PACIFIC COAST SOCIETY OF ORTHODONTISTS
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Reframing Clinical Patient Management with SureSmile Technology

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In an age of digital orthodontics, a clinician needs to have skills to manage a patient both at the chairside and in the virtual environment-—The "OrthoPit". It is the blending of this expertise that enables an orthodontist to provide proactive clinical care to a patient in a reliable and timely manner without putting the patient at risk. This article describes the use of both 'hard' and 'soft' tools in managing the orthodontic care of a patient with SureSmile technology.

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PSCO NewsWire, Vol. 2, No. 1: March 2009. Available as an online article at http://www.pcsortho.org/newswire/March-09.cfm
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SureSmile has developed an integrated 3D imaging, diagnostic and therapeutic technology platform to enable an orthodontist to plan and deliver customized care for a patient.[1 2 3 4 5]

In this patient report, the application of SureSmile[6] technology in the treatment of a patient with a mild skeletal asymmetry and moderate crowding in the lower arch is described.

Diagnosis and Etiology

An adult female in her mid 40s presented with the Chief Complaint, "I don't like the appearance of my lower teeth" (Fig. 1). A summary of her clinical findings (Table I) and Cephalometric analysis is presented in (Fig. 2 and Table II)

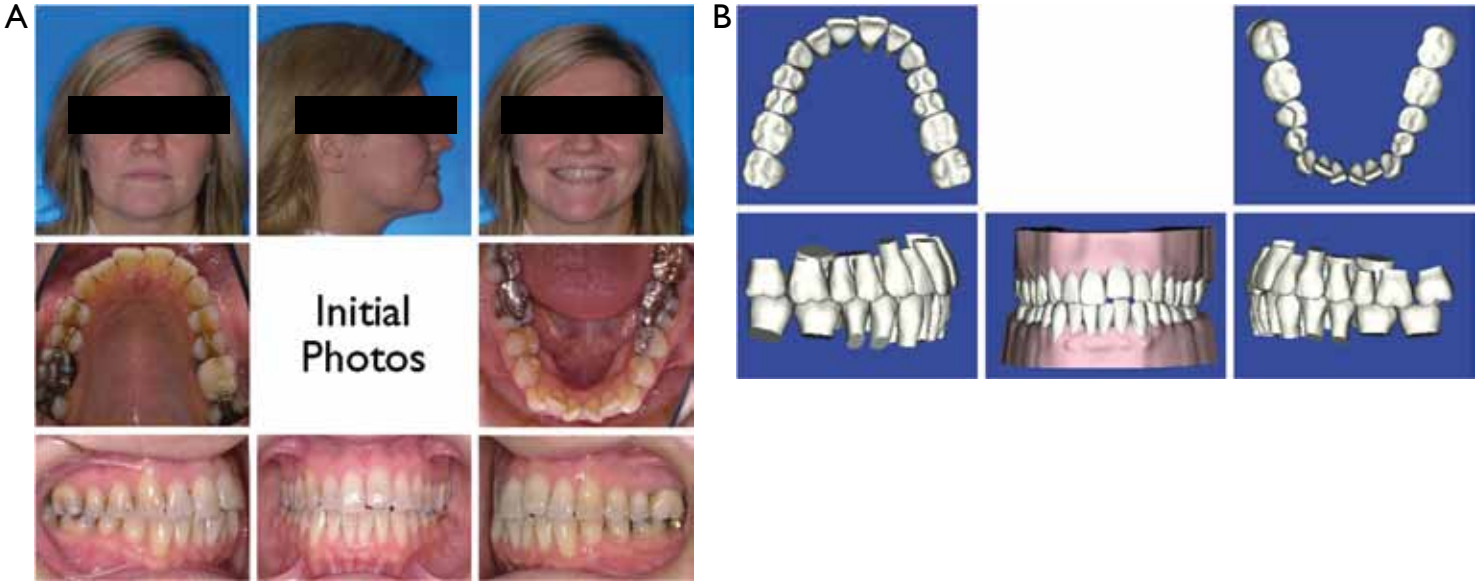

Fig 1.A. *Initial photographs.* ***B.*** *Initial Diagnostic Simulation Models*

	Sagittal	Vertical	Transverse
Soft Tissue	• Mildly concave • Retrusive lips	• Upper facial height to lower facial height • Upper anterior gingival tissue height differential • Competent lips	• Lower right facial asymmetry • Soft tissue Pogonion shifted to right
Skeletal	• Mildly concave	• WNL	• Skeletal asymmetry
Dental	• Class III left • Class I right	• End to End • Vertical height discrepancy between upper 1s	• Lower midline deviated right • Severe lower crowding
Others	• Moderate–severe lower dental crowding • Oral hygiene WNL • Numerous dental restorations • Normal ROM		

Table I. *3D Orthodontic Diagnosis*

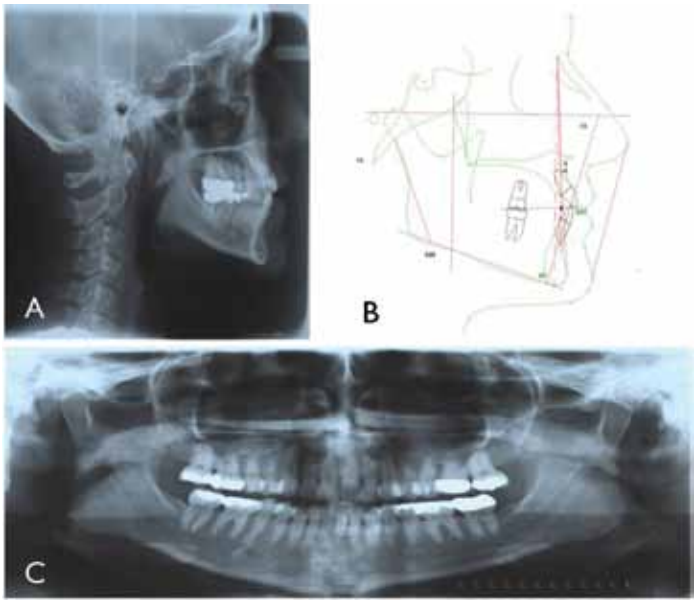

Fig 2 A. Initial Ceph. B. Initial Ceph Tracing. C. Initial Panoramic Radiograph

Dental	Pt	Std	Diff
Interincisal Angle (U1-L1) (°)	136.9	130	6
Overbite (mm)	1.8	2.5	2
Overjet (mm)	2.6	2.5	2.5
Molar Relation (mm)	0.7	–3	1
Dental/Skeletal			
L1 Protrusion (L1-APo) (mm)	4.1	2.7	1.7
L1 to A-Po (°)	19.9	22	4
U-Incisor Protrusion (U1-APo) (mm)	6.6	6	2.2
U-Incisor Inclination (U1-APo) (°)	23.2	28	4
IMPA (L1-MP) (°)	86.9	95	7
FMIA (L1-FH) (°)	73.9	64.8	8.5
U1 - FH (°)	117	111	6
Skeletal—Vertical			
FMA (MP-FH) (°)	19.2	23.9	4.5
Mand Plane to Occ Plane (°)	21.7	17.4	5
Occ Plane to FH (°)	–2.5	6.8	5
Gonial/Jaw Angle (Ar-Go-Me) (°)	129	122.9	6.7
Skeletal—Horizontal			
Convexity (A-NPo) (mm)	–0.7	0.7	2
ANB (°)	0.6	1.6	1.5
Maxillary Skeletal (A-Na Perp) (mm)	2.8	0	3.1
Mand. Skeletal (Pg-Na Perp) (mm)	6.8	–4	5.3
Wits Appraisal (mm)	1.1	–1	1
Soft Tissue			
Lower Lip to E-Plane (mm)	–7.2	–2	2
Upper Lip to E-Plane (mm)	–10.4	–6	2

***Table II.** Initial Ceph Analysis*

SureSmile in Clinical Practice

SureSmile technology has been designed to be integrated into normal clinical processes. Its clinical application can be broadly classified into three distinct components:

- Clinical Decision Support with Simulations
- Customized Therapeutics
- Outcome Evaluation

Clinical Decision Support with Simulations

Virtual simulations are performed to quickly compare and contrast a variety of treatment strategies and identify the best treatment option. In addition, simulation provides an important visual interface for communication between the care provider and patient.

Simulations begin by first establishing general treatment objectives. The objectives are applied as input parameters in defining boundary conditions to run the simulations which are subsequently analyzed for their clinical feasability.[4] Generally speaking, multiple treatment scenarios can be simulated within a span of 5-10 minutes. Simulations need not be done if the clinician is confident in his/her treatment decision.

General Treatment Objectives (Boundary Conditions)

Treatment objectives were limited to treating the dental malocclusion. The skeletal asymmetry and soft tissue profile of the patient were accepted. The dental treatment objectives were:

- Treat to the upper functional occlusal plane
- Treat to the lower archform
- Treat to Class I occlusion on the patients right and Class III on the left—in other words accept the current sagittal relationship of the dentition
- The conflicting objectives were either to treat to the upper midline or maintain the upper/lower midline

Simulations

Simulations were performed on the 3D-virtual diagnostic/simulation model which in this case was obtained by scanning a rough pour of the original physical model at the office with the OraScanner.[1,2,4] This model can also be generated from an alginate impression. This is sent to OraMetrix where it is scanned to create a virtual model. Recent advances in SureSmile Technology also make it possible to take a CBCT scan of the physical model in practices that have a CBCT to create a virtual model. The OraScan or CBCT scans are sent from the practice via the internet (Virtual Practice Network VPN) to the OraMetrix Digital Lab for processing. The post-processed model is sent back via the Internet (VPN) back to the practice within five business days (Fig.3).

The virtual diagnostic simulation model was used to evaluate the following:

- Arch length discrepancy
- Treatment scenario simulation

Arch Length Discrepancy

Crowding in the mandibular arch was evaluated since it was considered the independent arch to which the maxillary archform would be designed.

The following boundary conditions were applied to the virtual simulation model to measure the amount of crowding present in the lower arch.

