EDITORIAL

Univocal Therapeutic Protocols: a Real Possibility or a Utopia?

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A few years ago, during an international conference, a dear friend and colleague of mine made a bet with himself. He requested three well-known colleagues to examine the records of three not particularly complex orthodontic cases. If the treatment plans suggested by the three colleagues were essentially the same, he would win the bet with himself as this would show that orthodontics is an exact science, at least as far as the guidelines are concerned. In the opposite case, i.e. if the colleagues should suggest completely different treatment plans, he would pay his closest friends a dinner in the best restaurant in town. The dinner was excellent.

The most important treatment discrepancies concerned the need for extraction, the possibility to induce mandibular growth, the need for surgery, and whether it was possible to obtain complete resolution of complex dysfunctional symptoms through orthodontic treatment... in other words, the whole orthodontic treatment!

I thought about this problem... had it been a case of diabetes, the same thing would not have happened.

If a patient with diabetes was brought to the attention of three colleagues also of different nationalities, the management protocols would be similar or even identical. The brand names of prescription drugs would probably be different, but the active ingredients would be the same.

Why did the same thing not happen then - and why does it still not happen today in the field of orthodontics? Management decisions ought to be quite similar in the light of the current diagnostic methods, such as Cone Beam Computing Tomography (CBCT), Magnetic Resonance Imaging (MRI) and Computed Tomography (CT), which have shed light on numerous diagnostic issues.

Why not create standard operating protocols in order to protect the patients from professionals, whose work is, at best, "unorthodox" if not actually deontologically unethical?

Is the scientific literature related to our field really so varied that for everything that is true, its opposite is also true?

Novus Ordo Seclorum: A Manifesto for Practicing Quality Care

Part II

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To Nikita, my very dear daughter, I wish to express my eternal gratitude and thanks for helping me in the preparation of this manuscript.
I am most grateful to Dr Antonella Maselli for continually encouraging me to share my philosophy and approach to patient care with my colleagues.

"Quality Care with BioDigital Orthodontics. Cui Bono?"

Abstract

The principles and practice of error-proofing the orthodontic practice under the auspices of the manifesto for BioDigital Orthodontics are presented. The management of errors using both professional expertise (knowledge and skill) with 3D imaging and suresmile total patient care management technology is discussed. The latter are enabled by 3D imaging.

Keywords
Error-proofing, biodigital, simnostics

INTRODUCTION

In Part I of this series[1], I described the key dimensions of quality care: patient centredness, patient safety and clinical effectiveness. Errors committed during the delivery of care have the greatest potential to negatively influence quality outcomes. Therefore, it is important to recognize the types and sources of errors that occur in daily practice and find ways to prevent them or at least create appropriate barriers to diminish their likelihood.

I have found that errors in clinical practice commonly cluster around the 8 Ms: miscommunication, misdiagnosis, misplanning, misprescription, mismanagement, misadministration and misaction. Any clinical strategy to attain quality care outcomes must be designed with a mindset of identifying, preventing or containing these "misses".

The tenets of BioDigital Orthodontics reside in the practice of *aeger primo* and *primum non nocere*.

Its constitution mandates that the patient is treated with empathy, dignity and as a "patient of one" within a caring and learning environment where patient safety (high reliability/error free) and continuous improvement are priorities[1]. As one might expect, such practices shift the quality curve to the right.

The objective of this paper is to familiarize the reader with the principles, tools and clinical practices that I have developed in the service of error-proofing the care of my patients and enhancing their safety.

PRINCIPLES AND PRACTICE OF ERROR PROOFING

I have developed both strategic and tactical approaches to error-proof my patient care practices against the 8 Ms. They are based on a foundation of biomechanical principles and are enabled with the use of 3D imaging technologies such as cone beam computed tomography (CBCT), OraScan (*Fig. 1*) and computer-aided design and computer-aided manufacturing (CAD/CAM) technologies offered by the suresmile total patient care management system[2] (*Fig. 2*).

"We can't solve problems by using the same kind of thinking we used when we created them."
Albert Einstein

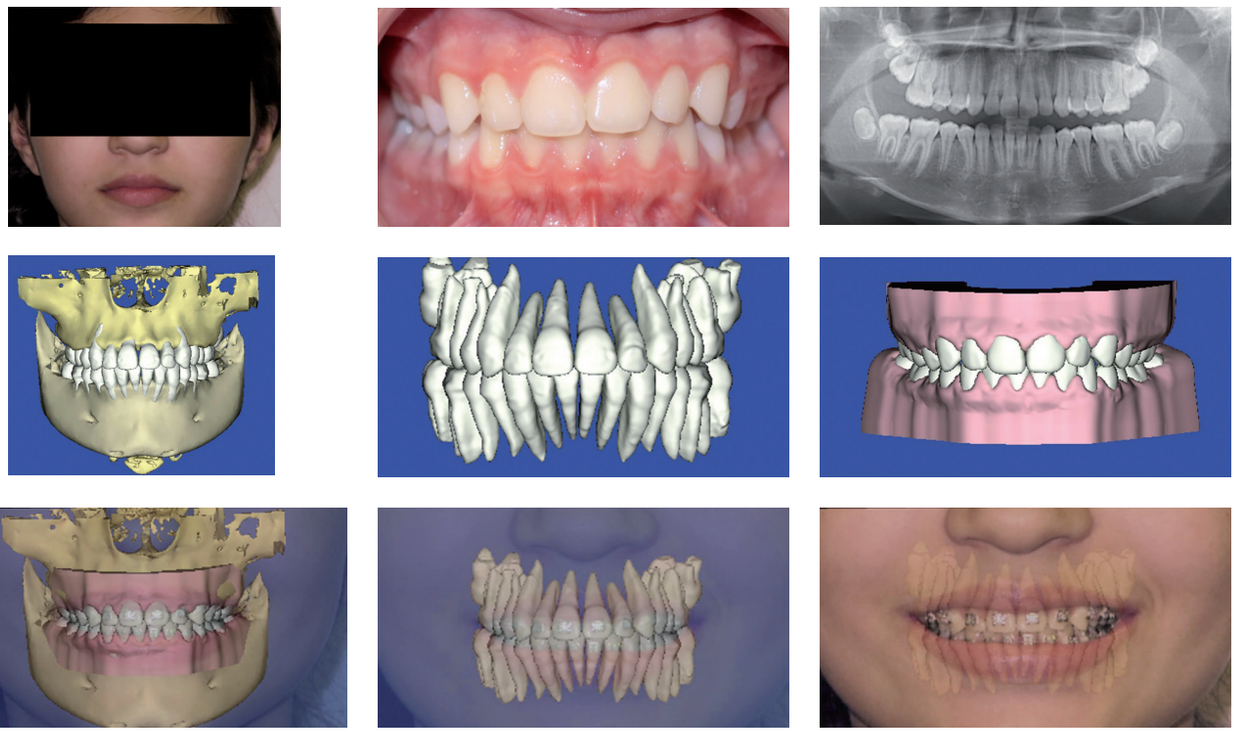

Figure 1: Various types of images used for care design and planning. Note: The CBCT provides information regarding bone, crown and roots. The OraScan is limited to the crowns and gingival tissue. suresmile offers the service of merging the CBCT image with the OraScan and 2D extraoral frontal images.

Figure 2: use your smartphone and scan the QR code to view the figure

These approaches are discussed below.

ERROR-PROOFING AGAINST MISDIAGNOSIS

A major thrust of orthodontic diagnosis involves the understanding and delineation of the complex spatial interrelationships between the various anatomical components of the craniofacial complex. Misdiagnosis in orthodontics commonly occurs as a result of perceptual, measurement and judgement errors. By using 3D images and 3D virtual models of a patient for simulations, such errors can be minimized. Clinical examples of the use of these tools follow.

High-Fidelity 3D Diagnostic Imaging

2D images of patients, such as photographs or Panorex X-rays, are commonly used as aids in diagnosis. Unfortunately, such images lack depth and are also prone to projection errors[3].

This limits the doctor's ability to perform a thorough diagnosis for his or her patient. 3D imaging helps overcome these issues.

Examples of both the clinical 'misses' resulting from 2D images and the benefit of using 3D images in these situations are shown in *Fig. 3*.

Autoanalytics

Many of our diagnostic decisions rely upon accurate and precise measurements of the dentition. We are often hampered by both the limitations of the tools we use and our perceptual biases.

This is primarily due to a lack of operational definitions for the region of interest and having no common plane of reference to measure against. This leads to inaccurate, unreliable (inter- and intra-operator) measures that result in the incorrect diagnostic assessment of a patient.

Autoanalytic tools overcome these limitations[4] (*Fig. 4*).

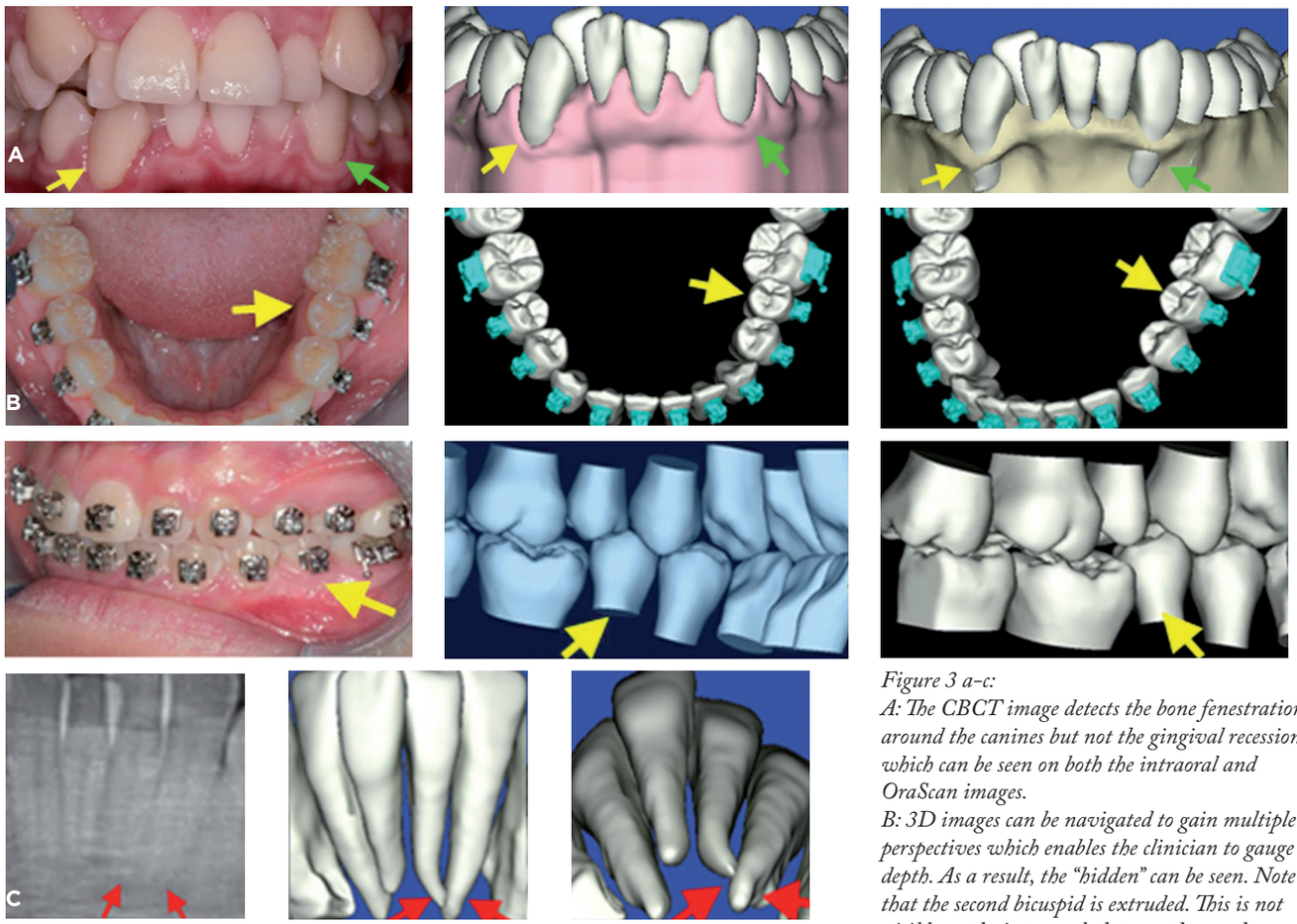

Figure 3 a–c:
A: The CBCT image detects the bone fenestrations around the canines but not the gingival recession, which can be seen on both the intraoral and OraScan images.
B: 3D images can be navigated to gain multiple perspectives which enables the clinician to gauge depth. As a result, the "hidden" can be seen. Note that the second bicuspid is extruded. This is not visible on the intra oral photographs or when viewing the 3D model from an occlusal perspective. However it is clearly seen from a lingual perspective of the 3D OraScan. It is clearly visible from the lingual perspective of the OraScan.
C: The Panorex image does not show the dilaceration at the apex of the lower left central incisor. This is seen in the CBCT image.

