wire appliances. Explained and compared. *J Clin Orthod* 1976; 10:174-195.
3. Kesling PC. Expanding the horizons of the edgewise arch wire slot. *Am J Orthod* 1988; 94:26-37.
4. McLaughlin RP, Bennett JC, Trevisi HJ. Systemized orthodontic treatment mechanics, 2001. London: Mosby.
5. Kesling PC. Kesling archwire slot. *Am J Orthod Dentofac Orthop* 2007; 131:702-703.
6. Galicia-Ramos GA, Killiany DM, Kesling PC. A comparison of standard edgewise, preadjusted edgewise, and Tip-Edge® in Class II extraction treatment. *J Clin Orthod* 2001; 35:15-153.
7. Parkhouse RC. Tip-Edge® Orthodontics, 2003. Edinburgh: Mosby.



Figure 1 - Pretreatment frontal photos of 10 year 8 month old female triplets. Only slight weight differences help distinguish between them. Different colors help identify each sister and her various records.

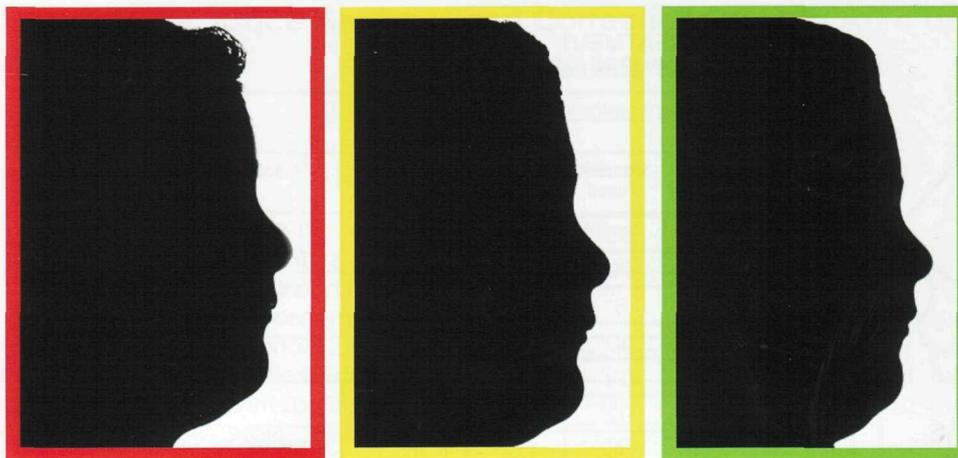


Figure 2 - Photo silhouettes disclose extremely similar soft tissue profiles



Figure 3. Hand-wrist x-rays of triplets indicate they all have identical rates of ossification and that adolescent growth spurts are eminent.

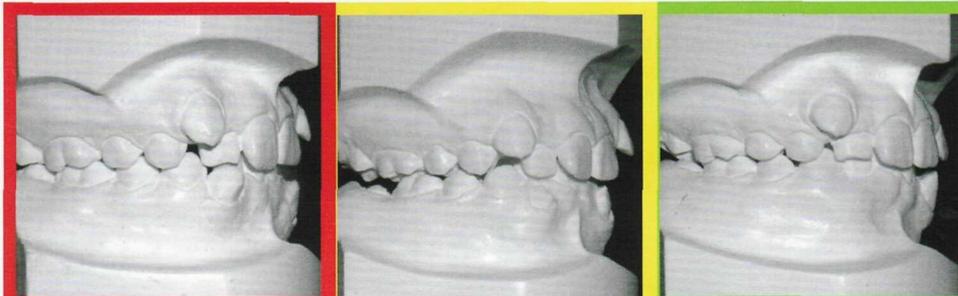


Figure 4. Plaster casts display not only similarities of Class I malocclusions but in crown shapes and sizes as well.