- Maintain the lower arch form (Natural)
- Maintain the lower incisor/Anteroposterior (AP) position
- Maintain the current lower midline

Based upon the above inputs, (Fig. 4A) arch length discrepancy was automatically calculated by the software. The total discrepancy was 4.6 mm, with 2.2 mm and 2.4 mm of crowding in the lower right quadrant and left quadrant respectively (Fig. 4B).

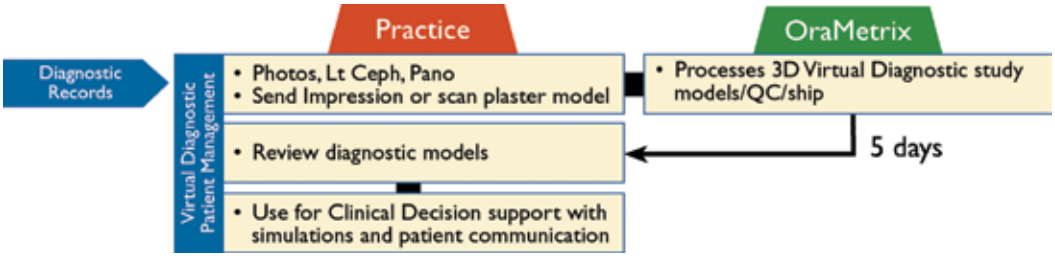

Fig 3. *SureSmile Initial Records Collection and Processing*

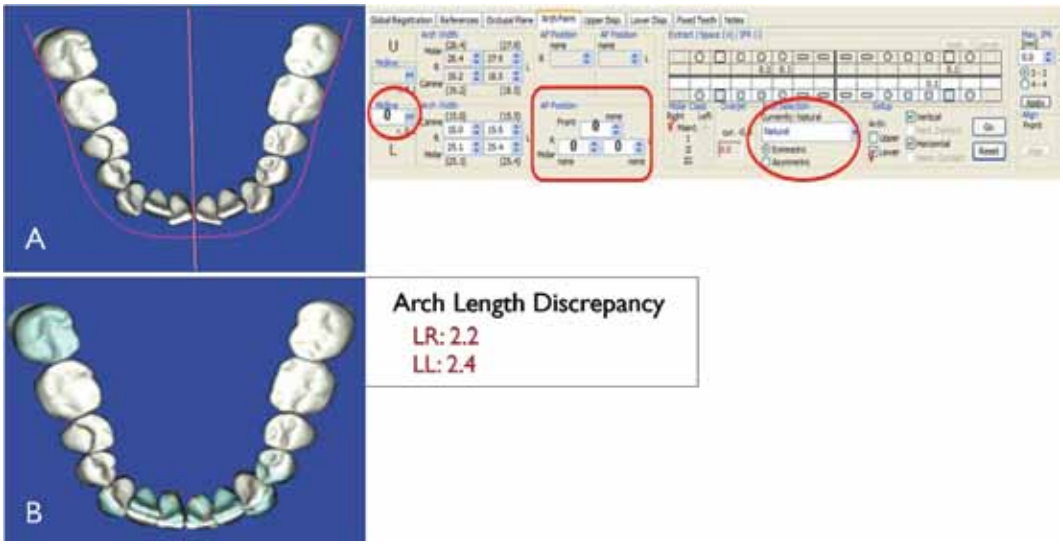

Fig 4.A. *Estimation of mandibular crowding. Boundary constraints set in the dialog box.* ***B.*** *The arch length discrepancy is displayed. The blue model represents the initial condition and the white model is the simulation of the aligned teeth.*

Treatment Scenario Simulation

Having assessed the arch length discrepancy, the next phase of simulation was designed to delineate the optimal treatment strategy within the framework of the general treatment objectives described earlier. The following scenarios were considered:

- Simulation of a Lower Incisor Extraction
- Interproximal Reduction (IPR)
- Additional Simulations to Analyze "Risk Factors"

Extraction of a lower left central incisor was simulated.[7,8] This treatment strategy allowed for correction of the crowding and also alignment of the lower midline to the upper, but resulted in excessive asymmetric overjet on the patient's left side (Fig. 5 and 6).

Interproximal reduction (IPR) of the lower anteriors was simulated. The dimensions of the teeth were measured at the level of the contact points (automatically) to assess if IPR was feasible. Also, a Bolton analysis was performed (Fig. 7). This treatment strategy required a minimum amount of tooth movement to correct the crowding in the lower arch (Fig. 8). However, this would result in the lower midline being maintained. A minimum amount of retraction of the lower incisors occurred, resulting in an overjet that was less severe than if a lower incisor was extracted (Fig. 9).

Simulations with the gingival tissue "ON" was performed to evaluate the risk of black triangle formation during alignment. It was noted that the greatest risk for black triangle formation would be between the two lower central incisors (Fig. 10).

The treatment goal was to maintain the lower archform which also meant that the AP position of the lower incisors could not be violated. The lower incisor AP position post IPR simulation was evaluated against a ceph radiograph. Fig. 11 shows that the AP position of the incisor was maintained close to the original lower incisor position.

Both treatment approaches were discussed with the patient over a "web-consult" and the non-extraction approach was agreed upon both by the patient and care provider.

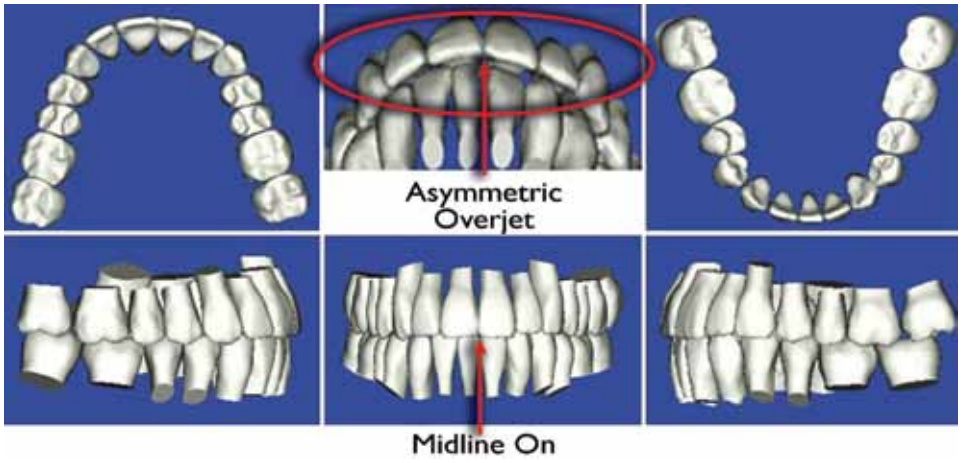

Fig 5. *Simulation with lower left central incisor extraction.* ***Note:*** *Excessive asymmetric overjet in the left quadrant.*

Customized Therapeutics

The Pre-SureSmile Therapeutic Phase

The goal of this phase of treatment is to achieve moderate alignment and leveling. The initial wire used for both upper and lower was a preformed 16x22 CuNiTi (TTR 35°C) with an Orthos™ archform. IPR was performed concomitantly to allow for alignment and minimal proclination of the lower incisors.

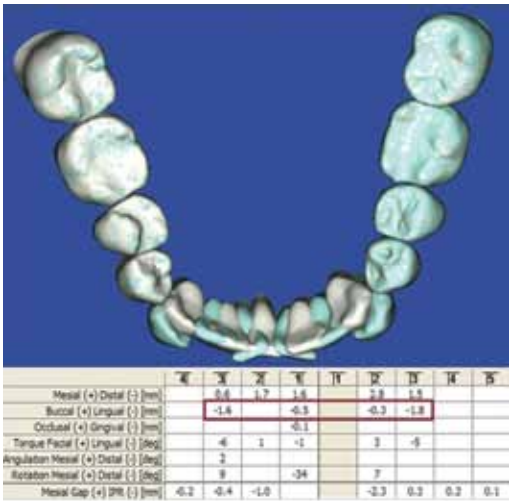

Fig 6. *Simulation with lower incisor extraction. Original model (blue) superimposed over target model (white). Compare the displacements with the IPR simulation (Fig 8).*

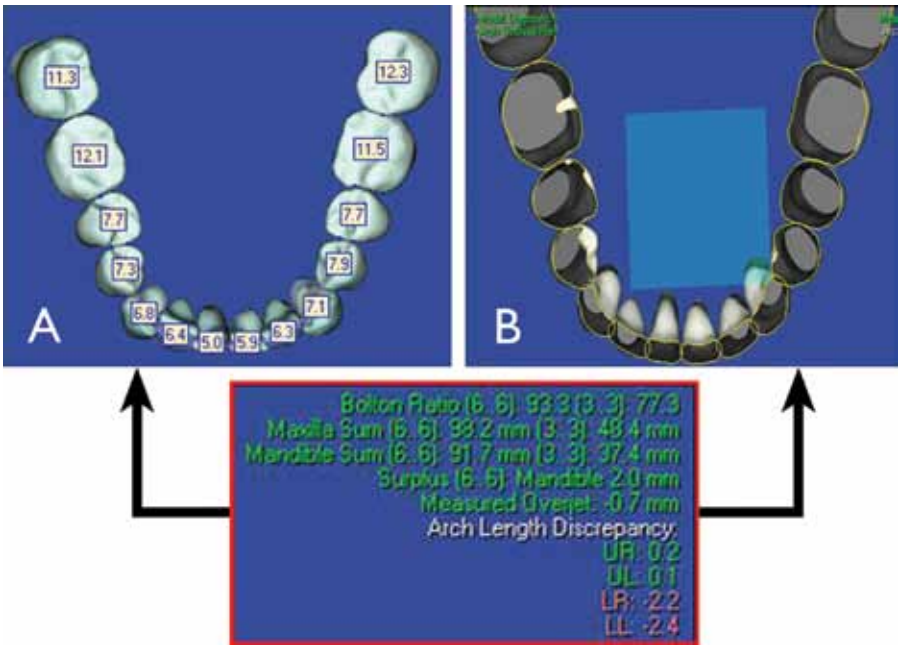

Fig 7.A. *Tooth size and Bolton ratio assessment.* ***B.*** *Lower arch view using the clipping plane. The overlap between the anteriors demonstrates the site and amount of interproximal reduction.*

The SureSmile Customized Therapeutic Phase

The SureSmile customized therapeutic phase was initiated about six months into treatment. At this time, an in-vivo therapeutic scan was taken using the SureSmile OraScanner. Today, a CBCT scan of the patient can be taken as an alternative to the OraScan. The therapeutic OraScan provides information regarding the current state of the dentition (crowns) and the location of the brackets (with the CBCT scan one can also visualize roots). Once the therapeutic scan is captured in the practice, it is sent electronically to the OraMetrix Digital Lab for processing and is returned within five business days to the practice for evaluation.