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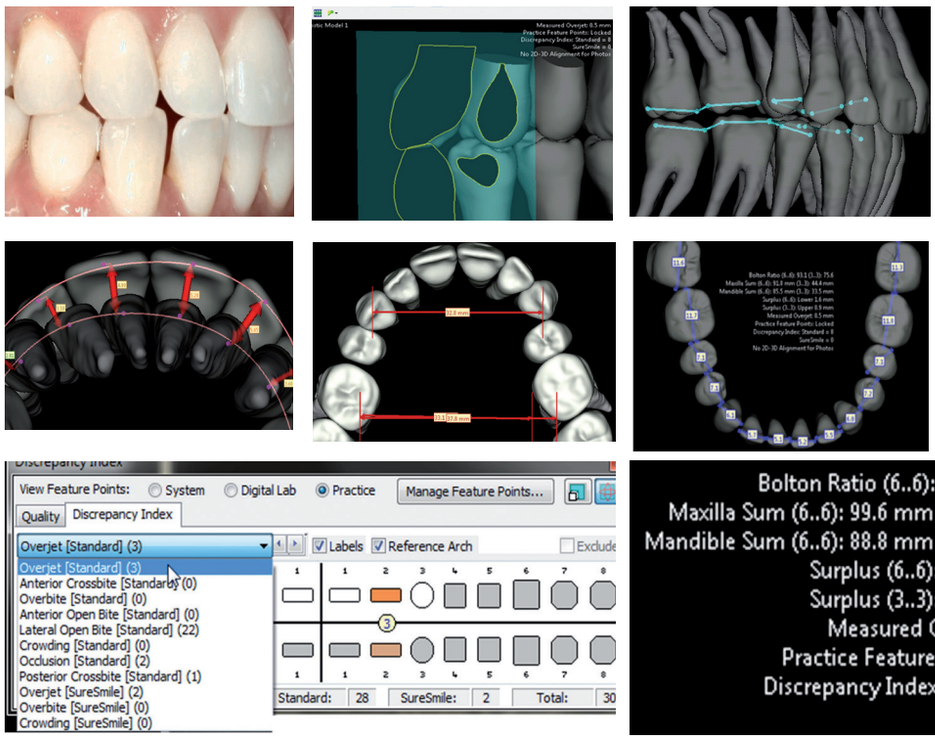

Figure 4: Autoanalytic tools offered by suresmile technology allow the automatic measurement of various features of interest. Also, feature points such as marginal ridges are automatically detected. The doctor can override their location and relocate the points. Also, the ABO discrepancy index and the Bolton tooth size discrepancy index are automatically measured.

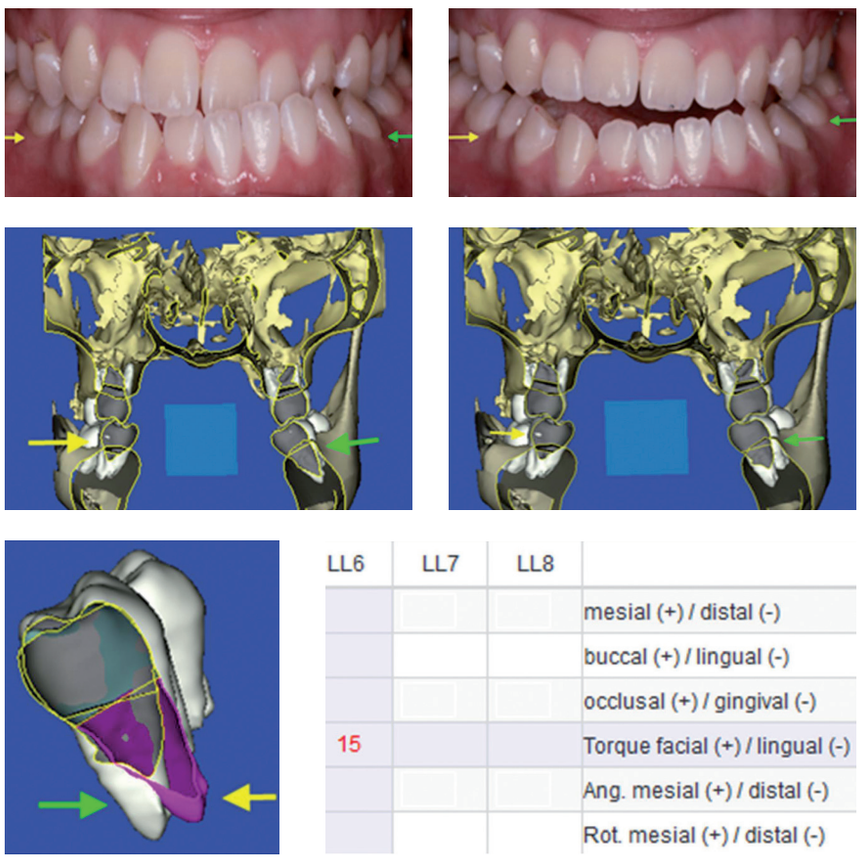

Figure 5: SimDiagnosis. This patient demonstrates a significant shift (asymmetry) of the mandible to the left. The severity of the dentoalveolar compensation in the lower left buccal segment is difficult to assess with conventional intraoral images. The nature of compensation can be seen in the CBCT when compared to the right side. Quantifying its extent and the nature of the tooth movement to correct it require the ability to both simulate and measure the movement of the tooth to the desired state. In this situation, the lower right first molar was controlled tipped 15° with a centre of rotation at the left of the crown tip. This is a difficult movement to accomplish and will take time to correct and require the creative design of a force-driven appliance. Recognition of this patient need can only be done with the aid of SimDiagnosis.

Interactive diagnosis with SimDiagnostics

Currently we measure the degree of severity of a malocclusion by measuring against a normative age/sex/ethnic based sample. However, it is equally important to measure the degree of severity of a malocclusion based upon the amount and nature of tooth displacement required to achieve the treatment objective (*Fig. 5*).

Assessing this measure with conventional tools is difficult. For instance, the assessment of the severity of crowding is affected by a multiplicity of boundary conditions such as arch form, nature of tooth movement, midline and anatomical constraints. Accounting for all these variables is beyond the capacity of the clinician. The ability to run multiple simulations on a patient's virtual models and impose upon these models varying boundary conditions provides an elegant solution to this problem (*Fig. 6*). I term this practice SimDiagnostics.

Figure 6: use your smartphone and scan the QR code to view the figure

It is performed quickly and, most importantly, does not put the patient at risk as all the simulations are done virtually.

ERROR-PROOFING AGAINST MISPLANNING

Misplanning is commonly a result of misdiagnosis and a misguided understanding of the impact of one's treatment measures on the course and outcome of care. I use two approaches to overcome these limitations:

Proactive Care Prototyping with SimPlanning

Prior to beginning active treatment on a patient, I run simulations that model different treatment scenarios to critically evaluate and validate the best "care flight plan" for the patient. This avoids wayfaring or midcourse retractions during the patient's care journey, allowing for the promotion of patient safety and less wasteful practices (*Fig. 7*).

SimPrognostics

A very important aspect of care planning resides in a doctor's ability to determine the prognosis of treatment. This requires that the clinician be skilled in forecasting the potential "fault lines" or risks associated with the treatment measures and the likelihood of a successful treatment outcome. Simulations provide a very useful method to assess the prognosis of treatment (*Figs. 8–10*).

ERROR-PROOFING AGAINST MISCOMMUNICATION

It is not uncommon to observe a disconnect between the voice of the patient and that of the doctor in terms of treatment needs. Furthermore, this disconnect commonly extends into the larger concentric circle of the care team and interprofessional care collaborators. This leads to conflicting treatment goals and measures, placing the patient at risk, compromising the patient's care experience, delaying treatment and potentially hindering the quality of treatment outcomes.

One common source of this angst lies in the high signal-to-noise of information shared orally or in the form of abbreviated text in the patient's notes. Visual communication with simulations, complemented with both the oral and textual mediums, provides a realistic solution to overcome miscommunication[5].

A brief description of the approach I use to better communicate amongst all the stakeholders is provided below.

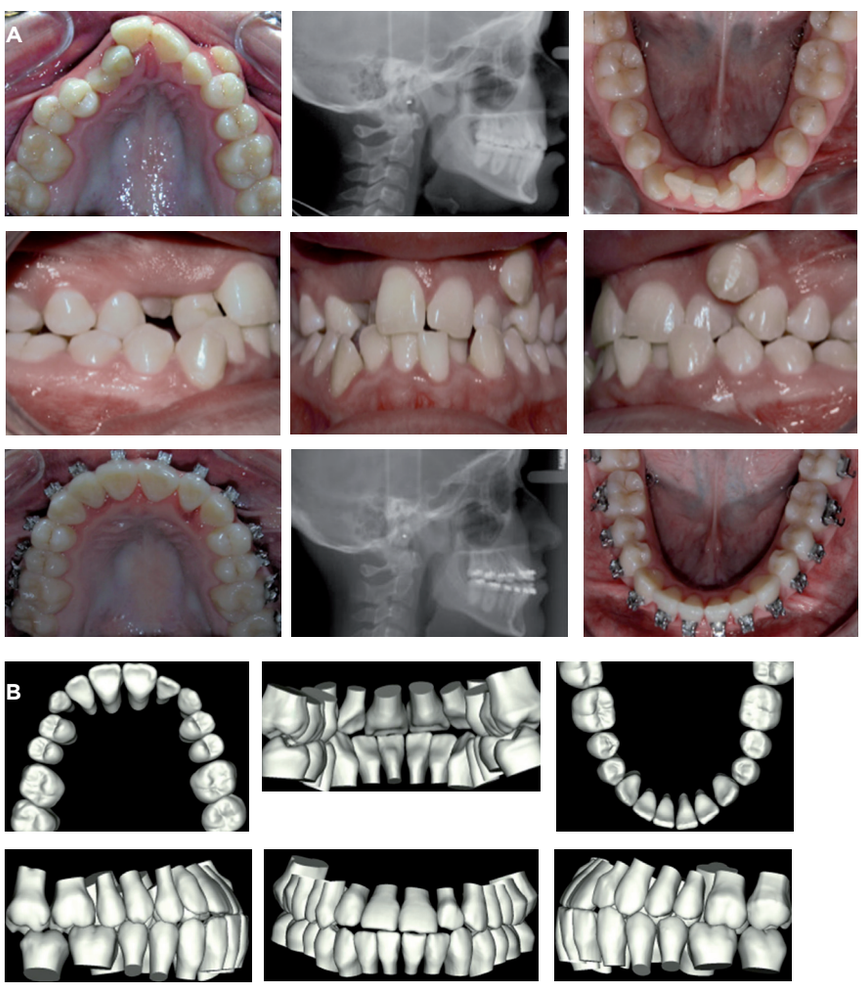

Figure 7 a, b: SimPlanning.
A: This patient would have benefited from SimPlanning prior to the start of treatment.
B: Note the simulation depicting the non-extraction approach to care clearly demonstrates that such a treatment would result in a bimaxillary protrusion with an anterior open bite. This treatment strategy would not be in the best interest of the patient.

Figure 7 c- e: SimPlanning.
C: Note the similarity between the non-extraction simulation and the clinical result.
D: An extraction approach to treatment would have been a better approach to treatment.
E: The four first bicuspids were extracted mid-treatment. Although the bimaxillary protrusion is resolved, it is apparent that space closure has not been well controlled, resulting in forward tipping of the buccal segments, especially the lower right buccal segment. Practising orthodontic care by a "fly of the wheel" approach is not the right patient care and adds to treatment time as well.