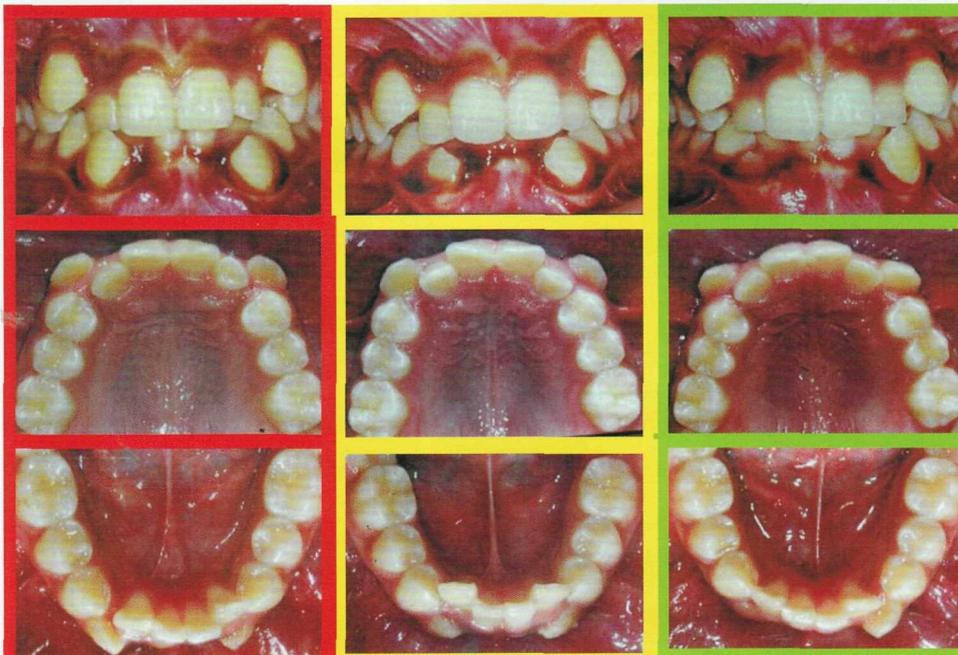


Figure 5. Intraoral photos reveal three different, yet almost identical developing crowded dentitions and also similar upper and lower arch forms.

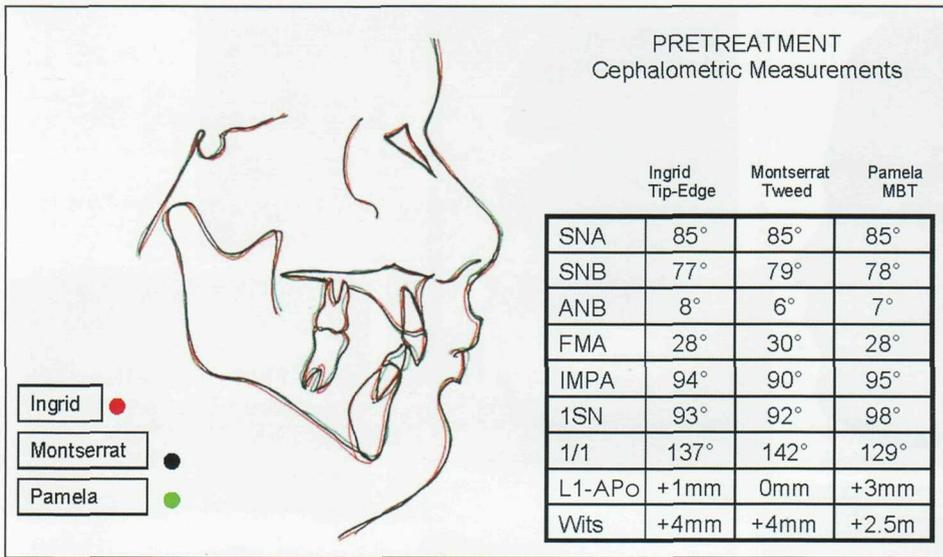


Figure 6 - Tracings of pretreatment lateral head x-rays of triplets superimposed on Sella-Nasion lines at Sella. Congruence of structures confirms skeletal similarities between all three sisters before treatment. Note: Montserrat's (yellow) tracing done in black for clarity.



Figure 7 - Patient Ingrid (**red**) was treated utilizing preadjusted Tip-Edge® brackets and the Differential Straight-Arch® Technique.<sup>3,5</sup> The single wing bracket has the unique .022" Kesling archwire slot that can open to .028" during crown tipping to eliminate binding and reduce friction. This free tipping permits relatively rapid bite opening from light forces from .016" Australian archwires and 5/16" intermaxillary elastics (5 and 2.5 ounces respectively). No anchorage auxiliaries were required. Spaces were closed with light (2-3 ounces) forces utilizing stiff, .022" Australian archwires to provide vertical and horizontal stability. Second molars were not banded. Final uprighting and torquing powered by Side-Winder springs working against rigid .0215" x .0275" stainless steel archwires.