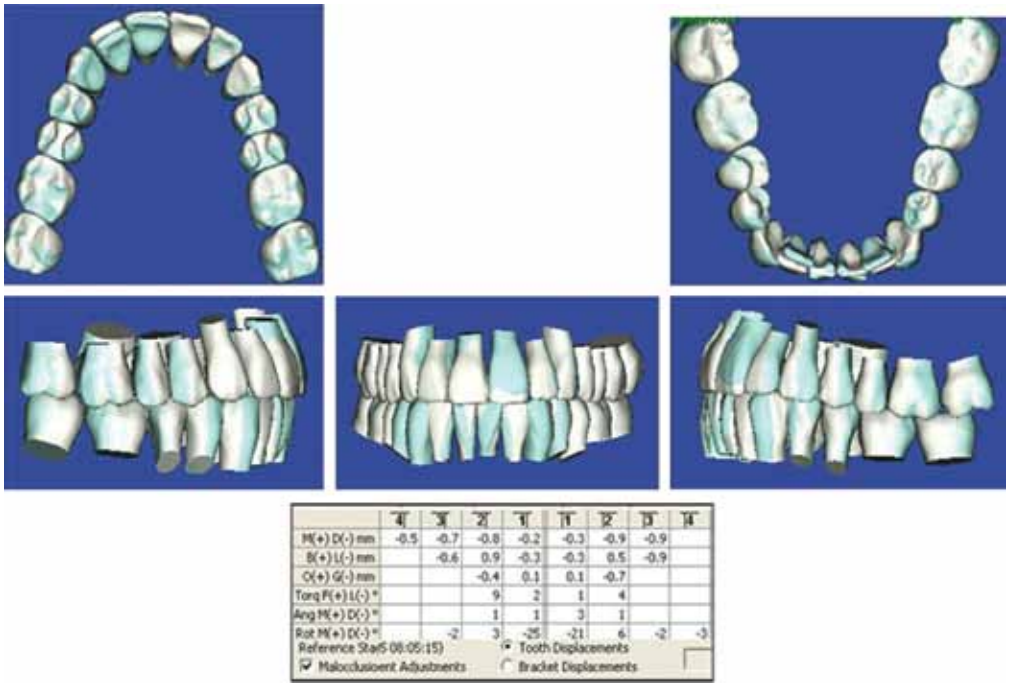

Fig 8. *Treatment simulation (white) with IPR compared to diagnostic model (blue) registered on the buccal segment. Note: Minimal displacement of the dentition required to meet objectives with a lower incisor extraction treatment approach (Fig. 5).*

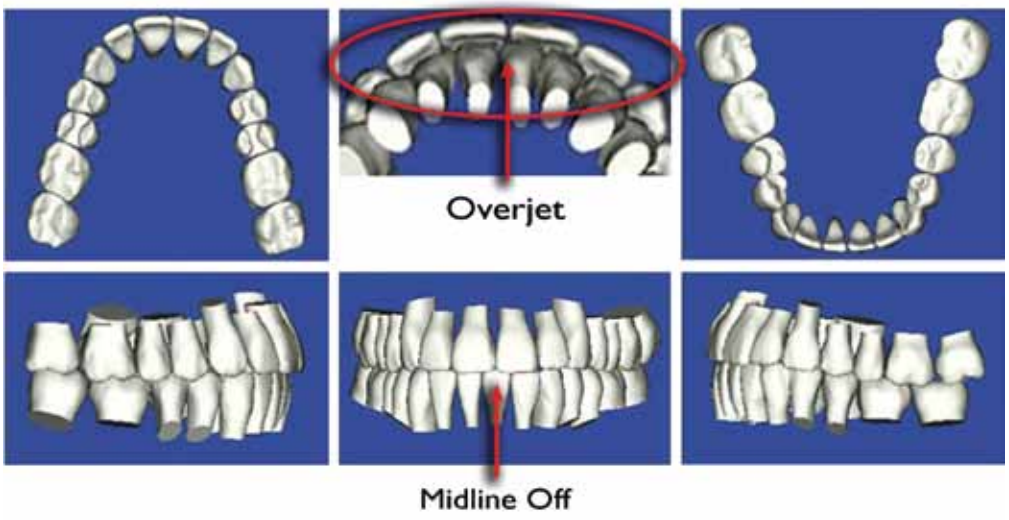

Fig 9. *Treatment simulation of diagnostic models with IPR (non-Extraction)*

The Therapeutic model is used for the following:

- Assess the progress of care
- Assessing "Straight Wire" performance
- Formulating a customized setup prescription

Prior to designing the customized appliance prescription, it is important to understand if the initial treatment objectives have been violated and whether they need to be reconsidered. The initial model with IPR simulation was superimposed over the therapeutic scan and registered on the second molar, which was not bonded and therefore assumed to be relatively stable in position (Fig 12).

Fig13 shows that the initial treatment objectives were closely adhered to. However, the upper incisors had extruded and the lower incisors advanced a little. On closer examination of the therapeutic model, it was observed that the upper left incisor had not leveled (Fig13). "Root cause" for this finding was conducted by performing a simulation on the therapeutic model. The upper left central incisor was extruded to the desired level, and this caused a heavy contact on the lower left central incisor, which suggests that the interference between these teeth may have prevented the upper left central incisor from reaching its desired level (Fig. 14).

A "root cause" was performed to understand why the rotation on the lower incisors had not completely corrected. Two possible situations were analyzed. These were the potential interference between the upper and lower teeth and or incorrect bracket

Fig 10. *A Virtual diagnostic model showing crowding of anterior teeth. B. Intraoral diagnostic photo showing crowding of anterior teeth. C. Virtual simulation model (IPR scenario) showing largest black triangle between the central incisors.*

Fig 11. *Ceph shows superimposition of simulation and original model, registered on the lower second molars. Simulation model is in white and initial model is in blue.*

Fig 12.A. *Mid-treatment photos. B. Therapeutic Simulation Models*

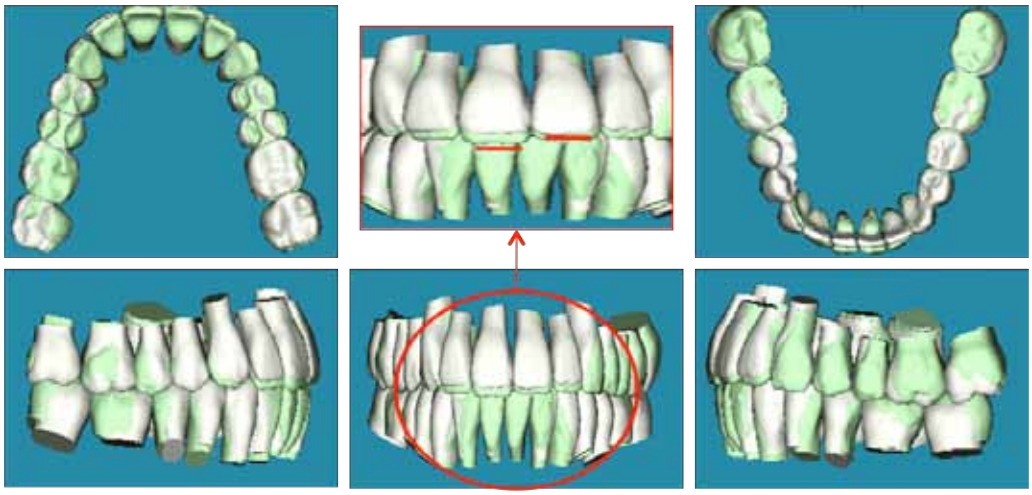

Fig 13. *Superimposition of therapeutic model (green) on initial model (white) registered on the upper second molars.*

position. The simulation consisted of rotating the lower incisors to the correct position and simultaneously evaluating the deactivation of the straight wire. One can see that a straight segment exists between the incisors when rotated. This confirms that the brackets were placed correctly in the first order position. However, one can observe heavy contacts develop as the incisors move to their final corrected position. This finding suggests that interferences between the upper and lower incisors affected the alignment of the lower anteriors. Also, note that by correcting the rotation and the first order buccolingual position of the upper right incisors, the collision between upper and lower teeth is minimized, obviating the necessity of equilibration or additional IPR of the lower incisors (Fig. 15).

With SureSmile software tools, one can read how much the straight wire has "worked out" or "deactivated" (Fig. 16 A). Furthermore, one can also better visualize errors in bracket placement and predict their potential effects on the subsequent movement of a tooth.

