

A Professional Courtesy of:

Dr. David Shapiro, BA, DDS, MSc(ORTHO), FRCD(C)

9200 Bathurst Street, Suite 30
Thornhill, Ontario L4J-8W1
905-731-9699
www.mybraces.ca



AUTUMN 2010



Orthodontics

*Alert*TM

Two-dimensional vs Three-dimensional Imaging in Diagnosis and Treatment of Impacted Maxillary Canines

Diagnosis and treatment planning for impacted teeth typically depend on results of 2-dimensional (2D) radiographs. Such imaging allows for localization of the impacted tooth, which in turn determines diagnosis and mode of treatment. Newer technology in the form of cone-beam computed tomography (CBCT) has made 3-dimensional (3D) imaging available. This allows for localization of the impacted tooth in all planes. Haney et al from the University of California at San Francisco compared 2D and 3D technology to see if they led to different diagnoses and the utilization of different therapies.

Eighteen patients with 25 impacted maxillary canines were included in the study. Each patient had 2D and 3D images obtained. Two-D imaging included a panoramic film, an occlusal

x-ray and 2 periapical radiographs. CBCT was used to obtain 3D images. Seven faculty members assessed all impacted canines and completed a questionnaire for each tooth. The data were collected and analyzed.

The collected data indicated that, depending on the imaging modality, the judges had come to different conclusions regarding impacted tooth localization. There was a 16% difference in perceived labiopalatal position and a 21% difference in perceived mesiodistal cusp tip position. There was a 36% difference in perceived root resorption of adjacent teeth. For 27% of the teeth analyzed, there was a difference in treatment plan (leave, recover or extract) when using 2D technology as opposed to 3D. Finally, there was a statistically significant increase in the accuracy of the diagnosis and treatment plans when the faculty members used CBCT technology.

Conclusion

These results indicate that there is a difference in the diagnosis and treatment plans of maxillary canines when using 2D vs 3D technology. The increased accuracy of the 3D technology may lead to improved diagnosis and treatment plans, result-

IN THIS ISSUE

- Statistical Prediction of Mesiodistal Crown Width of Unerupted Teeth
- Postretention Stability of Open-bite Treatment
- A Quantitative Assessment of Root Resorption Over 16 Weeks
- Use of the "Rhythmic Wire" to Treat an Occlusal Cant



ing in more successful treatment. This underscores the desirability of obtaining CBCT imaging whenever possible for a patient with impacted canines. **QI**

Haney E, Gansky SA, Lee JS, et al. Comparative analysis of traditional radiographs and cone-beam computed tomography volumetric images in the diagnosis and treatment planning of maxillary impacted canines. Am J Orthod Dentofacial Orthop 2010;137:590-597.

Statistical Prediction of Mesiodistal Crown Width of Unerupted Teeth

The goal of mixed dentition analysis is to assess the space needed for alignment of the canines and premolars, and the space currently available. This is traditionally done on plaster casts, but predicting the mesiodistal crown diameters of the unerupted teeth is difficult. These diameters are predicted based either on correlation of the crown diameters or on radiographic views of the unerupted teeth. Boboc from Philipps University, Germany, and Dibbets from Lucian Blaga University, Romania, developed a way to predict the widths of unerupted premolars and canines, and evaluated the accuracy of the various estimation methods.

A total of 320 plaster casts of orthodontically treated patients were randomly divided into 2 groups. One group of 223 casts was used to calculate a new prediction method, while a group of 97 was used to test the methods. The mesiodistal crown diameters of the 28 adult teeth were measured on all casts using a digital caliper. The new predictor for estimation was calculated based on multiple linear regression equations.

The best predictors of tooth width were the mandibular right lateral incisor, mandibular first permanent molar and the left central incisor. The accuracy of this equation was 67% for the

maxilla and 69% for the mandible. One permanent tooth in the second transitional period improved the accuracy of the prediction equation. Regression equations were calculated for every canine and premolar because the sequence of eruption is so variable. When the study group was used to assess accuracy, the inclusion of a canine or premolar led to 93% correct estimates. When the study group was used to assess the validity of the other prediction methods, the Bachmann method was the most accurate, at 66% for the maxilla and 69% for the mandible (Table 1). Tränkmann and Raufmann's equation was accurate, at 64% for the maxilla and 65% for the mandible.