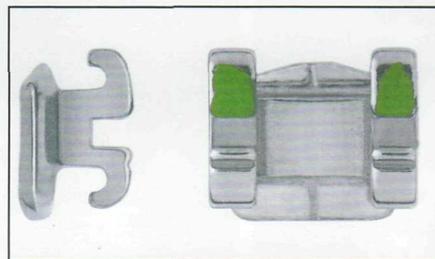


Figure 8 - Patient Montserrat (**yellow**) was treated with Tweed technique<sup>1</sup> using conventional (non-adjusted) Ormco® twin edgewise brackets with .022" Angle archwire slots. A Nance button and lingual arch were placed to reinforce anchorage. Initial .016" nickel titanium archwires were used for leveling in conjunction with a pair of open coil springs to create spaces for the mandibular lateral incisors. Subsequently, .018" stainless steel archwires were placed while distalizing the canines. This was followed by retraction using .019" x .025" nickel titanium archwires. Second molars were banded and included for improved control. Final archwires of .019" x .025" with crimpable hooks and double, Class II elastics pulling 80 ounces were used to obtain Class I canine relationships.

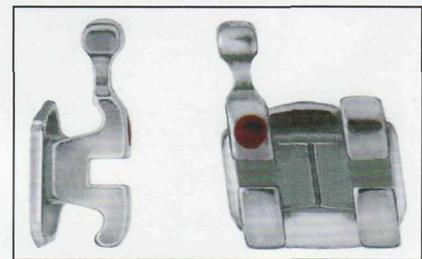


Fig. 9. Patient Pamela (**green**) was treated with MBT (McLaughlin, Bennet & Trevisi) system utilizing Unitek® Versatile preadjusted<sup>2,4</sup> twin brackets with .022" Angle archwire slots. Treatment was initiated with .016" copper nickel titanium Orthoform III oval archwires. Cuspid ligature lace backs and a transpalatal bar were used to reinforce anchorage. Next, .016" stainless steel archwires were placed with open coil spring to create space for the blocked out mandibular lateral incisors. Within 5-6 months .016" x .022" nickel titanium archwires were used for leveling. Next .019" x .025" stainless steel archwires with crimpable hooks were placed and figure 8 ligatures used to bind canine to canine and retract the six anterior teeth in groups. Second molars were banded to help meet ABO requirements. Return to upper and lower .016" nickel titanium archwires for leveling. Finally, replace the .019" x .025" archwires.

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# Mandibular Space Analyses and Corrections of L1 to A-Po Lines for Each Triplet

## Mesiodistal Space Analyses

	Ingrid	Montserrat	Pamela
Mandibular available space 1 <sup>st</sup> molar to 1 <sup>st</sup> molar	67mm	66mm	68mm
Required space for all teeth 1 <sup>st</sup> molar to 1 <sup>st</sup> molar	85mm	85mm	85mm
Available Space & Tooth size Discrepancy	-18mm	-19mm	-17mm

## Cephalometric Position of lower incisor

Li to A-Po line	+1mm	0mm	+3mm
Correction to norm for Hispanics +3mm	+2mm	+3mm	0mm
Multiplied by 2 (left and right sides)	+4mm	+6mm	0mm

## Total Tooth Size and Cephalometric Discrepancy

-14mm	-13mm	-17mm
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Figure 10 - Based on these analyses of space requirements, positions of lower incisors, Class I Angle occlusions and soft tissue profiles, it was decided to extract the four first premolars from each triplet prior to placement of her respective edgewise appliance system.

## Treatment Progress

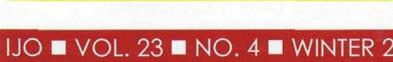
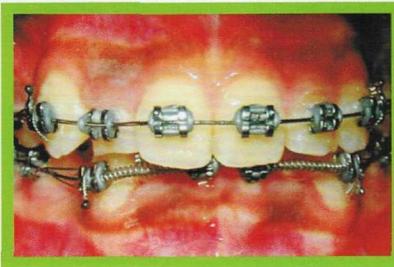
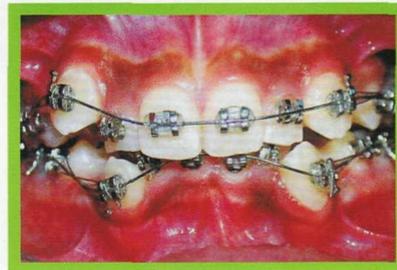