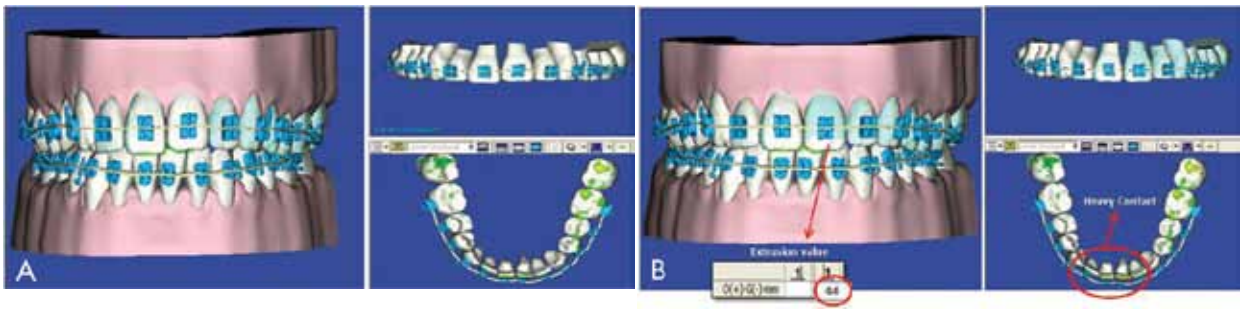

Fig 14. A. *Shows the upper left incisor has not extruded completely and there is a light contact with the lower incisor.* ***B.*** *When the upper incisor is extruded to the correct level, observe the heavy contact created on the lower left incisor. The interaction of the upper and lower incisor during alignment affects tooth movement.*

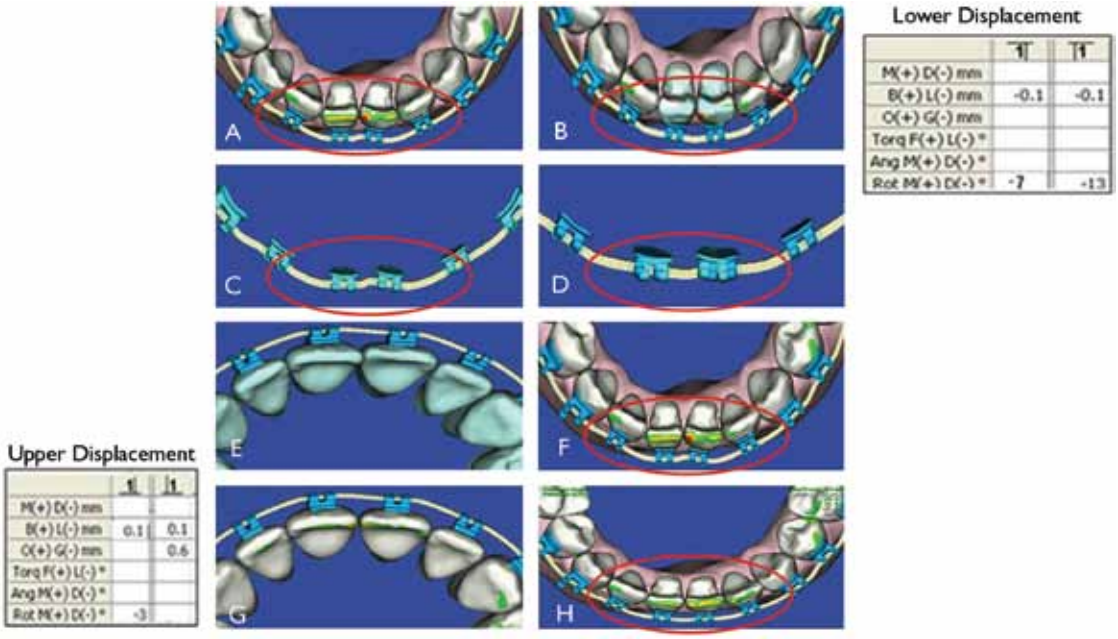

Fig 15. A. *Hard contact on the mesioincisal surface of the lower left incisor.* ***B.*** *As the lower left incisor is derotated mesial out, the hard contact persists.* ***C.*** *The archwire between the lower central incisors has not deactivated completely.* ***D.*** *When the incisors are rotated to their final position, the wire between the incisors becomes straight suggesting the brackets have been placed correctly.* ***E and F.*** *The labiolingual discrepancy on the upper right central incisor initiates the collision with the lower left central incisor.* ***G.*** *When the upper right incisor is rotated and moved slightly labially, the hard contacts with the lower disappears.*

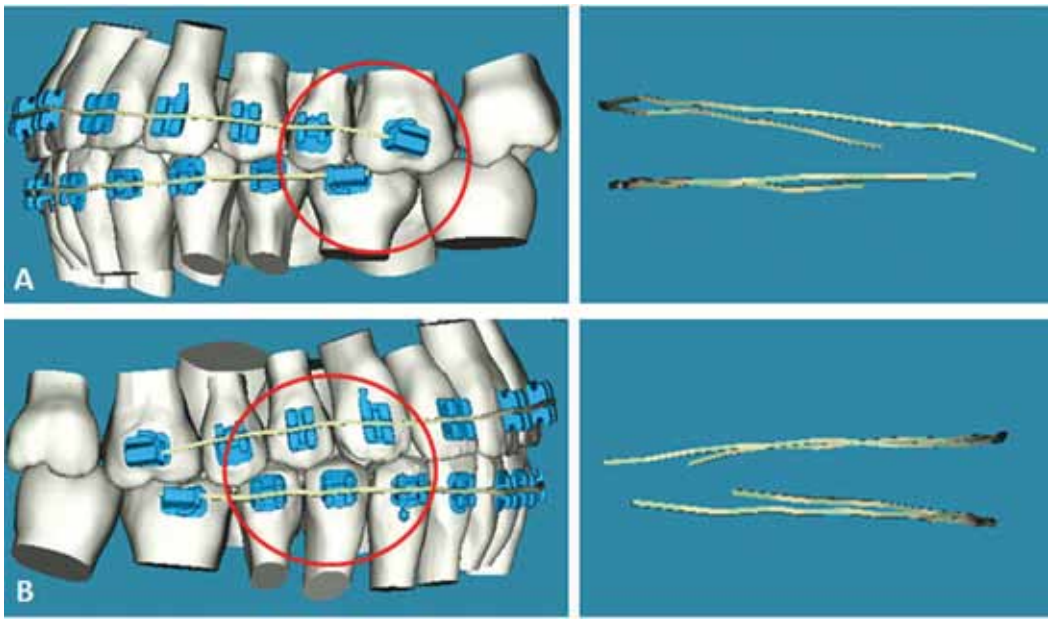

Fig 16. A. As the wire works out in the upper left molar, it will have a tendency to tip back the tooth. The lower archwire has substantially deactivated **B.** *The wire is not completely deactivated in the upper right canine. As the root develops, an anterior cant can develop.*

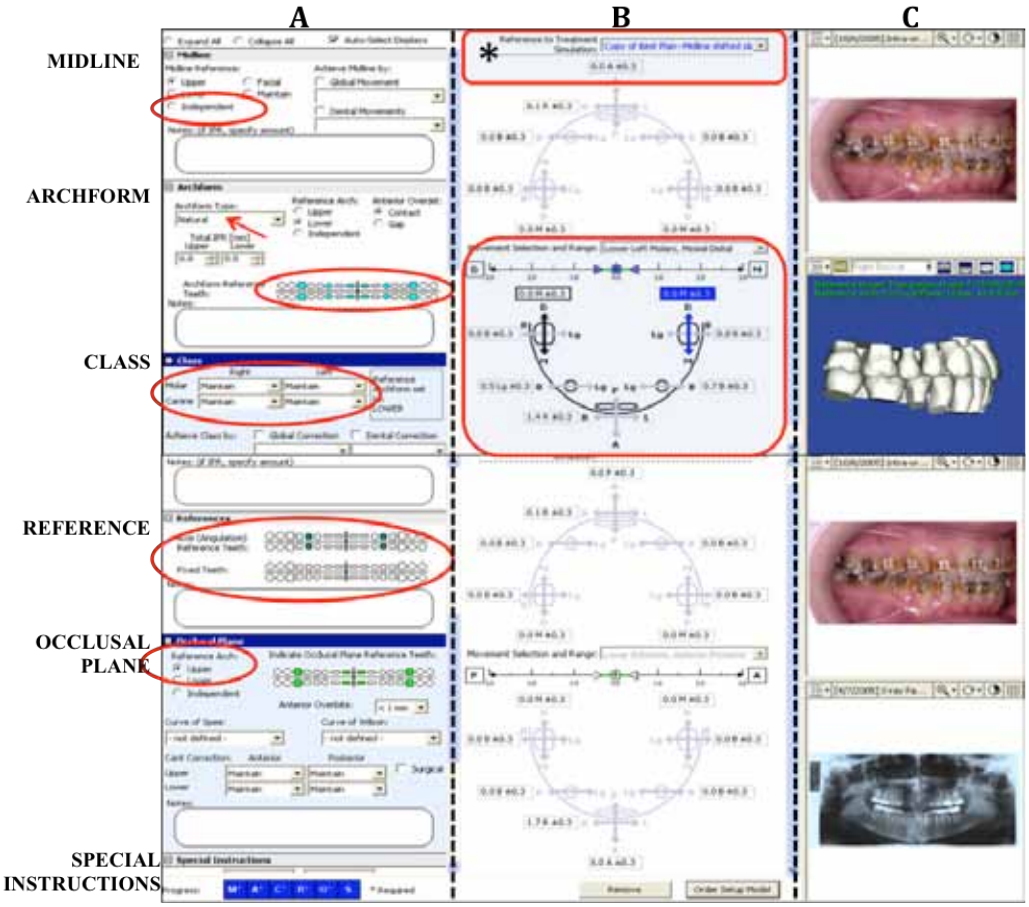

Fig 17. SureSmile Electronic Prescription for Setup **A.** *The boundary conditions are defined.* **B.** *The limits of tooth movement can be defined* **C.** *Various 2D and 3D images can be used to help in writing the prescription. (Simulation can also be attached to the prescription).*

By reading the "state of deactivation" of an archwire, a clinician can better understand its efficacy in alignment and leveling wire. In the current situation, it is apparent that if the wire continued to work out, the upper left first molar would tip back (undesirable effect). The lower arch wire has completely "deactivated" in the second order (Fig. 16 B). Further deactivation of the wire in the upper right canine region could lead to excessive distal root correction of the tooth and potentially lead to an anterior cant.

In summary, evaluation of the therapeutic model helps the orthodontist to better understand the rate limiting factors affecting tooth movement during orthodontic care.