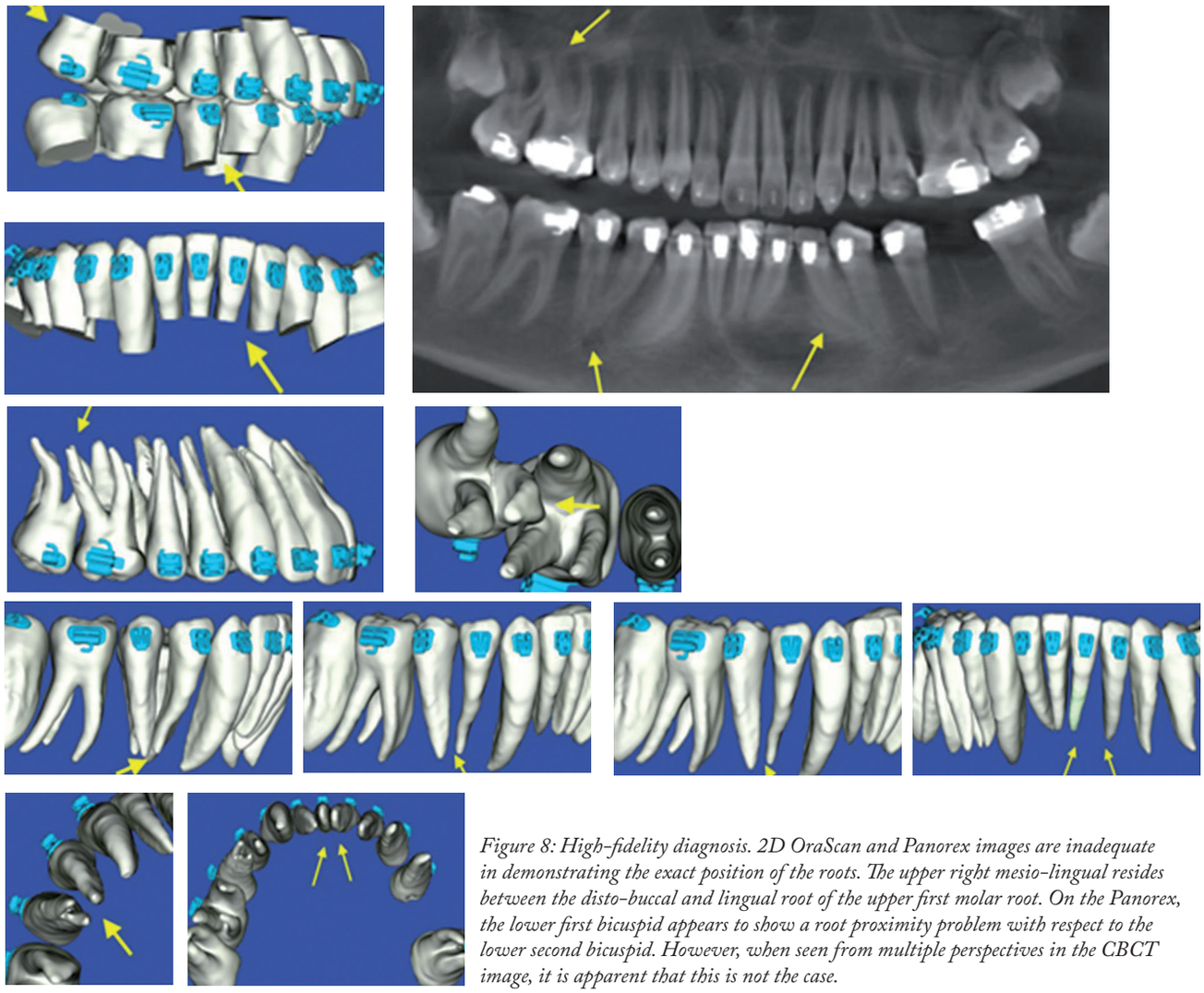

Figure 8: High-fidelity diagnosis. 2D OraScan and Panorex images are inadequate in demonstrating the exact position of the roots. The upper right mesio-lingual resides between the disto-buccal and lingual root of the upper first molar root. On the Panorex, the lower first bicuspid appears to show a root proximity problem with respect to the lower second bicuspid. However, when seen from multiple perspectives in the CBCT image, it is apparent that this is not the case.

Figure 9: use your smartphone and scan the QR code to view the figure

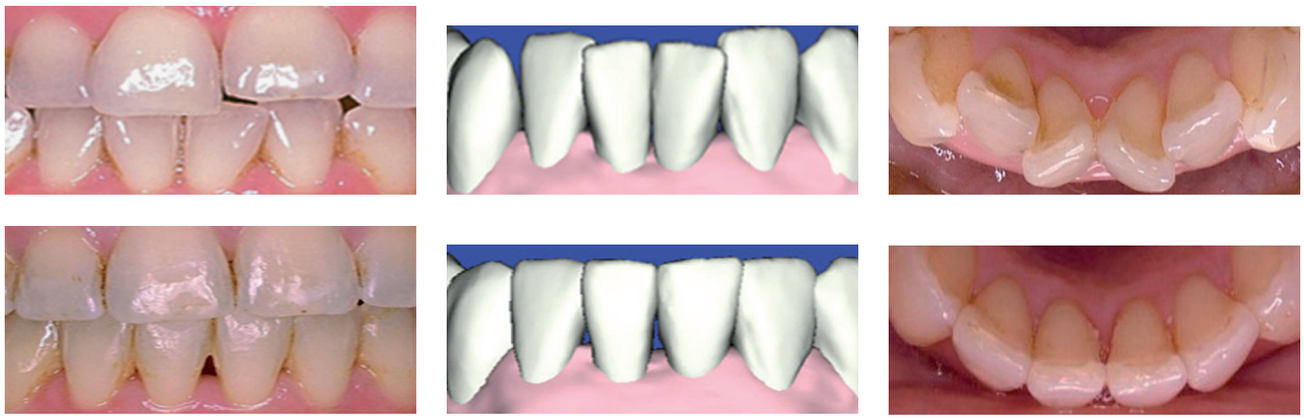

Figure 10: SimPrognostics. Alignment of the lower incisors leading to the appearance of black triangles was forecast prior to the start of treatment and discussed with the patient. She declined any more interproximal reduction than was required to correct the crowding between the incisors and accepted the black triangles. However, she was very satisfied with the results as she was made aware of this occurrence using simulations at the beginning of treatment and made a personal choice to accept the black triangles.

Figure 11: use your smartphone and scan the QR code to view the figure.

Figure 12: Thematic vagabonding. The patient has been in treatment for 16 months and shows little progress in treatment over this period.

Shared decision making and participatory communication with SimComm

To break the walls of miscommunication between the patient and the care team, a shared "blue space" for all the stakeholders is created. Real-time simulations are used to both design and explain treatment to the patient.

This draws the patient into a "show and share" versus "show and tell" mode of communication with the doctor(s). Thinking out loud encourages both the patient's "buy-in" in terms of his or her care needs and adherence to future requests made by the doctor, such as the wearing of elastics (real-time).

The virtual visual treatment plan established for the patient is accessible to all members of the care team, bringing concurrence in understanding the goals of care to all stakeholders involved in the care process (*Fig. 11*).

Orthodontic Literacy with Patient Decision Aids

Communication with patients is further facilitated by ensuring they have access to current disease-specific literature that is context sensitive and caters to cultural diversity.

ERROR-PROOFING AGAINST MISMANAGEMENT AND MISACTION

Continuous Active Participatory Care Management with Checklists, Clinical Pathway Guidelines and Patient Care Navigation Maps with SimTracking

A common challenge in managing patient care through the care cycle is that the care team loses sight of treatment goals, leading to clinical inertia or thematic vagabonding[6] (*Fig. 12*).

This is commonly seen in practices that are busy or where work stress and intensity are high and the environment encourages safety violations[7] (*Table 1*).

As a result, treatment is delayed and greater opportunities for failure emerge. Such unwanted practices are contained with the use of checklists and clinical pathway guidelines (*Fig. 13*). Checklists are also used to minimize errors of omission and commission[8] (*Fig. 14*).

Another solution to cure clinical inertia involves the creation of patient care navigation maps (PCNMs). These visual simulations show a temporal sequence of the milestone-driven goals of the patient's care journey.

The care team and patient can use PCNMs to track treatment progress (*Fig. 15*). I term this approach to care management "SimTrack". I also use SimTracking to manage patient visits. Patients are provided their PCNMs and asked to self-monitor and assess their care progress against the map. Patients then schedule their care visits based on the attainment of the planned milestones, allowing for just-in-time care scheduling. SimTracking results in fewer unnecessary patient visits, opening the doctor's schedule up, decreasing the "busyness" in the clinic and, in turn, minimizing the risk of operator-induced errors due to a decline in workload intensity.

Patients are also encouraged to use PCNMs to detect any untoward or spurious tooth movement and may schedule an appointment immediately to rectify the presenting problem. Such care management practices help contain errors and, most importantly, encourage the patient's enthusiastic and active participation in his or her own care. Indeed, patient cooperation is vital to achieve a successful outcome.

ERROR-PROOFING AGAINST THERAPEUTIC MISMANAGEMENT, MISPRESCRIPTION AND MISADMINISTRATION

By nature, conventional orthodontic care is error-prone and reactive. A number of factors contribute to this mode of practice. First, the diagnosis, plan (if there is one) and choice of therapeutics are often disintermediated. Second, normative prescriptions built into the appliances (brackets) fail to account for individual variation[9].

The manufacturing tolerances tend to be poor, adding to inexactitude in the prescription. Third, the clinician often ignores sound principles of mechanics in favour of "convenience and simplicity" when designing, selecting and managing orthodontic appliances. This often results in spurious tooth movement remedied only by reactive therapeutic measures.

Additionally, the skills of the doctor are challenged in reliably bonding brackets[10] or precisely bending archwires in 3D because of a lack of reproducible and reliable anatomical references to bond teeth or bend archwires.

Practice violations
High levels of diagnostic uncertainty
High decision density
High cognitive load
Narrow time windows
Multiple transitions of care
Multiple interruptions/distractions
Low signal to noise ratio
Surge phenomena
Circadian dysynchronicity
Fatigue
Novel

Table 1: Some factors contributing to safety violations in an orthodontic practice.

Figure 13: use your smartphone and scan the QR code to view the figure

Figure 14: use your smartphone and scan the QR code to view the figure.

This issue is further compounded by limitations in human perception, manual skills and the fidelity of orthodontic tools used[11]. These intertwined factors cause therapeutic dissonance, resulting in error that manifests in unplanned or unwanted tooth movement.

There are four major approaches that I use to prevent or contain errors related to the therapeutic management of a patient. These include:

Diagnopeutics and Personalized Targeted Therapeutic Planning Driven by SimPeutics

Diagnostic findings are integrated with therapeutic strategies (Diagnopeutics) to design a personalized 3D virtual target setup; I term this technique "SimPeutics" (*Fig. 16)*.

This setup is based on consideration of patient needs, aesthetics, anatomical constraints (root position, bone morphology and growth potential), physiological limits and a realistic appraisal of the corrective potential of the appliance used. I use both the auto and interactive design abilities of suresmile software to design the precision personalized indirect bonding trays and archwires.

The interactive design tools allow me to design unique, customized appliances based on my planned therapeutic strategies to minimize spurious tooth movement (*Figs. 17 and 18*).

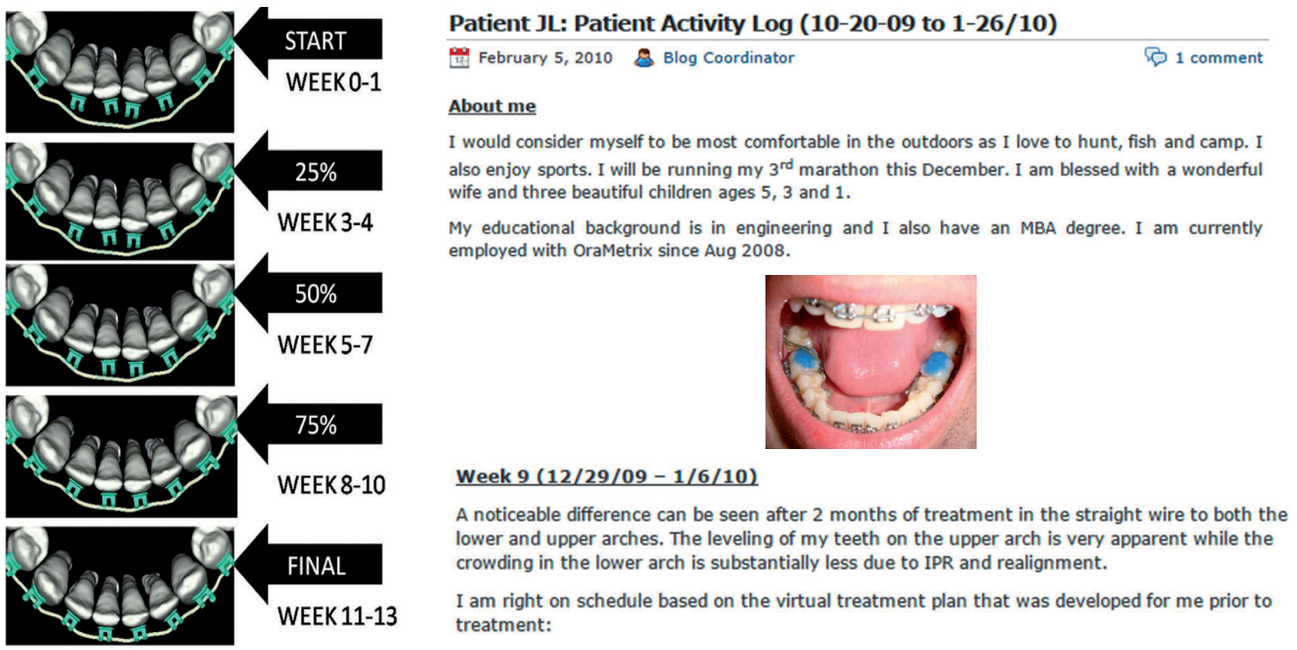

Figure 15: SimTracking. A patient care navigational map is shown. Patients are encouraged to self-monitor their treatment progress by taking images of their own teeth during the course of treatment and matching them against the map. Care team members also have access to these maps to monitor treatment progress. These practices create a flat bed structure, allow for open communication between all stakeholders and minimize errors.