Figure 11 - January 2002: Ingrid (red). An appliance or technique had not yet been selected for her. Note extractions have not been done. Montserrat (yellow). Treatment with Ormco non-adjusted, (zero-zero) twin brackets began with .016" nickel titanium archwires. A Nance button and lingual arch are in place to reinforce anchorage. Pamela (green). Treatment initiated with 3M Unitek MBT Versatile brackets and .016" copper nickel titanium archwires. A transpalatal bar and canine lace back ligatures in place to reinforce anchorage and limit canine mesial inclination.

Figure 12 - July 2002: Ingrid (red). Preadjusted, single-wing Tip-Edge brackets (TP Orthodontics) with high tensile, stainless steel .016" archwires (A. J. Wilcock). Light, 2-ounce Class II intermaxillary elastics in place as well as Class I, 2-ounce elastics to Power Pins on the lower canines. Montserrat (yellow). Non-adjusted edgewise appliance has nearly completed leveling with .018" stainless steel archwires. Lower lateral incisors engaged. Pamela (green). MBT system—.016" stainless steel archwires with open coil springs to gain space in lower.



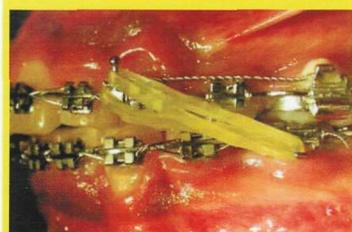
Figure 13 - March 2003: Ingrid (red) Tip-Edge. Bite is open with .022" stainless steel archwires in place. Extraction spaces closed and patient wears 2-ounce Class II elastics as needed to maintain light contact between upper and lower anterior teeth. Montserrat (yellow) Tweed non-adjusted edgewise. Slightly more bite opening with round archwires. No active attempt so far to correct the Class II tendency. Pamela (green) MBT. Archwires (.019" x .025") and figure 8 ligatures from canine to canine. Bite is still deep—no direct attempt yet to correct Class II tendency.

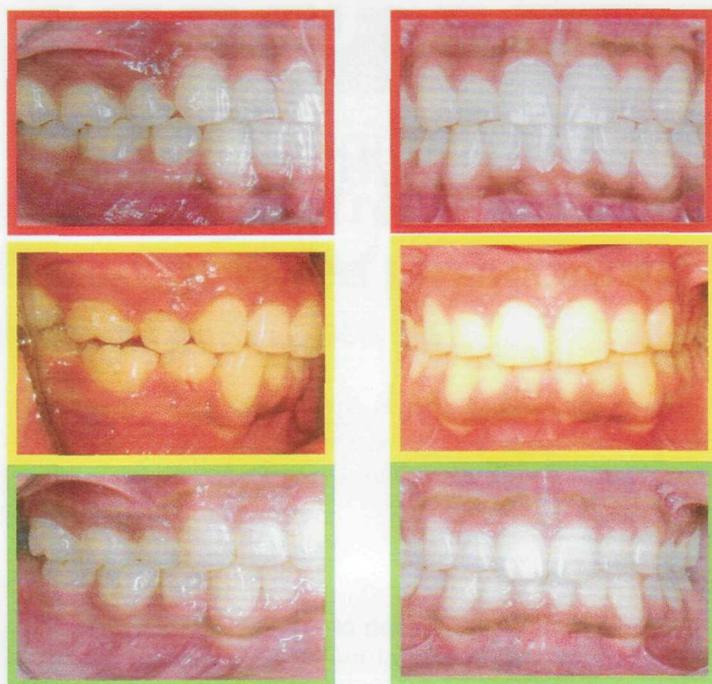


Figure 14 - August 2003: Ingrid (red). Tip-Edge appliance completing stage three with .0215" x .0275" steel archwires and Side-Winder springs to power all uprighting and torquing. Montserrat (yellow) Tweed non-adjusted edgewise. New nickel titanium archwires .019" x .025" with crimpable hooks on upper. Steel ligatures in upper and elastomeric chains in lower to close spaces. Pamela (green). MBT. Back to .016" nickel titanium archwires for leveling. Bite still relatively deep.