Fig 18. *Virtual Customized Setup*

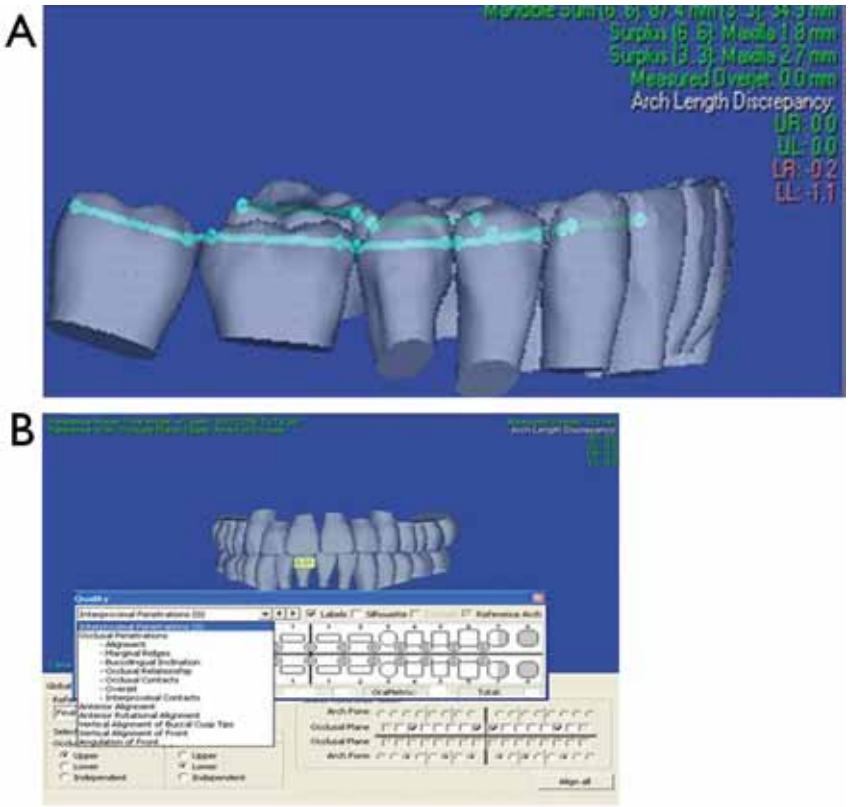

Fig 19. A. *Evaluation of lower marginal ridges.* ***B.*** *Measurement items for evaluating quality of setup calibrated to ABO/OGS guidelines.*

Appropriate simulations on a therapeutic model can prepare the clinician to make better clinical decisions without putting the patient at risk.

Formulating a Customized Setup Prescription

The next step involves writing a setup prescription for the customized setup (Fig. 17). This setup drives the design of the suresmile targeted prescription archwire. Learnings from the therapeutic scan re-evaluation were taken into consideration in the writing of this prescription. Five boundary conditions defined by MACROS 1* were selected to guide the digital lab at OraMetrix in the design of the setup:

- Treat to the upper and lower midline independently
- Treat to the lower archform
- Treat to the current sagittal relationship of the dentition
- Use the axial inclination of the lower and upper first bicuspids as a guide to plan for the root angulation in the buccal segment
- Treat to the upper functional occlusal plane

The prescription request can be provided by filling the table, as shown in note form or providing a rough simulation. The choice of any of the above approaches is driven by both doctor's preferences and the patient's needs.[10]

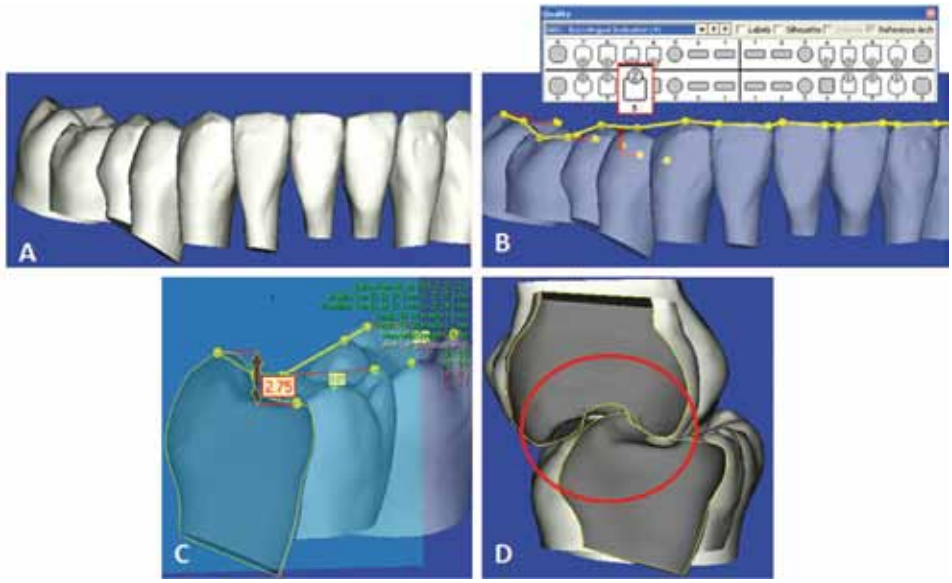

Fig 20. A and B. *Lower second bicuspid buccolingual inclination: quality score shows a loss of 2 points.* ***C.*** *Shows the height difference between the buccal and lingual cusps of the second bicuspid.* ***D.*** *Interference between upper and lower bicuspids.*

* MACROS is an acronym for midline, archform, classification of occlusion, reference teeth, occlusal plane and special instructions developed by the first author

Setup Evaluation

After submission of the setup prescription order, SureSmile takes five business days to process and send the setup (Fig. 18) back to the practice for evaluation.

The setup is evaluated on the basis of its adherence to the prescription provided and the design of the archwire is also assessed. The software allows for evaluation of specific points of interest, e.g. marginal ridges as seen in Fig. 19A. It also has tools that are calibrated in accordance with the ABO/OGS guidelines.[11] These provide a quick approach for the systematic and reliable measure of the quality of the setup (Fig. 19B).

The automatic quality grading tool showed a loss of 2 points. A height difference of 2.75 mm is seen between the buccal and lingual cusp of lower right second bicuspid (Fig. 20).

Also, with the aid of the clipping plane one clearly observes a collision on the lingual incline of the buccal cusp of the lower bicuspid with the lingual incline of the lingual cusp tip of the opposing tooth (Fig. 20D). A third order tooth simulation was performed on the bicuspid in order to evaluate if this discrepancy could be corrected and whether a perfect score of "zero" could be accomplished. A significant amount of buccal crown torque 32° would

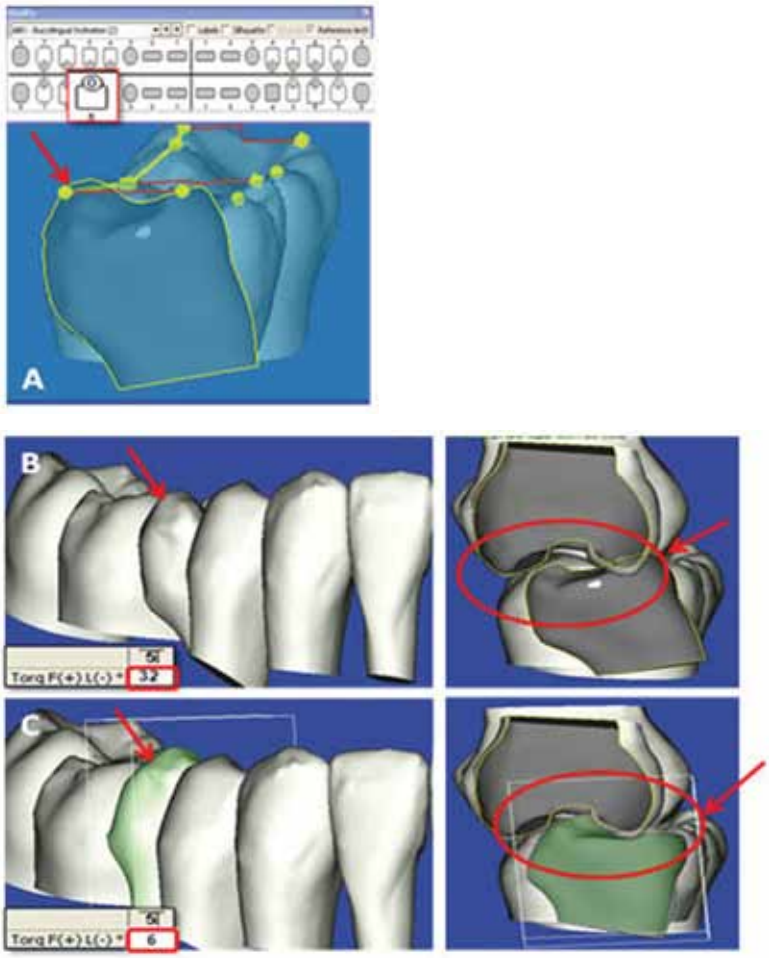

Fig 21. A. *Simulation shows a score of zero.* ***B.*** *Buccal crown torque of 32° to reduce score to "ideal". Note the tooth is out of alignment.* ***C.*** *Buccal crown torque of 6° was actually performed. This resulted in minimal collision and with better alignment.*

be required to reduce the score to "ideal" (Fig. 21A). However, this would result in severe misalignment of the tooth (Fig. 21B). So rather than treat to an "ideal" score a decision was made to place an additional 6° (Fig. 21) of buccal crown torque. This improved the alignment of the bicuspid and also corrected the interference obviating the need for equilibration (Fig. 21C).

The lab at OraMetrix can also be instructed to make these changes. However, most clinicians make these final virtual tweaks by themselves, as it requires substantial clinical judgment. Furthermore, it is easier to make the changes in the practice than shuttle the model between the lab and the practice.

The virtual prescription archwire is checked by reading the direction of the bends against the mid treatment bracket positioning captured on the therapeutic scan (Fig. 22A). For example, note in the upper left molar segment the wire is designed passive to counter the incorrect bracket position. Also, the wire in the upper right buccal segments has been designed to extrude the 3-4 segments to close the open bite (wire lies below the brackets). Fig. 22B shows the final design of the wire in the passive state.