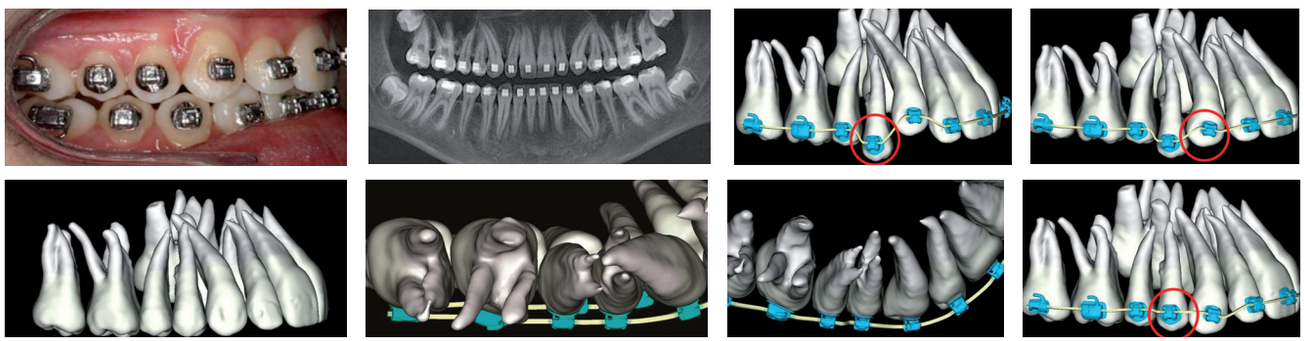

Figure 16: An example of the principles of Diagnopeutics and the use of SimPeutics to manage care for this patient. There is a possibility of root collision occurring between the upper right canine and first premolar during its mesial root correction if conventional mechanics were used. The diagnopeutics-defined strategy in this patient was to initially extrude the upper first bicuspid to minimize the risk of root collision during root correction of the canine. SimPeutics was used to design the plan along with the series of staged archwire. First, the bicuspid was extruded while all the other teeth were stabilized. Second, the root of the canine was corrected while stabilizing the rest of the arch with a passively designed archwire (active only for the canine). The last archwire was designed passively across the whole arch and an active intrusive bend was placed to intrude the first bicuspid.

Figure 17: Interactive software tools are used to design single-tooth IDB jigs or trays. An extensive electronic bracket library allows the clinician to choose his/her preferred bracket system. .stl files of the jigs/trays are produced and can be used for printing the output.

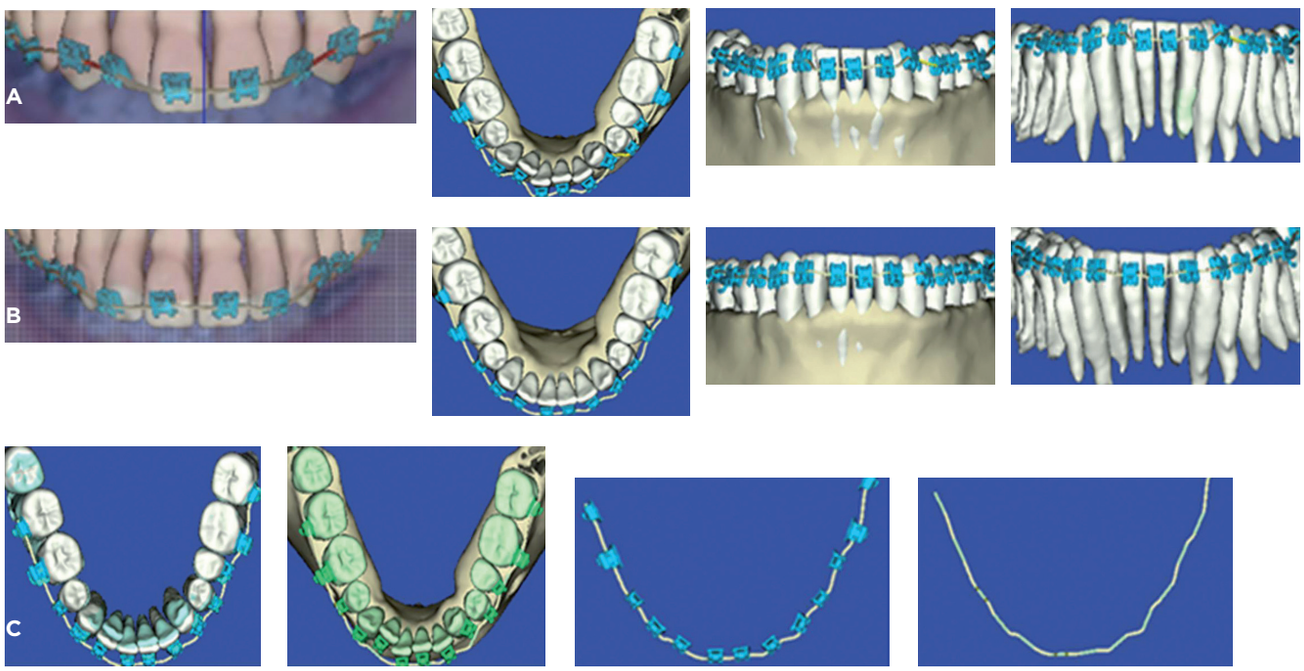

Figure 18 a-c: Personalized precision archwires are designed using a virtual target setup. A: Initial malocclusion; B: virtual target setup. Some of the design considerations for the setup include aesthetics (smile line), root position, anatomical limitations (bone), bracket prescription archwire cross-section and material. C: Evaluation of both target tooth position against initial position and archwire design

Robotic and 3D Printing Assisted Precision Appliance Fabrication

Robotically assisted precision archwire bending and precision 3D printing technology are used to bend personalized archwires and fabricate indirect bonding jigs or trays, respectively. Both these technologies offer the ability to manufacture orthodontic archwires and indirect bonding (IDB) trays with great reproducibility, precision and accuracy[2]. These precision manufacturing technologies overcome the limitations of human capabilities discussed earlier (*Fig. 19*).

Figure 19: use your smartphone and scan the QR code to view the figure

Anticipatory Orthodontics with Free-Body Diagrams and SimTheranostics

One of the best ways to manage error is to anticipate it and institute corrective measures in advance. Using free body diagrams, I try to predict the impact of both active and reactive forces on tooth displacement. I then design the appropriate therapeutic strategies to counter unwanted tooth displacements (*Fig. 20*). I use simulations to forecast the influence of additive or subtractive bends placed in an orthodontic archwire (e.g. a curve of Spee) and bracket slot prescription to understand their potential to cause undesirable tooth movement. I term this technique SimTheranostics (*Fig. 21*).

Figure 20 a-c: Anticipatory orthodontics.
A: Patient in whom an open bite developed with the use of a continuous archwire engaged in the high canines.
B: This could have been predicted with the use of a free body diagram.
C: Diagnopeutics-driven appliance design. The risk of an open bite was averted by using a passive bypass archwire (reactive appliance) and a piggy-back archwire (active appliance) to extrude the canines.

Statically Determinate and Consistent Force System-Based Appliance Design

Designing and using appliances that generate statically determinate systems, such as cantilevers, allows me to apply both predictable and controlled force systems and achieve reliable and planned orthodontic tooth movement[12] (*Fig. 22*).

ERROR-PROOFING WITH ROOT CAUSE FAILURE ANALYSIS

Every error incident in the practice should be reported and a root cause analysis (RCA) performed[13]. RCA is a preventative method of problem solving that attempts to seek the root cause(s) of the problems. Once a root cause is identified correctly and removed from the problem fault sequence, recurrence of the undesirable event is eliminated. Removing causal factor(s), as is commonly done in practice, helps treat the symptoms, but unlike removing root cause(s), does not prevent its recurrence. RCA is tool of continuous improvement.

DESIGNING PATIENT-CENTRED HIGH RELIABILITY (PATIENT SAFETY) PRACTICES

The success of error-proofing a practice depends on establishing a culture of a high reliability organization and implementing operational practices that position the patient at the hub of the wheel of care.

At the macro level, seven spokes around the wheel must be aligned to achieve the tenets of quality care. I call these spokes the 7 Ps: People (the care team should have appropriate skills and work in an integrated and coordinated manner), Plan (the patient and care team should understand and agree upon a care plan and the path to accomplish it), Products (selection of the appropriate technology and materials), Processes and Procedures (the correct sequence and way in which things are done), Place (the appropriate work space designed around transparency and a culture of reporting) and Performance (measures to gauge effectiveness that drive a

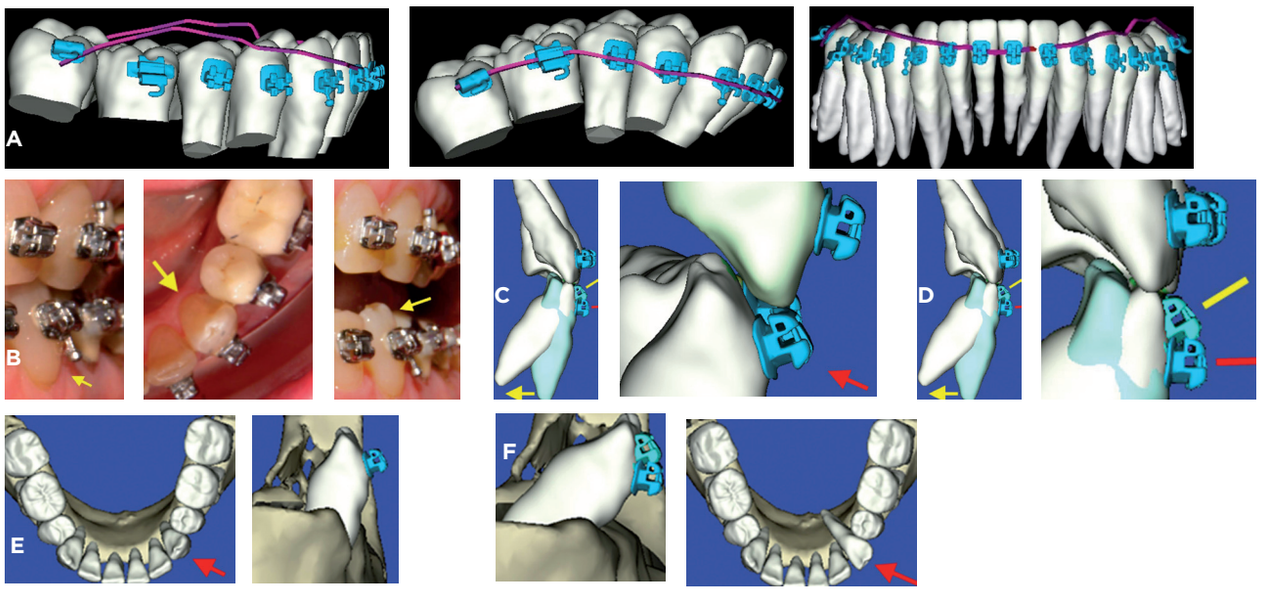

Figure 21 a-f: SimTheranostics. A: The effect of using a reverse curve of Spee on the lower arch is predicted using simulations. B: SimTheranostics used to predict the expression of standard slot prescription built into the lower left canine bracket. Note that clinically the torque on the canine appears fine. C: The canine bracket torque prescription has not fully expressed itself. D: Simulation shows full expression of the canine bracket prescription. Note the excessive amount of lingual root torque. E: The canine is in a bony housing. F: One can easily recognize with simulations the potential risk of creating dehiscence/perforation in time on the lingual side of the canine if a full-sized archwire is used.

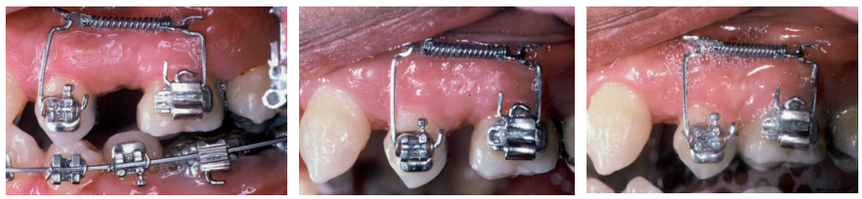

Figure 22: A statically determinate force system is generated when a single force system is used. Note in this patient the line of action of the force system is located through the centre of resistance of the canine and molar. As a result, no tipping is seen during the retraction of the first bicuspid.

system of double-loop learning to achieve continuous improvement in patient care) (*Fig. 23*).