Figure 15 - October 2003: Ingrid (red). Tip-Edge appliances removed after 15 months. Patient was given a Pre-Finisher® to be worn as a retainer while her sisters continued with fixed appliances. Montserrat (yellow) non-adjusted brackets. Archwires of .019" x .025" still in place. Lower figure 8 ligature from molar to molar. Upper figure 8 ligature from canine to canine and twisted ligatures from crimpable hooks to molars. Double Class II elastics pulling 80 ounces on each side. Pamela (green), MBT - replace .019" x .025" stainless steel working archwires. All spaces closed yet Class II tendency remains and bite is still deep.





## The orthodontic treatment systems

### Comparative Study of the Triplets' Orthodontic Treatments

System	AVG	SE	SD	CV	AVG
Tip-Edge	10.0	1.0	1.0	10.0%	10.0
Tweed	17.5	1.5	1.5	8.6%	17.5
MBT	16.5	1.5	1.5	9.1%	16.5

Figure 16 - November 2005: Ingrid (red). Occlusion after 15 months in Tip-Edge appliances, one year with Pre-Finisher® followed by another year with no retention. Montserrat (yellow) Non-adjusted Tweed and Pamela (green) MBT—occlusions at time of appliance removal, each after 47 months of active treatment.



Figure 17 - Posttreatment smiles. Ingrid (red) has had her Tip-Edge appliances off for two years. Montserrat's (yellow) Tweed and Pamela's (green) MBT appliances have just been removed.

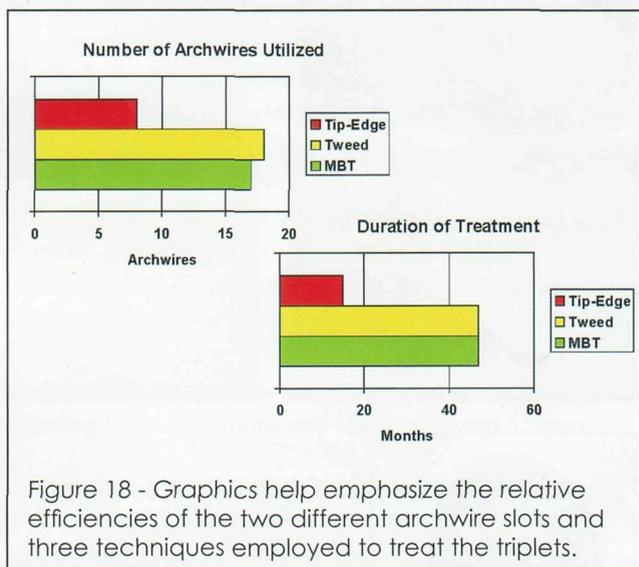


Figure 18 - Graphics help emphasize the relative efficiencies of the two different archwire slots and three techniques employed to treat the triplets.



Figure 19 - October 2010: Frontal and profile photographs showing the results of treatment and facial maturation over a nearly 9-year span.

## PRE and POSTTREATMENT Cephalometric Measurements

	Ingrid Tip-Edge		Montserrat Tweed		Pamela MBT	
	Pre	Post	Pre	Post	Pre	Post
SNA	85°	85°	85°	88°	85°	87°
SNB	77°	81°	79°	84°	78°	82°
ANB	8°	4°	6°	4°	7°	5°
FMA	28°	16°	30°	18°	28°	18°
IMPA	94°	111°	90°	110	95°	110°
1SN	93°	107°	92°	112	98°	108°
1/1	137°	120°	142°	118	129°	115°
L1-	+1m	+3m	0m	+3	+3m	+3m
Wits	+4m	0m	+4m	0m	+2.5	0m

Ingrid ●  
Montserrat ●  
Pamela ●



Figure 20 - Pre and posttreatment tracings of lateral head x-rays of triplets superimposed on S-N lines at Sella. It is apparent that the different edgewise archwire slots, archwires, techniques and forces resulted in varying, yet all satisfactory posttreatment dental changes. However, the efficiencies of the slots and techniques differed greatly. Note: Montserrat's (yellow) tracings done in black for clarity.



Figure 21 - October 2010: Ingrid (red) Tip-Edge, seven years posttreatment. Montserrat (yellow) Tweed and Pamela (green) MBT approximately five years posttreatment. Even though Ingrid's treatment time was less than half that of her sisters, all results are similar and satisfactory.



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