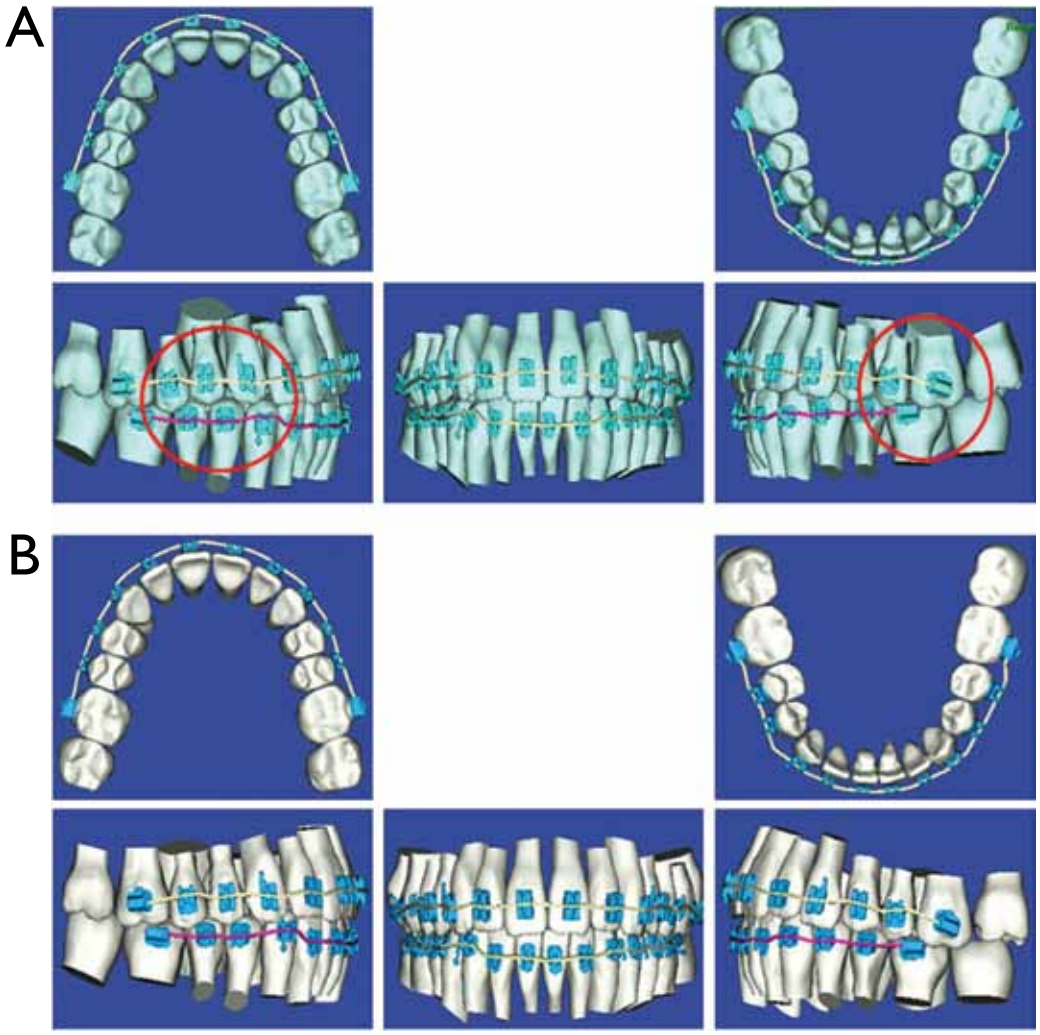

Fig 22. A. *Final arch wire read against therapeutic scan.* ***B.*** *Final wire design matched against the setup.*

Checking for Wire Insertion and Placing Wire Order

Bends in the archwire can collide with the brackets and retard tooth movement. Therefore, a wire insertion simulation is conducted on the therapeutic model to evaluate potential conflicts between the wire bends and the brackets. No collisions were observed (The slot line, the light green marks on the wire aligned with the bracket slots perfectly). The software also has simulation tools to guide the clinician and identify the optimal initial tying position of the archwire to minimize collisions (Fig 23).

After the design of the archwire is evaluated, the archwire material and cross section are selected. A clinician may select between the following materials Copper NiTi, Ormco AZURLOY, Ormco TiNb[9], Elgiloy[12] and also various cross sections 0.16", 16x22", 17x25", 19x25" 17x25" and 19x25" CuNiTi SureSmile prescription archwires were ordered simultaneously and received 10 business days later (Fig. 24). A summary of the clinical and SureSmile (OraMetrix) processes is provided in Fig. 25.

Clinical Management of SureSmile Wires

The SureSmile 17x25 CuNiTi wire was the first wire to be inserted.[13] It was allowed to work for a period of two months. This was then followed by the SureSmile 19x25 CuNiTi archwire for an additional two months. Four months into treatment, it was realized that the patient would benefit from a little more exposure of the upper incisors and the original wire design was modified virtually at the chairside using the virtual plier tool. Instructions for the appropriate direction and magnitude of the bends were typed in the dialogue box (Fig. 26).[14] The "new" modified physical wire was received and inserted 10 days later.

This final (modified) wire19x25 CuNiTi was allowed to work for two months.

By comparing the in-vivo position of the brackets against the bracket position on the final setup, the clinician can make a reasonable judgment as to whether the wire has worked out and then decide if a patient is ready for debonding (Fig. 27). The patient was debonded and the final records for outcome evaluation taken. The final model was scanned and sent to OraMetrix for processing. It was received five days later (Fig. 28).

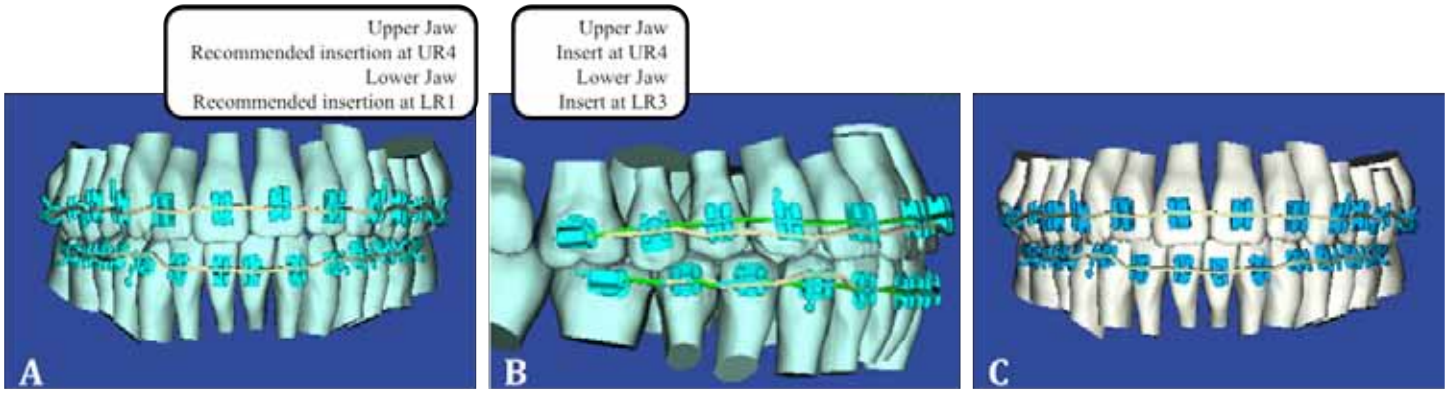

Fig 23. A and B *Wire installation and conflict check. The blue model represents the therapeutic model and the white the final setup model. The grey colored wire is the final archwire design. It is read against the brackets on the therapeutic model (blue) to check for the direction and magnitude of the bends. The green wire on the therapeutic models (blue) is a simulation of archwire insertion. It is read against the brackets on the therapeutic model to check for conflicts between archwire bends and brackets. When the light green hatch marks on the archwire corresponds with the bracket slots a "perfect fit" is realized with no collisions. The software also recommends the initial tying position of the archwire inorder to minimize conflicts between bends in the wire and brackets.* ***C.*** *Shows the prescription archwire on the final setup model.*

Outcome Evaluation

The outcome was evaluated with facial photographs, ceph analysis, ceph superimposition,[15] 3D setup to final model superimposition and an audit of the therapeutic protocol. (Fig. 29-31, Table III and IV).

The Cephalometric findings showed that the incisor position and the molar positions were maintained as planned (Fig. 30). Also, the setup vs. final model superimposition registered on the second molars clearly demonstrates that the predicted outcome was realized. Additionally, the 3D final model was superimposed on the initial ceph and this analysis also verifies the control of the AP positions (registered on the second molars). This analysis also verified the control of the AP position of the incisors (Fig.31).

The black triangle predicted in the simulation was observed at the end of care (Fig. 32). This issue did not pose as a concern to the patient, since she was informed about both its occurrence and site during initial consultation.