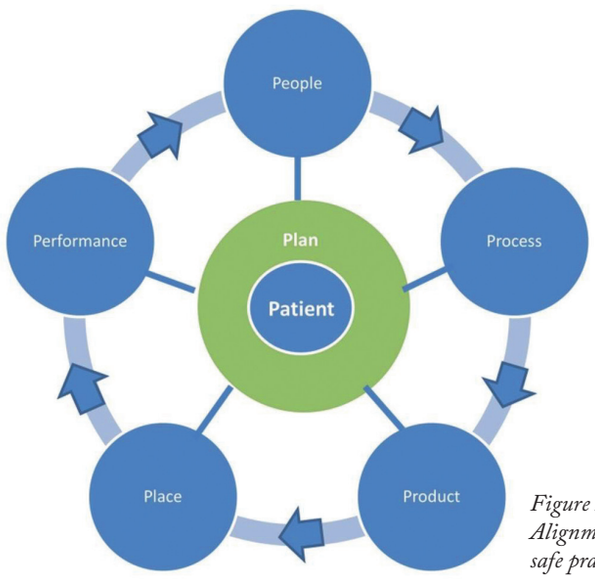

Figure 23: The wheel of care. Alignment of all the 7 Ps encourages safe practices.

DISCUSSION AND CONCLUSIONS

In this article, I have described some multidimensional clinical care practices, many of which I have developed and use to prevent or minimize error-triggering events, especially as they relate to the 8 Ms. These practices include the use of various technologies and processes, including 3D imaging (such as CBCT) and the tools offered by the SureSmile total patient care management system. Safe practices mandate that the doctor relies upon a strong foundation in the principles of diagnosis, and biomechanics, with a robust understanding of the nature of orthodontic tooth movement to design and plan appropriate patient care.

"Omnia mutantur, nos et mutamur in illis"

Furthermore, the larger concentric of coordinating care team activities and the sociocultural aspects of patient care cannot be blindsided when developing an error management strategy.

It is imperative for orthodontic practices to commit to a culture of high reliability, authenticity and transparency. Doctors must be fearless in terms of reporting errors, providing fertile grounds for the practice of patient safety. Furthermore, reflective, lifelong learning on the part of the doctor fortifies the path to better patient care. Also, at the system-wide level, normalization of deviance defined by Vaughan[14] as "The gradual process through which unacceptable practice or standards become acceptable. As the deviant behavior is repeated without catastrophic results, it becomes the social norm for the organization" should no longer be accepted as a *modus operandi* by our profession. It is time to elevate our care delivery platform from a craft-based, reactive, error-prone, error-accepting system to a professional, generative, error-reporting, error-preventing, patient-safe care environment.

The new reality on the ground is that the doctor and his or her team need to extend their skill sets and repertoire from managing patients in vivo to doing so in silico via simulation-driven orthodontics. This will require challenging one's mental models of care and ensuring they are congruent with reality. It is important to realize that dissonance between these models leads to incorrect design inputs for the virtual care plan, in fact creating pathological virtual simulations/setups, which in turn lead to the manufacture of incorrect appliances.

This leads to spurious tooth movement. "Push button" digital orthodontics is fool's gold. Inappropriate management of a patient in the virtual world adds another layer of complexity to error containment. Despite all of the technologies and processes that we have in our armamentarium to manage errors, the clinician must recognize that successful error management pivots around the human attributes of mindfulness, judgement, reason, sensemaking and active listening. Most importantly, the doctor can never abdicate his or her primary responsibility to his or her patients; with a healthy dose of empathy, the doctor must care for patients in the physical world.

My intention for this paper was to highlight some of the approaches I have developed to serve my patients with quality care. Creating a patient-centred, ultrasafe practice environment – described under the auspices of the BioDigital Orthodontics manifesto – is a long, arduous journey. However, as Lao Tzu said, "I have taken the first step in a thousand-mile journey."

In closing, to quote Cicero, the meaningful question that should arise in our minds is, "*Cui bono?*" Who benefits from the practices discussed in this paper? It's the patient! And shouldn't this be all that really matters for us as doctors who have taken the ρκος *horkos* (Hippocratic oath)?

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The Composite Cone Technique: an Effective Tool for Enhancing Transverse Maxillary Stability in Multisegmental Le Fort I Surgery

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> *"This technique helps to achieve transversal stability after maxillary surgical expansion"*

Abstract

Stability of the transverse dimension of the maxilla is difficult to achieve clinically in patients undergoing segmental osteotomy. The likelihood of relapse is directly associated with the gain in maxillary width. New methods are needed to avoid or reduce transverse relapse.

This study describes the preliminary results in two patients of a technique designed to avoid or reduce transverse relapse after segmented Le Fort I osteotomies. The technique includes the preoperative construction of higher than normal cusps, built using flow composite filling material in the non-functional cusps of the molar teeth, including the lingual cusps of the lower molars and the buccal cusps of the upper molars.

In the first patient, the correction of a dual occlusal plane by multisegmental Le Fort I osteotomy increased the upper dental arch width between mesiobuccal (MB) cusps of second molars from 54 mm to 56 mm, with the width remaining stable 1 year after surgery. In the second patient, the transverse dimension of the upper dental arch, measured at the MB cusp of the first molar, increased after surgery from 58 mm to 63 mm between MB cusps of second molars, remaining stable for 3 years.

These preliminary results indicate that the "composite cone technique" can control transverse relapse after segmental Le Fort I osteotomy.

Keywords
Maxillary, surgical expansion, stability

INTRODUCTION AND LITERATURE REVIEW

Transverse maxillary deficiency, whether isolated or associated with other dentofacial deformities, results in aesthetic and functional impairment.

Patients may have difficulty chewing due to unilateral or bilateral transverse discrepancy and dental crowding, or a deep palatal vault and nasal blockage, leading to oral breathing and apnea[1].

These problems may be solved more easily in growing than in non-growing patients with orthopedic maxillary expansion. Although these deficiencies can also be solved in non-growing patients with mild orthodontic problems, patients with moderate to severe discrepancies require orthognathic surgery. If the problem is just transverse, it may be solved by surgically assisted rapid palatal expansion (SARPE)[2,3]. Correcting discrepancies in the vertical and/or sagittal planes, however, requires conventional orthognathic surgery. In most patients, a segmental Le Fort I osteotomy can correct discrepancies in the transverse dimension, although some cases require a midline mandibular osteotomy, a combination of these two methods, or distraction osteogenesis[3,4].

Although achieving correct transverse dimensions intraoperatively is not challenging, postoperative relapse may occur, probably due to the tension of palatal fibromucosae. Many methods have been developed to avoid relapse[5-8].

This study describes a new technique designed to avoid or reduce transverse relapse in maxillary expansion after segmented Le Fort I osteotomies. The method consists of building non-functional, higher than normal megacusps in the molars that lock occlusions intraoperatively, thus avoiding transverse relapse postoperatively.

TECHNICAL AND SURGICAL PROCEDURE

Prerequisites for the successful use of the composite cone technique: protocol for building higher than normal cusps (megacusps)

The first step consists of making plaster models of the teeth (*Fig. 1*). Molar cusps are increased by free-hand augmentation (*Fig. 2*). Impressions are taken of the dental arches, followed by model casting. The model of the upper jaw is segmented, and the segments of the upper jaw model are fitted onto a model of the lower jaw; areas that require additional augmentation or reduction are marked.

The cusps in the mouth are reduced and augmented according to the models (*Fig. 3*). The impression taking, model casting and segmenting as well as fitting steps are repeated until the segmented model of the upper jaw can be seated perfectly on top of the model of the lower jaw, with deep intercuspation of the megacusps and with functional cusps in occlusion.

Although indirect bonding of the

Figure 1: Fitting of a maxillary segment on top of a lower dental arch reveals the best position for the megacusp. The location is marked in black.

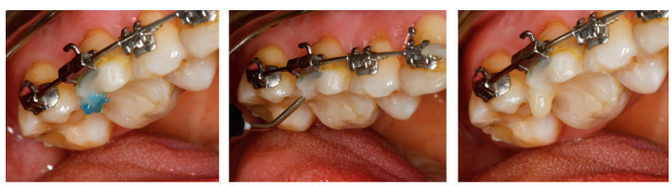

Figure 2: Free-hand augmentation of the molar cusp in the mouth. Acid etching, bonding and augmentation with flow composite material results in the megacusps

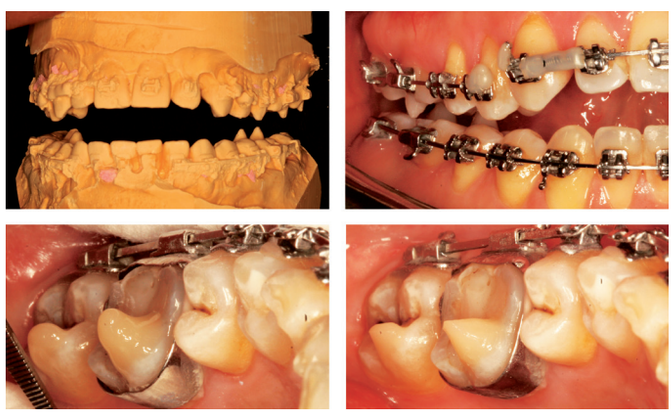

Figure 3: Following the final occlusion on the models, the megacusps are reduced or augmented as required in the mouth.

megacusps would provide accurate final occlusion, it would add significant laboratory expenses to the costs of treatment.

SURGICAL PROCEDURE

Since the megacusps cannot prevent active relapse forces, the maxilla must be mobilized adequately, and all of its segments must be passive to the extent that no excessive force should be needed to push the segments into the right position on the lower dental arch. The maxilla must be totally freed from the pterygoid plates, and all bone behind the descending palatine artery must be removed. Maxillary passivity can be tested by effortless posterior downward mobilization with a Turvey spreader. The maxilla can then be segmented by performing two parasagittal osteotomies in the floor of the nose and connecting them with a transverse osteotomy extended into the dentoalveolar process. The transverse passivity of the lateral maxillary segments can be tested using a Turvey spreader. The mobility of the segments can be checked by palpation and manual checking to ensure that the segments have separated adequately at the dentoalveolar level where they are attached to the intact mucosa.

Vertical control of the maxillary segments must be precise. The patient should not have a posterior open bite after surgery. Accurate posterior plate bending, passive osteosynthesis, and gentle condyle seating are prerequisites for good vertical control of the posterior maxilla. If postoperative posterior open bite occurs, the megacusps cannot prevent transverse relapse.

Stable osteosynthesis and the wedging of posterior maxillary bone defects with grafts or synthetic material are required to avoid surgical relapse. The megacusps can prevent only transverse relapse at the level of the teeth, with a proper surgical technique ensuring stability at the bone level.

In constructing plaster models, the ideal position for cusp enlargement was designed with the models in final occlusion. High cusps were constructed of flow composite filling material, according to the rules of restorative dentistry, and were built up incrementally in each patient's mouth just before the acquisition of the impressions for model surgery and splint fabrication. If a patient had a temporary or ceramic crown, acrylic resin or other materials were used instead of flow composite. Alternatively, if adherence is questionable, the crowns could be replaced with the new ones with megacusps augmented in the laboratory.

The cusps are usually positioned on the non-functional cusps of the molars, including on the lingual cusps of inferior molars and the buccal cusps of upper molars. These cusps may be made of a filling material, in a different shade, to facilitate their safe removal at the end of treatment. During the healing process, these cusps prevent transverse relapse and stabilize expanded maxilla at the level of the teeth. A final splint was not used, so the final interdigitation of upper and lower teeth was not inhibited.

Megacusps were removed at the time of reinsertion of continuous archwire after surgery, most usually 3–4 months postoperatively when the bone segments have healed completely. In many patients with worn out dental anatomy and a poor fissure-cusp relationship, however, the megacusps were retained until the end of orthodontic treatment. Alternatively, if patients are unwilling to undergo reconstruction of dental anatomy, the megacusps were kept in throughout the retention period. The megacusps are subsequently ground to half-size in order not to interfere with functional jaw movements but can still assist in maintaining the transverse dimensions of the upper dental arch.

DESCRIPTION OF THE CASES

The first patient had an upper dental arch width between the MB cusps of the second molars of 54 mm. The planned expansion was 2 mm. Transverse dimensions were measured after 1, 6, and 12 months, with the occlusion being stable 1 year after the end of treatment (*Figs. 4–6*).

The second patient had an upper dental arch width between the MB cusps of the second molars of 58 mm. The planned expansion was 5 mm. Transverse dimensions, measured after 1, 6, 12, and 36 months, remained stable throughout follow-up. The remaining non-functional megacusps on the upper molars continued to act as retention devices 3 years after the end of treatment (*Figs. 7–9*).

Although the technique is a promising and reliable tool for achieving transverse stability following the multisegmental Le Fort I procedure, it had a few drawbacks; for example, it required additional chair time of about 40 minutes for the construction of the megacusps, as well as the additional use of dental facilities. This method requires taking a series of impressions and cast moldings to ensure that the cusps are placed properly. Moreover, they must be trimmed to a size, such that they are unable to interfere with the final occlusion when the model of the upper jaw is segmented and placed onto the model of the lower jaw. This technique is also inconvenient for patients. The megacusps raise the bite, obliging patients to switch to a soft diet even before surgery. To minimize this period, the megacusps are constructed 2 to 3 days before surgery; however, this also shortens the interval needed for surgical planning. Since the megacusps open the bite preoperatively, all surgical planning must be started only after the megacusps are in place. Therefore, surgical planning is somewhat more difficult since the bite is converted to an open bite. Planning must therefore allow for some autorotation of the lower jaw. Since the megacusps can collide with the antagonizing teeth during model block surgery, the lower jaw may have to be opened wider during treatment planning to create space for an intermediate splint. This may increase the incidence of error due to undetermined and arbitrary rotation axis of the mandible.