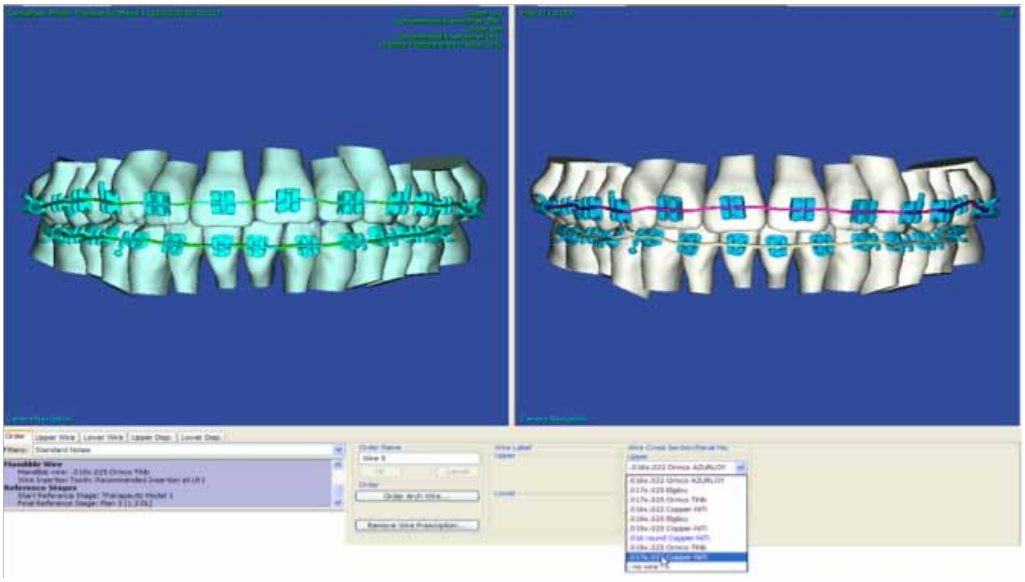

Fig 24. *Selection of Archwire. Once the design is finalized, the archwire material and cross-section is selected and ordered.*

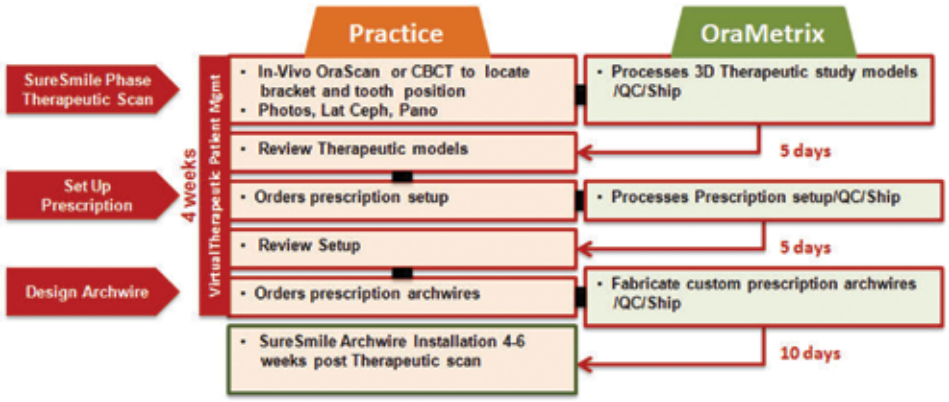

Fig 25. *SureSmile process from therapeutic scan to design and installation of archwire.*

The care cycle could have been shortened by an additional four months if one less pair of wires was used, i.e., bypassing the 17x25 wire with the 19x25. The additional extrusion of the upper anteriors could have been anticipated at the onstart through better clinical evaluation at the time of the therapeutic scan and built into the setup prescription. This would have obviated the necessity of the refinement step and therefore saved additional treatment time. Finally, the patient could have been debonded "on demand" rather than wait for a month after the final checkup.[16]

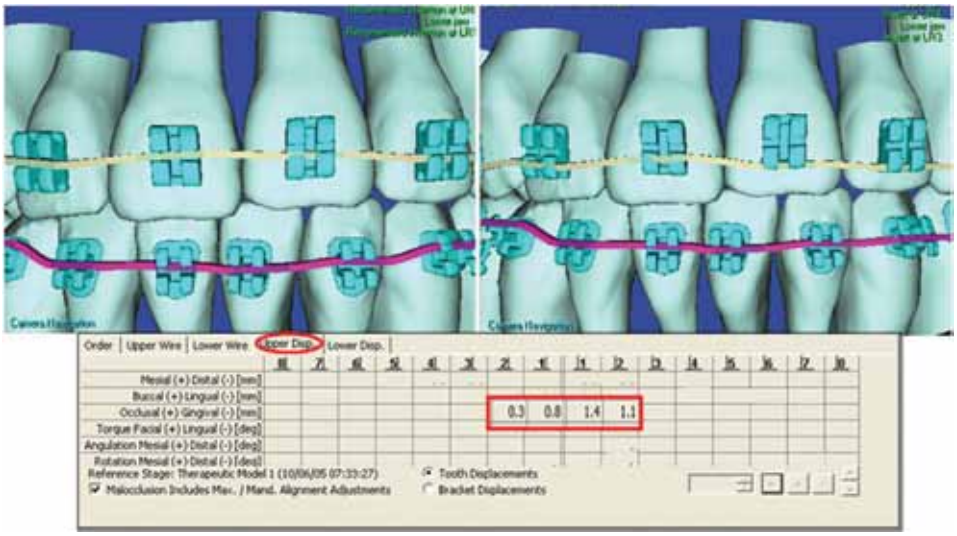

Fig 26. Virtual Plier Dialogue box: Note the additional wire adjustments are typed and added to the original wire. The new wire design is shown in the upper right hand box.

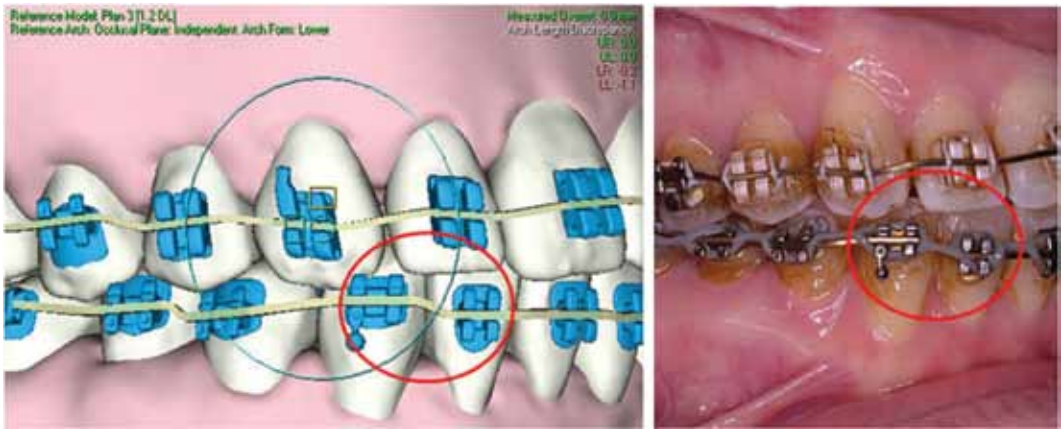

Fig 27. Note: *The bracket position on the lower right canine and lateral in the final setup and in-vivo image are similar suggesting that the archwire has worked out.*

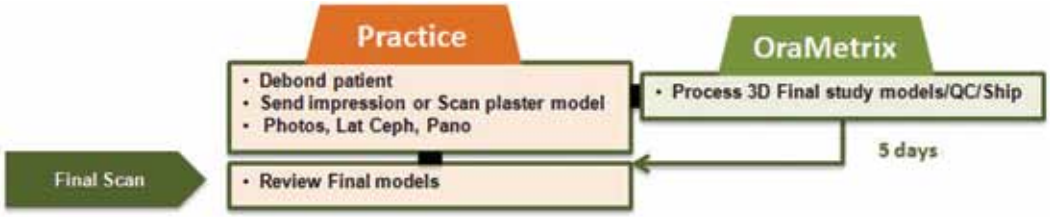

Fig 28. *SureSmile process for patient debond and final outcome assessment.*

Conclusions

SureSmile technology provides the orthodontists with a comprehensive set of tools, which include image management, process management, archival, communication, decision support, archwire design and modification and monitoring capabilities. Deliberate practice with the software is needed by the clinician to develop expertise to manage SureSmile and provide the patient with the benefit of proactive care in a timely manner without putting the patient at risk. In other words, the ability to achieve quality care with SureSmile is dependent upon the skill of the orthodontist. SureSmile technology has the potential to enable the practice to transform into a high reliability environment.

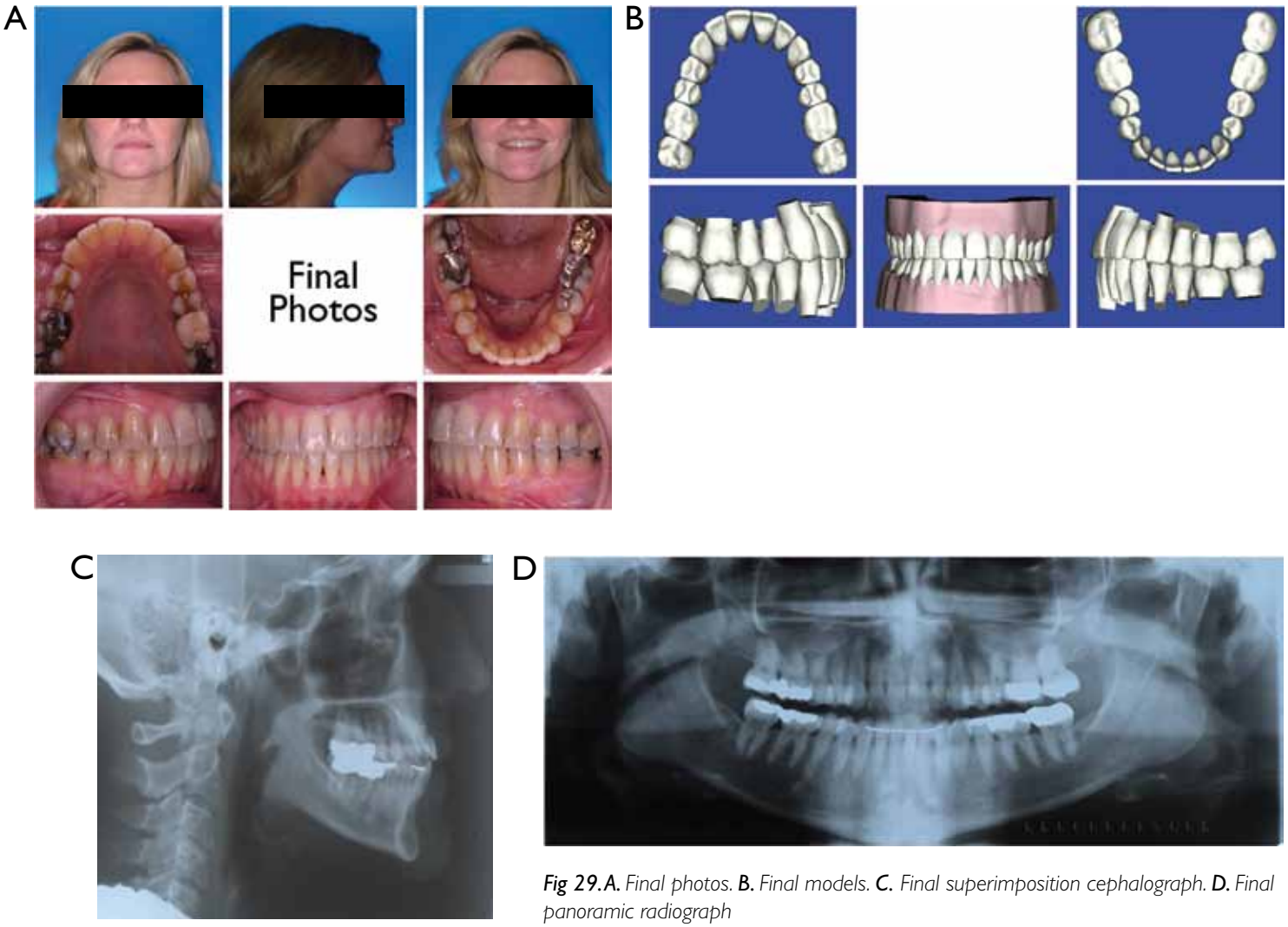

Fig 29.A. *Final photos.* ***B.*** *Final models.* ***C.*** *Final superimposition cephalograph.* ***D.*** *Final panoramic radiograph*

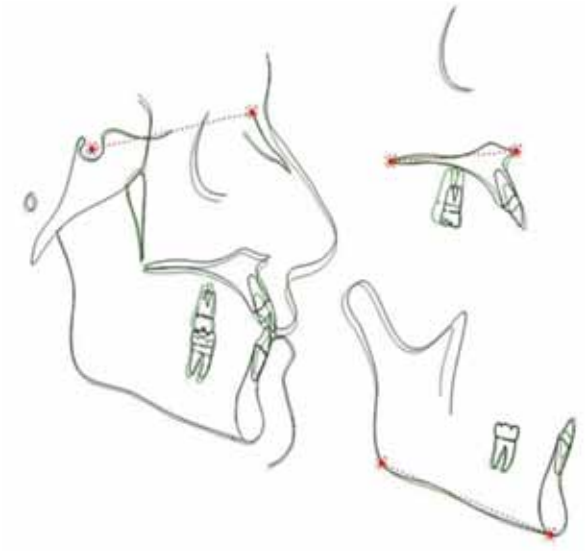

Fig 30. *Ceph Superimposition Initial vs. Final. Note control of AP and vertical position of incisors and molars.*

Dental	Pt	Std	Diff
Interincisal Angle (U1-L1) (°)	136.9	131.7	5.2
Overbite (mm)	1.8	1.3	0.5
Overjet (mm)	2.6	2	0.6
Molar Relation (mm)	0.7	–4.7	5.4
Dental/Skeletal			
L1 Protrusion (L1-APo) (mm)	4.1	5.7	–1.6
L1 to A-Po (°)	19.9	23.4	–3.5
U-Incisor Protrusion (U1-APo) (mm)	6.6	7.7	–1.1
U-Incisor Inclination (U1-APo) (°)	23.2	24.9	–1.7
IMPA (L1-MP) (°)	86.9	89.8	–2.9
FMIA (L1-FH) (°)	73.9	69	4.9
U1 - FH (°)	117	117.3	–0.3
Skeletal—Vertical			
FMA (MP-FH) (°)	19.2	21.2	–2
Mand Plane to Occ Plane (°)	21.7	22.9	–1.2
Occ Plane to FH (°)	–2.5	–1.7	–0.8
Gonial/Jaw Angle (Ar-Go-Me) (°)	129	133.7	–4.7
Skeletal—Horizontal			
Convexity (A-NPo) (mm)	–0.7	0.5	–1.2
ANB (°)	0.6	1.7	–1.1
Maxillary Skeletal (A-Na Perp) (mm)	2.8	3.7	–0.91
Mand. Skeletal (Pg-Na Perp) (mm)	6.8	6.3	0.5
Wits Appraisal (mm)	1.1	2.1	–1
Soft Tissue			
Lower Lip to E-Plane (mm)	–7.2	–10.3	3.1
Upper Lip to E-Plane (mm)	–10.4	–10	–0.4

Table III. *Ceph Analysis Initial vs. Final*

Date	Activity
4.27.05	Consultation
5.26.05	Bonded Titanium Orthos, IPR as per plan initiated, Lingual buttons on lower incisors to facilitate rotation U & L 016x022 CuNiTi wires placed
7.7.05	Checkup and IPR
8.17.05	Checkup and IPR
SureSmile Therapeutics	
10.6.05	SureSmile Therapeutic Scan performed
11.3.05	SureSmile Wire Insertion 017x025 SS CuNiTi wires placed (IPR performed), PC lower 6-6
110.06	019x025 SS CuNiTi wires placed (Re PC L 6-6), IPR performed
3.16.06	Checkup
5.23.06	019x025 SS CuNiTi wires placed (refined archwire) PC U 6-6
7.6.06	Checkup
8.3.06	Debond
Auxillary Appliances	Anterior and mini box-elastics worn at various intervals throughout treatment
Retention	Upper/Lower Hawley

Table IV. *Therapeutic Audit*

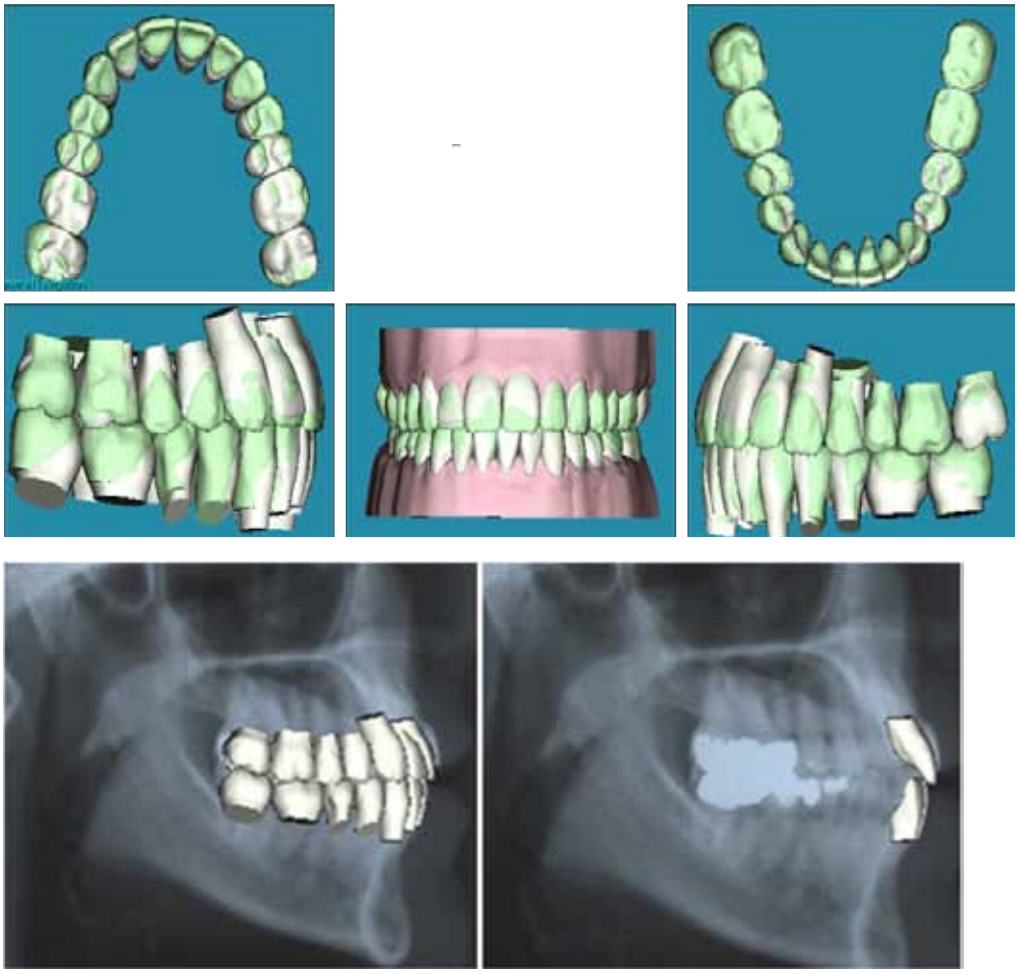

Fig 31. *Final model superimposition (white) against setup (green).*

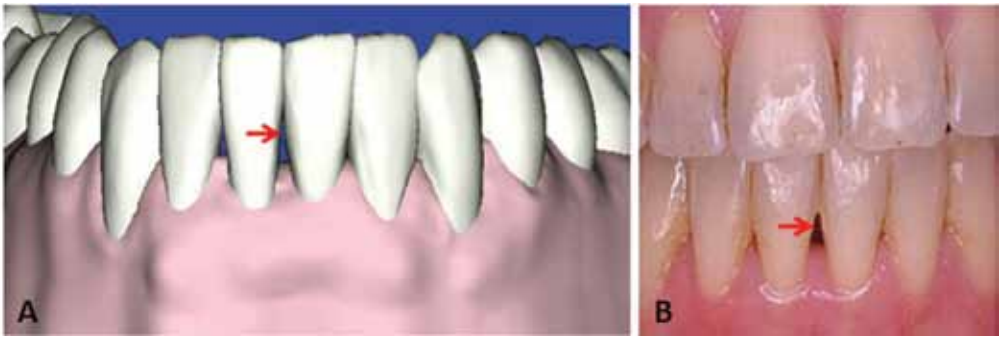

Fig 32 A *Black triangle simulation vs.* ***B*** *in-vivo condition at finish of treatment*

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Acknowledgement

The authors wish to thank Dr. Sharan Aranha, BDS MPA, for all her help in the preparation of this case report.