DISCUSSION

Relapse is the main problem in transverse expansion with Le Fort I osteotomy. If relapse occurs in the posterior part of the maxilla, constriction of the maxilla may lead to premature contacts, which could open

Figure 4: Patient 1. Sequence of orthodontic treatment.

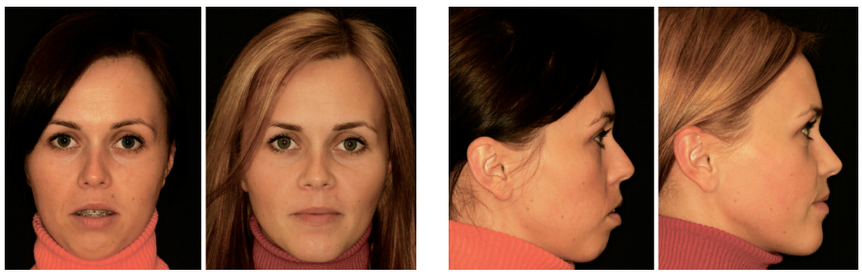

Figure 5: Patient 1. Facial front and profile views before and after surgery.

the bite. Since the fibromucosae on the palatal side are deemed responsible for relapse[2-7], overcorrection has been recommended to protect the transverse dimension from relapse[7]. Since most of this expansion occurs during bimaxillary orthognathic surgery, it is very important to achieve the most accurate occlusion.

Several techniques have been reported to prevent relapse following segmented Le Fort I osteotomies. For example, initial SARPE surgery has been reported to increase transverse dimensions, with any sagittal or vertical problems being corrected during the second surgery[2,3]. Although these results are stable, patients must undergo two operations. Another technique consists of splint fixation to the upper arch for 1 month to prevent the collapse of the upper arch[8].

Although these splints are as thin as possible, they still prevent the upper and lower teeth from coming into occlusion, which may prevent the control of final occlusion. Another method includes the use of a palatal bar during the osteotomy healing period, thus preventing palatal tilting of the lateral segments[9-13]. Insertion of a palatal bar is a simple procedure but may actively displace maxillary segments and produce a shift in final occlusion or the loss of overbite.

Other techniques include acrylic on the arch, a new archwire with overcorrection, cross-elastics, and palatal splints. Regardless of the retention device chosen, it must be totally passive, should not interfere with the final interdigitation of teeth, and should not result in accumulated plaque formation or impingement of oral hygiene. Reconstruction of dental anatomy before proceeding to segmental maxillary osteotomies has been recommended to ensure deep cusp-fissure contacts and stable occlusion after surgery.

To date, however, no studies have assessed the implementation of higher than normal megacusps for postoperative retention.

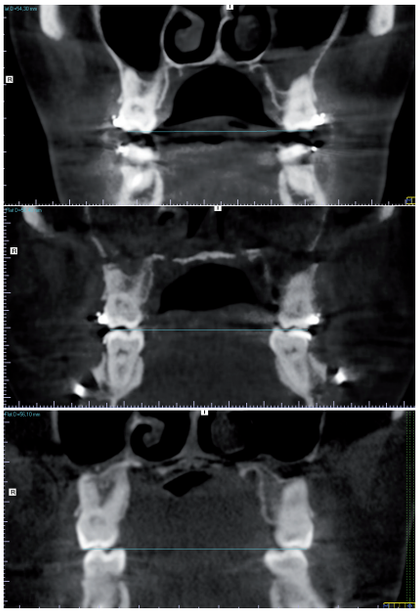

Figure 6: Patient 1. CT coronal views before surgery and 1 week and 1 year after surgery (top to bottom).

CONCLUSIONS

Optimal postoperative management of the transverse dimension in patients undergoing a multisegmental Le Fort I osteotomy remains unclear. Our findings suggest that achieving a good occlusion with megacusps may be the best retention technique. These megacusps prevent transverse relapse at the level of the teeth alone, while a proper surgical technique ensures stability at the level of the bone. Stable osteosynthesis and the wedging of bone defects with grafts in the posterior maxilla must be performed to avoid surgical relapse.

Use of this method yielded stable results after 12 months in one patient and after 36 months in the second. Although these results may be promising, further research is needed to determine the indications and limitations of this technique.

Figure 7: Patient 2. Sequence of orthodontic treatment.

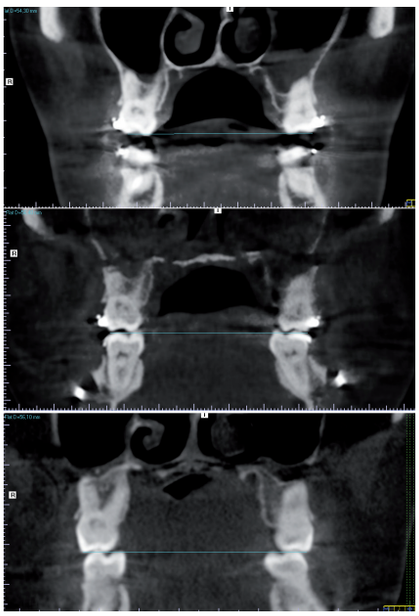

Figure 9: Patient 2. CT coronal views before surgery and 1 week and 3 year after surgery (top to bottom).

Figure 8: Patient 2. Facial front and profile views before and after surgery.

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Missed Finding of Enlarged Sella Turcica on Lateral Cephalogram: A Clinical Report

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Abstract

BACKGROUND

Lateral cephalograms play an important role in orthodontic diagnosis and treatment planning. They assess the relationship between dental, skeletal and soft tissue and help us plan to achieve a harmonious relationship between these parameters. There are various studies in the literature regarding incidental pathologic findings seen on lateral cephalograms.

FINDINGS

Here, we describe a case of a patient who developed symptoms of headache, dizziness and galactorrhoea during orthodontic treatment. The patient was referred to a physician who advised endocrinological investigations and magnetic resonance imaging (MRI). The orthodontic appliance (0.018 lingual appliance) was debonded. The patient was diagnosed with hyperprolactinaemia and medical management by a physician was advised. After an MRI scan, the bonding was done again with a ceramic bracket to facilitate frequent MRI scans and meet the aesthetic demands of the patient. When the pretreatment lateral cephalogram was studied for sella turcica morphology and size, it revealed a large sella turcica that was missed during the initial examination. Because frequent MRI is required at regular intervals in such cases, the benefit of using ceramic brackets is emphasized.

CONCLUSIONS

It is very important for a clinician to study the diagnostic radiographs with the utmost care, not only to concentrate on the area of interest but also to screen the radiograph for any pathological findings.

Keywords
Lateral cephalogram, sella turcica

> *"It is very important for a clinician to study the diagnostic radiographs with the utmost care, to screen the radiograph for any patological findings"*

BACKGROUND

Lateral cephalograms play an important role in orthodontic diagnosis and treatment planning. They assess the relationship between dental, skeletal and soft tissue and help us plan to achieve a harmonious relationship between these parameters. They can also be used for the study of growth and facial forms and assessment of skeletal maturation[1].

There are various studies in the literature regarding incidental pathologic findings seen on lateral cephalograms. The following are documented: cervical vertebrae anomalies[2]; anomalies in shape[3,4], size[5, 6] and bridging of sella turcica [7–9]; and glandular[10], dental[11], foreign body[12] and vascular pathologies[13].

The sella turcica, which houses the pituitary gland, is an easily seen landmark in the lateral cephalogram. The geometric centre of the sella, located by visual inspection and denoted by S, is frequently used as a stable derived landmark for various cephalometric analyses[14].

The sella turcica lies on the intracranial surface of the body of sphenoid. It consists of a central pituitary fossa, which is bounded anteriorly by tuberculum sellae and posteriorly by dorsum sellae. There are two anterior and two posterior clinoid processes that project over the pituitary fossa. The anterior clinoid processes are formed by prolongations of the lesser wing of the sphenoid bone, and the posterior clinoid processes are terminations of the dorsum sellae[15].

Sella size is quite variable. According to the literature, in the South Indian population, the length, depth and antero-posterior diameters are 5–14 mm (9.1±1.639), 3–10 mm (7.3±1.210) and 8–15 mm (11.1±1.291), respectively[16]; in the Iraqi population the length, depth and antero-posterior diameter are 4.13–13.97 mm (9.22±1.97), 4.51–10.63 mm (7.56±1.15) and 7.89–15.15 mm (11.56±1.59), respectively[17].

According to Alkofide, the mean length, depth and diameter were found to be 10.5–11.2 mm (10.8±2.335), 9.0–9.7 mm (9.3±1.361) and 14.1–15.2 mm (14.6±2.084), respectively, in the Saudi population[7].

We describe a case report where we missed the finding of an enlarged sella turcica on the lateral cephalogram of a patient who, during the course of orthodontic treatment, developed symptoms of headache, dizziness and galactorrhoea and was diagnosed as hyperprolactinaemia.

CASE PRESENTATION

A 22-year-old female consulted for orthodontic treatment with the chief complaint of irregularly placed upper and lower teeth and had a strong desire for lingual orthodontic treatment.

The treatment was started with a 0.018 slot lingual orthodontic system (Libral Traders Pvt. Ltd, New Delhi, India).

She complained of headache, dizziness and galactorrhoea during the 5th month of orthodontic treatment and was referred to a physician for consultation who then advised a few endocrine tests and an MRI scan. The lingual brackets were removed for the MRI scan. The investigations revealed a significant rise in prolactin level (1676µIU/ml) (*Table 1*).

The MRI findings were inconclusive, although a homogenous enhancement of the sella turcica was seen. A clinical diagnosis of hyperprolactinaemia was made.

As there was ongoing research in the department for the shape, size and bridging of the sella turcica in orthodontic patients, we checked the morphology of the sella turcica in this patient on the lateral cephalogram. There was a significant increase in the antero-posterior diameter and depth of the sella turcica (width 11.18 mm, depth 13.52 mm, antero-posterior diameter 15.24 mm). These linear dimensions of the sella turcica were measured using the method of Silverman[18]. The sella was enlarged in depth in comparison to the antero-posterior diameter and width (*Fig. 1*).

The patient was recommended medical management with two 0.25 mg tablets of Tab Caberlin per week (Sun Pharmaceutical Industries Ltd, Mumbai, India). After six months of treatment, the prolactin level returned to within the normal range (22.6 ng/ml; reference range 2–29 ng/ml). The patient again reported for orthodontic treatment. This time, we started the patient with ceramic labial brackets so that in the event of future diagnostic MRI scans, the brackets would not need to be removed, meanwhile delivering an aesthetic treatment to the patient[19–21].

Hormone	Normal Reference Range	Patient Value
Free T3	4.25–8.1 pmol/l	6.8 pmol/l
Free T4	10–28.2 pmol/l	16.2 pmol/l
TSH	0.46–4.68 µIU/ml	4.7 µIU/ml
Prolactin	66–490 µIU/ml	1676.70 µIU/ml

Table 1: The endocrine investigations prescribed by the physician along with patient values and normal reference range

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DISCUSSION

Many studies describe the morphology of the sella turcica on lateral cephalograms[22–24].

Cephalometric radiographs of subjects with certain syndromes and conditions show an abnormal sella region, or vice versa: subjects with an abnormal sella turcica may in fact have an undetected underlying disease[5, 10]. Abnormal morphology of the sella may be seen in Fragile X syndrome[3], Down syndrome[25], Williams syndrome[26] and Seckel syndrome[27].

Enlarged sella turcica is seen in acromegaly[4], the presence of intrasellar adenomas (e.g. prolactinoma)[28,29], empty sella syndrome[28, 30], Rathke's cleft cysts and aneurysms[29]. Small sella turcica is seen in holoprosencephaly[4] and Williams syndrome[26]. In the current case, sella turcica shape and size were measured according to Silverman's method[18]. The width of the sella was 11.18 mm, depth was 13.52 mm and anterior posterior diameter was 15.24 mm, all of which were significantly higher than the normal values suggested in the literature. This was a case of finding of an enlarged sella turcica in a lateral cephalogram that was initially overlooked primarily because the orthodontist's main focus was on the relationship between dental, skeletal and soft tissues, which was the primary objective of the lateral cephalogram.

Kuhlberg and Norton[11] studied 396 records of orthodontic radiographs and remarkable radiographic findings (conditions or abnormalities) were found for 26 (6.2%) patients. Moffitt[31], in his research, revealed that about 50% of orthodontists will likely discover a significant finding or abnormality on a lateral cephalogram. This also highlights the role of orthodontists while examining radiographs and diagnostic aids, because they are well trained in examining the normal anatomy present in radiographs and distinguishing it from any abnormality.

CONCLUSION

This case shows that we tend to primarily focus on the part of the film that interests us and hence we may miss critical information that is present in the entire film. So, it is very important that we carefully examine the entire film, appreciating the normal anatomy and morphology of the structures in the film. Lastly, in the words of Jones et al.[8]: "While underlying pathologic lesions that lead to the appearance of an enlarged sella is a relatively rare finding in the typical patient population presenting to orthodontists, it is this infrequency that increases the clinician's need for vigilance."

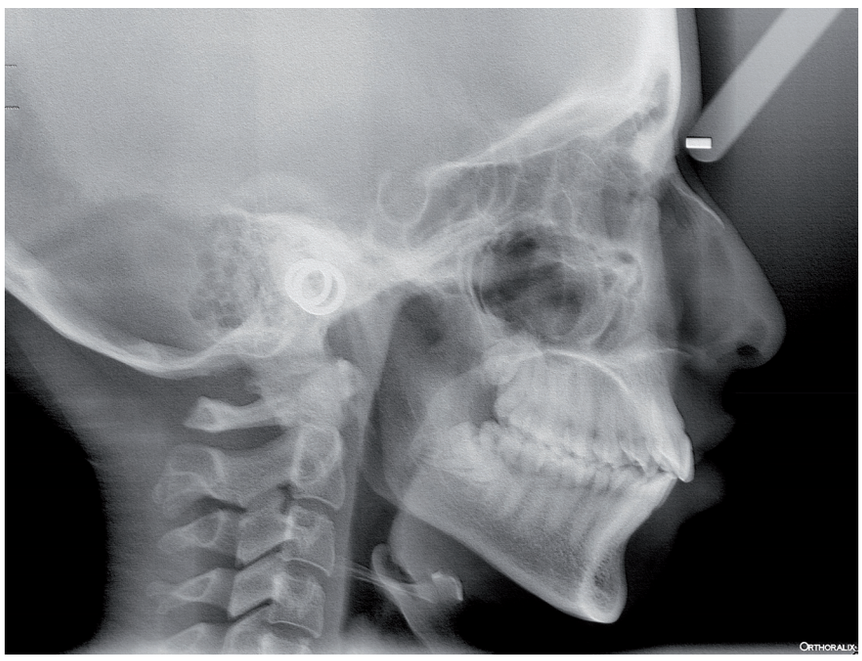

Figure 1: Lateral cephalogram showing a large sella turcica with measurements.

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Orthodontics 2.0: The Next Step in Orthodontic Marketing

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"Social media has the power to revolutionize the way orthodontists and dentists interact with their patients

Abstract

Social media is the latest buzzword around the world. From teenagers to techies, entrepreneurs to educators, all have embraced the new face of this sizzling phenomenon. Interestingly, social media has made its way into the health-care industry as well. The so-called "e-patients" of this generation are using the web to gather information, seek online guidance, demand better health information and insist on a distinct relationship with their doctors. However, orthodontists and dentists have failed to use the popular social networking platforms to their advantage. Social media can be an opportunity for better education, accrued compliance and higher outcomes for the patient, whereas orthodontists can learn from experts and peers, discuss clinical problems and share practice management. It might be still in its infancy in the field of orthodontics, but this form of media has the power to revolutionize the way orthodontists and dentists interact with their patients. They need to take advantage of tremendously popular social networking platforms while limiting their exposure to unwanted liability.

Keywords
Social media, orthodontics

INTRODUCTION

Social media is the latest buzzword around the world. From teenagers to techies, entrepreneurs to educators, all have embraced the new face of this sizzling development. "Social media" allows anyone to create and disseminate information, ideas and experiences and communicate quickly and efficiently using low-cost and highly scalable web-based technology[1]. Blogs and blogging may be viewed as a benchmark for the start of this shift from the age-old industrial media to the new age social media paradigm[2]. Blogs moved us from a read-only web to a "world live web" driven by user-generated content through tools such as blogs, wikis, podcasts, picture sharing, micro-blogs, livecasting, tagging, social network platforms, etc.[3]. Facebook, MySpace, LinkedIn, Skype and Twitter are just a few popular websites that use social media for networking and marketing. Although it is at an early stage in the field of orthodontics, the concept of social media marketing is quickly becoming popular and expanding to the majority of social media avenues with more and more corporations either experimenting with it or adding it to their marketing mix.

e-PATIENT

Interestingly, social media has made its way into the health-care industry as well. The health-care industry is embarking on a brand new generation of care delivery: one built around participatory medicine, where the active role of the patient is emphasized in medical decision making. Participatory medicine involves a new breed of informed health consumers, known as "e-patients", who are using the web to gather information, seek online guidance, demand better health information and services and insist on a different relationship with their doctors[4]. Social media allows online care systems to evolve to connect consumers to physicians immediately, whenever and wherever they need them, breaking down traditional barriers to access and allowing limited physician resources to be allocated in new ways. This allows patients and physicians to work together to select tests, treatment and disease management and support all based on evidence and the patient's informed preferences, which might reduce the patient's unnecessary anxiety and unnecessary visits to the physician's office[5].

e-PHYSICIAN AND e-ORTHODONTIST

Like patients, the numbers of physicians embracing this technology to cater to the patients' needs are growing rapidly. A survey by Manhattan Research estimated that 89% of physicians in the United States used the Internet to access pharmaceutical, biotech and medical information[6]. Nearly 90% of physicians use at least one site for personal use and over 65% for professional purposes[7]. They are finding Facebook, Twitter and their own blogs valuable tools to communicate with their colleagues and to stay in touch with their patients, offering informal advice[7].

In contrast, a survey of 9000 orthodontists and dentists reported that most orthodontists are struggling to incorporate social media and marketing into their practices. While 95% of those surveyed reported having a website, only 50% had a Facebook fan page[8]. The survey also found that almost three-quarters of the staff responsible for marketing their practices had no qualifications or experience in the field and that almost 50% of orthodontists and dentists are taking on the marketing responsibility of their practices. Many private marketing groups are helping orthodontist revive their sagging practice by incorporating new communication platforms to keep up in this competitive new marketing frontier. Social media provides an opportunity for orthodontists to address people's questions and provide them with information.

e-STRATEGIES FOR USE OF SOCIAL MEDIA FOR THE ORTHODONTIST

Establishing a 'brand'

The orthodontist has to clearly define the practice's "brand" and its place in the local market. This will help in keeping the plan focused on delivering a repeated message that patients and the community will associate with the practice. A set of personality traits should be established with which the practice can be endowed. Once the traits are established, it should be shared with the team. The team member(s) tasked with posting need to be keenly aware of the practice personality that has been created. Now, the clinic has been given a "brand".

Selecting the right network

To begin with, the orthodontist should focus on Facebook, Twitter and YouTube. By taking the time to build a presence on Facebook, patients are able to view the required details and also to get to know the providers. Facebook is an excellent social media network for building a multi-faceted promotion page. Twitter makes it easy to gain followers and bring engaging content to the masses, but this medium needs to be used carefully to grow businesses and reach the right consumers in the process. YouTube has also been proven to be very useful for health-care providers. By posting educational videos, patients can get a feel for the personality of the doctors and learn more about the services that they provide. These videos may also be shared on Facebook.

Create a blog

It is important to have a blog that describes the clinic's initiatives, facilities, goals and success stories in the healthcare industry. It's also a great way to share events and news for the clinic. The orthodontist should make sure that the blog links back to the clinic's Facebook, Twitter and YouTube pages. If more number of people notice the resources, subsequently the practice receives higher ratings.

Focus on content

Sharing the right content is just as important as selecting the right network. Orthodontists should formally discuss the questions that are asked, the cases they treat on a day-to-day basis and news pertaining to issues related to orthodontics. Content should be created and shared on a regular basis. This allows the practice to become a reliable source of information and to focus on the fact that patient education is an important, integral part of their operations. The content posted must be relevant, engaging and strong, and it should also be regular. Orthodontic practices can see an increased online engagement level over time by taking time to make social media content one of the practice's priority.

Create a forum

A forum should be provided that allows ongoing dialogue with patients, providing the orthodontist with an opportunity to respond to their concerns. Also it helps the practice to learn about individual patient experiences. Patients should be encouraged to share testimonials on the website. Also, providing an impetus like a contest could help to increase the number of visitors. When patients have a motive to engage, they're more likely to make the attempt to visit the website more.

Regular follow-up

Many practices falter on social media by not following up on it. Once the channels are implemented and running, it can fall into a comfortable pattern. Hence the orthodontist should make sure that information is posted on a regular basis. Social media accounts that post too often or not enough usually get 'de-friended' or 'un-followed' by the patients. Hence, the patients should not be inundated or overwhelmed.

EFFECT ON DOCTOR–PATIENT RELATIONSHIP

As social media extends its reach to the health-care setting, the effect on the doctor, patient and doctor–patient relationship needs to be assessed. According to QuantiaMD, 87% of physicians make personal use of social media, but a lesser amount, 67%, use it professionally[9,10]. Among orthodontists, though 95% of those surveyed reported having a website, only 50% had a Facebook fan page[10]. 72% of e-patients searched for information just before they visited the doctor and 70% found it influenced their decisions[10]. 41% of online health searchers read about somebody else's experience with medical issues and providers, and 24% had consulted the online rankings and reviews of physicians and medical practices[11]. These startling statistics show how e-patients are rapidly becoming a new valuable health source. They manage much of their own care, provide care for others, help professionals improve the quality of their services and participate in a wide variety of mutually beneficial patient–professional collaborations.

Yet, with all the promise and potential come strong concerns. Physicians are wary of diagnosing or treating patients online, with over 40% saying they were not interested in using this tool. However, although orthodontists and physicians appear to be embracing social media, not only worried about liability and privacy issues, they are also finding it difficult to dedicate enough hours in their routine[7].

COST OF e-COMMUNICATION AND RETURN ON INVESTMENT (ROI)

Although e-communication is becoming an integral part of the communication structure within the orthodontic fraternity, its costs and benefits are not being assessed routinely. The underlying motive of e-communication is to improve orthodontic practice and increase productivity. The biggest benefit of e-communication is giving appointments, where in the past a phone call was mandatory to confirm the appointment. With the availability of e-mail and text, appointments can be delivered electronically without taking patient's valuable time by interruption through a phone call. Also, savings can be made by sending newsletters, announcements, birthday wishes, competitions, Christmas cards, etc. electronically rather than through print media. By not having to pay for printing and postage, the investment in software and hardware is recovered in no time.

It is imperative to evaluate the return on investment in social media. Social media ROI is simply a measurement of efficiency of the investment. In general, social media returns can be an evaluation of increase in the amount of sales of the marketed product. But in the field of orthodontics, social media returns can be a better awareness of the practice's brand itself. However, it should be noted that the number of likes, comments, etc. cannot be considered as social media campaign's goals.

LEGAL IMPLICATIONS

Although doctors and medical students are increasingly participating in online social media, evidence from studies, legal cases and media suggest that the use of these media can pose risks for medical professionals[12,13]. Patients might consider use of social media as providing a transparency in health care, whereas physicians and dentists might consider it a way of educating patients and transforming an unknown scary procedure into something that can be understood.

However, being comfortable with putting information online for everyone to see can lead to trouble. Inappropriate online behaviour can potentially damage personal integrity, the doctor–patient relationship and future employment opportunities.

To tackle this issue, the Australian and New Zealand Medical Associations (AMA and NZMA) and the Australian Medical Students' Association (AMSA) have developed a code of ethics for their members[13].

They have created some practical guidelines to assist doctors and medical students to continue to enjoy the online world, while maintaining professional ethics. The guidelines mention maintaining confidentiality of information that is posted and guarding against any defamatory comments about an individual.

They also provide guidance on how to maintain privacy and doctor–patient boundaries.

Though restricted to its members, the guidelines can be universally applied to any orthodontic or dental professional.

CONCLUSION

Social media might be still in its infancy in the field of orthodontics, but this form of media has the power to revolutionize the way orthodontists and dentists interact with their patients. It can flourish in the health-care sector as a means of distributing information to patients or serve mainly as support groups among patients. It can also increase peer–peer interactions for the benefit of the patient. Orthodontists should take advantage of tremendously popular social networking platforms, while limiting their exposure to unwanted liability.

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X-RAY ODDITIES

Many times, when we see in our practice a radiograph, we have the opportunity to note images that may or may not influence directly our diagnosis and our treatment plan.
This column of EJCO gives us the opportunity to show these images and to make some brief observations about them. The style is concise: the images largely speak for themselves.
Your suggestions for future topics as well as your comments will be very welcome.

Radicular or Dentigerous?

The patient, a 53-year-old man, presented to the dentist with an asymptomatic swelling in the upper jaw localized between the upper left central incisor and upper left first premolar. Clinical examination showed the presence of two fixed rehabilitative prostheses in the upper arch from 14 to 11 and from 21 to 24.
An ortopantomography (OPT) (*Fig. 1*) showed the presence of both upper included cuspids and a well-defined, unilocular radiolucency with corticated margins in the zone of left upper impacted cuspid and adjacent non-vital left upper central incisor.
The diagnostic dilemma is that the cyst could be of radicular origin starting from the non-vital upper left central incisor or of dentigerous origin starting from the upper left included cuspid.
In the former case, the extraction of the incisor and curettage of the apical zone would be necessary or, alternatively, an apicoectomy. In the latter case, the eventual extraction of the impacted cuspid would be indicated together with the elimination of the cyst, but the upper incisor and corresponding prosthesis would remain in place.
A cone beam computed tomography (CBCT) was done to solve the dilemma. Radial sections showed that upper non-vital incisor had no cystic problems (*Fig. 2*) and that the cyst was in direct continuity with the crown of the upper left impacted cuspid (*Fig. 3*). The root of the impacted cuspid was not affected by the cystic lesion, confirming the follicular origin of the lesion. The axial section showed that the cyst had a cleavage plane with respect to the root of 21 (*Fig. 4*).

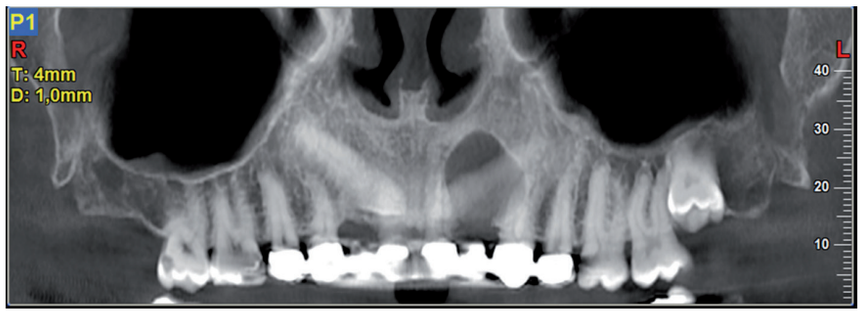

Figure 1: OPT showing both upper impacted cuspids and the presence of a well-defined, unilocular radiolucency with corticated margins in the zone of the left upper impacted cuspid..

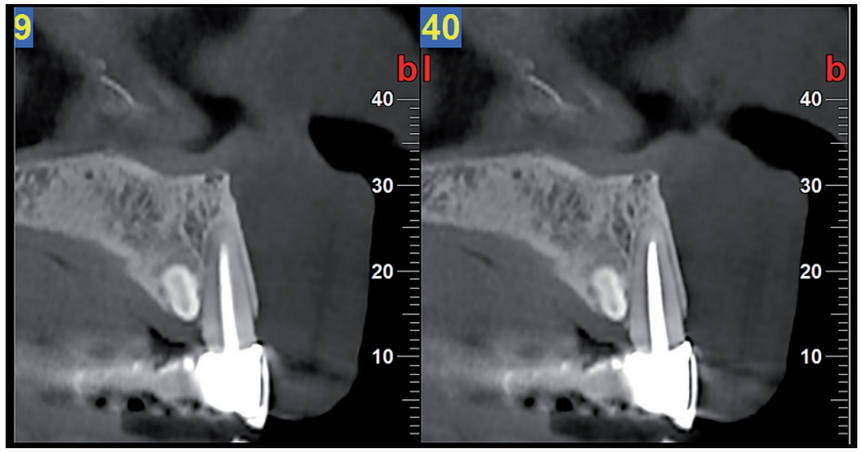

Figure 2: Radial sections showing upper non-vital central incisor without problems at the radicular apex.

DISCUSSION

Radicular cysts derive from the proliferation of small odontogenic epithelial residues (rests of Malassez) within the periodontal ligament and develop from a pre-existing periapical granuloma at the apex of a non-vital tooth.

A radicular cyst may be successfully managed by extraction of the associated non-vital tooth and curettage of the apical zone. Dentigerous cysts develop from proliferation of the enamel organ remnant and are attached to the tooth cervix (enamel–cementum junction).

A dentigerous cyst encloses the crown of an unerupted tooth.

Dentigerous cysts are most commonly seen in association with third molars and maxillary canines, which are the most commonly impacted teeth.

The definitive therapy of a dentigerous cyst is the removal of the associated tooth and enucleation of the soft tissue component[1].

Histologically and clinically, the radicular cyst is similar to the follicular cyst in that it is important to identify it from the point of view of clinical management[2, 3].

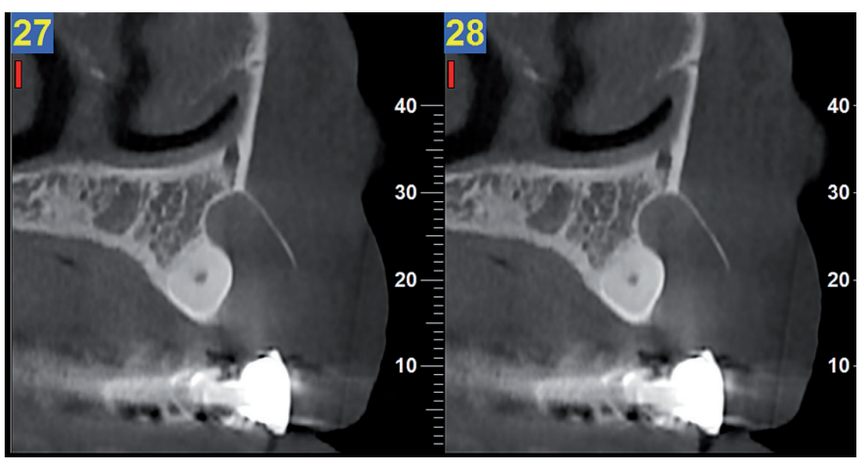

Figure 3: Radial sections showing that the cyst is in direct continuity with the crown of the upper left impacted cuspid.

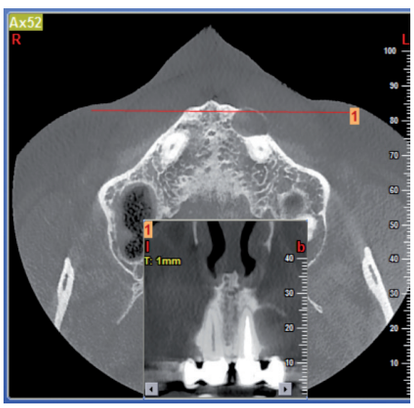

Figure 4: Axial section showing that the cyst had a cleavage plane with respect to the root of 21.

Images courtesy of Studio Radiologico D'Ambrosio, Rome, Italy

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Case Reports Guidelines

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In the previous article, I defined Case Reports and their clinical utility. In this second article, I will take into account the Care tools[1] that support the writing of Case Reports. The tools are available at www.care-statement.org/index, the website of Case Reports.

Introduction should report the scientific background and why this case is unique.

Patient Information should report demographic information, history, main concerns and symptoms of the patient.

Clinical Findings should describe the history including lifestyle and genetic information, comorbidities, relevant interventions and the physical examination (extraoral and intraoral analysis), including results from testing (radiographs, cephalometric description, other diagnostic tools).

Timeline should report important information from the patient's history organized as a timeline (*Fig. 1*).

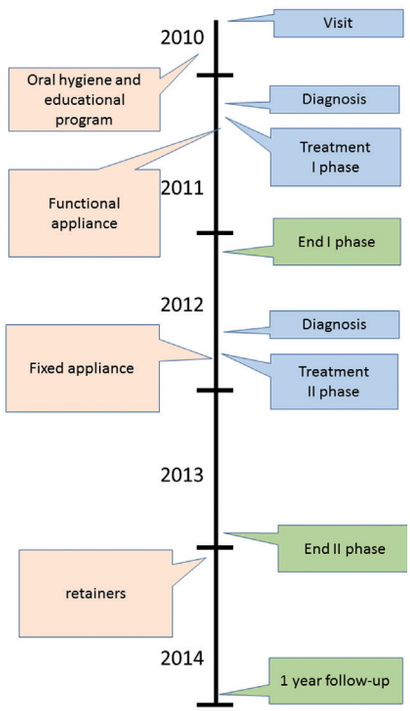
Diagnostic Assessment should provide an assessment of the diagnostic methods (such as physical examination, laboratory testing, imaging, surveys), diagnostic reasoning including other diagnoses considered and prognostic characteristics, where applicable.

Therapeutic Intervention should describe the types and administration of intervention (treatment objectives and treatment alternatives).

Follow-up and Outcomes should describe the treatment progress (intervention modification, interruption or discontinuation, and the reasons; adverse effects or unanticipated events), the results of treatment and eventually the follow up.

Discussion should report the literature relevant to this case report (the scientific and clinical context); the rationale for conclusions, potential causal links and generalizability; and the primary "take-away" lessons of this case report.

Patient Perspective
When appropriate, the patient should share their perspective on the treatments they received.
Obviously, the information should be suited to the context of orthodontics.



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Orthodontics and Traumatic Injuries to the Teeth

R. Schiavoni
Editor-in-Chief

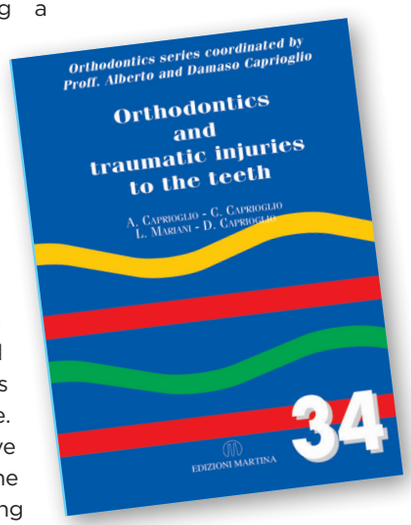
Every orthodontist has certainly had to face at least once the problems linked to trauma to the primary, mixed or permanent dentition. This issue is widely dealt with in the literature, but there is little scientific evidence. Especially for this reason, the experience reported by A. Caprioglio, C. Caprioglio, L. Mariani and D. Caprioglio, the authors of "Orthodontics and traumatic injuries to the teeth", provides a useful set of guidelines to follow in the various situations that may come to our attention.

The book provides irreproachable evidence related to a large series of patients monitored over several years starting right from the beginning, thereby providing the orthodontist with valuable tips suggesting a correct therapy.

Dental trauma furthermore requires a "team approach" which is essential to solve these problems, mainly in growing patients with malocclusion. The text exhaustively deals with this aspect and it is therefore extremely useful for the clinician.

The book is published by Edizioni Martina and should be considered a must for every orthodontist's collection of scientific literature.

We therefore join Prof. Jens Ove Andreasen, who has written the introduction, in congratulating the authors on this new book on orthodontics and dental trauma.



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Type of lesion	Observation period
Uncomplicated crown fractures and crown-root fractures	3 months.[46]
Complicated crown fractures and crown-root fractures	After pulpotomy and radiographic healing (hard tissue barrier)(approx. 3 months).[46]
Root fractures	1-2 years.[46,67] The time may be shorter in the absence of symptoms. In the case of healing with calcified tissue or interposition of connective tissue, or bone and connective tissue, the coronal fragment must be treated as a tooth with a short root. In the case of non-healing with interposition of granulation tissue, the tooth should not be moved until successful completion of endodontic treatment and connective tissue healing of the coronal fragment.
Slight periodontal ligament damage[21] (tooth still in its normal place and firm or slightly loose) concussion subluxation extrusion lateral luxation	3 months.
Moderate-severe periodontal ligament damage Lateral luxation (moderate-severe eccentric displacement) Intrusion Avulsion and replantation	1 year if ankylosis is not diagnosed.[46] Orthodontic movement is not recommended before complete periodontal healing (6 months). If the teeth are submitted to orthodontic movement between 6 and 12 months and the movement does not proceed as expected, the possibility of ankylosis must be seriously considered.
Immature injured teeth	Wait for radiographic evidence of advancing root development. Clinical and radiographic follow-up is necessary after 6 months, 1 year and 2 years.[46]
Root-filled teeth (due to caries)	Orthodontic movement can be started immediately as long as no periapical lesions are visible. Definitive root filling with gutta-percha is recommended[55] rather than leaving calcium hydroxide in the root canal.[59-61]
Root-filled teeth (due to inflammatory resorption)	Wait for radiographic evidence of healing and then allow at least a year to elapse. Teeth with signs of root resorption seem to be more prone to further resorption during orthodontic movement.[67-68]
Root-filled teeth (due to traumatic injuries)	In a tooth with a mature apex, initial filling with calcium hydroxide should be followed by definitive root filling with gutta-percha.[55] The recommended waiting time depends on the type of injury.
Autotransplanted teeth	3-6 months pulpal healing can be diagnosed clinically as well as radiographically 3-9 months pulpal healing i.e. after periodontal ligament healing[70] (8 weeks) the orthodontic treatment is possible without a significant risk of progressive resorption.

Table 1: Observation periods suggested by the Authors prior to orthodontic treatment related to the type lesion

AUTHORS
Caprioglio A, Caprioglio C, Mariani L, Caprioglio D.

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