Conclusion

Overall, the Bachmann method was found to be the most accurate, with the new equation calculated as part of the study being just as accurate. The inclusion of a premolar or canine improved the accuracy of predicting the mesiodistal crown diameters of unerupted premolars and canines. Clinicians may try this new method to predict the arch length so that treatment decisions can be as accurate as possible. **QI**

Boboc A, Dibbets J. Prediction of the mesiodistal width of unerupted permanent canines and premolars: a statistical approach. Am J Orthod Dentofacial Orthop 2010;137:503-507.

Table 1. Accuracy of existing methods of predicting arch length

Method	Arch	Overpredicted	Close (± .75 mm)	Underpredicted
Boboc and Dibbets (2010)	Upper	28%	67%	5%
	Lower	26%	69%	5%
Bachmann (1986)	Upper	13%	66%	23%
	Lower	16%	69%	19%
Tränkmann and Raufmann (1983)	Upper	16%	64%	18%
	Lower	16%	65%	15%
Miethke (1972)	Upper	3%	52%	45%
	Lower	42%	54%	4%
Moorrees et al (1957)	Upper	43%	51%	6%
	Lower	39%	52%	9%
Moyers (1960)	Upper	32%	53%	15%
	Lower	45%	48%	7%
Tanaka and Johnston (1974)	Upper	65%	34%	1%
	Lower	67%	32%	1%
Berendonk (1965)	Upper	64%	33%	3%
	Lower	65%	33%	2%
Pancherz and Schäffer (1999)	Upper	61%	36%	3%
	Lower	81%	19%	0%

Postretention Stability of Open-bite Treatment

While there are a variety of treatment modalities for an anterior open bite, relatively few studies have investigated the stability of open-bite treatment, and

many of those did not separate the anteroposterior component and vertical problem. Zuroff, a private practitioner from Washington, et al studied the stability of open-bite therapy ≥ 9.5 years postretention.

Sixty-four patients in the postretention period were selected and divided into 3 groups based on pretreatment overbite or contact. Twenty-five patients, all of whom had overlap of the mandibular and maxillary incisors but no contact, comprised the overlap group. Twenty-four patients made up the contact group, with incisor contact seen on films or casts. Fifteen patients had an open bite.

A series of measurements was obtained from each patient's radiographs. Seven measurements were taken at 3 timepoints:

- T1 (pretreatment)
- T2 (posttreatment)
- T3 (a minimum of 9.5 years postretention)

The study also examined whether there was a difference in the degree of change among the groups.

During the postretention period, all groups had maintained positive overbite (Table 2). However, 60% of the open-bite group lacked incisor contact.

Overjet increased more in the open-bite group than in the contact group, and the contact group had a significant deepening of the overbite compared with the open-bite group. Finally, pretreatment overjet demonstrated a mild correlation with postretention overjet relapse in the open-bite group, but the correlation was not strong enough to be used as a predictor.

Table 2. Posttreatment changes for each group

Group	Contact (n = 24)		Overlap (n = 25)		Open bite (n = 15)	
	Mean \pm SD	p value	Mean \pm SD	p value	Mean \pm SD	p value
Overjet	0.67 \pm 1.05	.05	0.76 \pm 1.20	.05	1.70 \pm 1.76	.05
Overbite	1.61 \pm 1.23	.005	0.88 \pm 1.08	.005	0.40 \pm 1.06	NS
Facial height	2.86 \pm 3.12	.005	3.82 \pm 3.70	.005	3.52 \pm 4.23	.05
U1 vertical height	2.25 \pm 1.90	.005	2.86 \pm 2.59	.005	2.69 \pm 2.92	.05
L1 vertical height	2.10 \pm 1.30	.005	1.80 \pm 1.87	.005	1.89 \pm 1.84	.01
U6 vertical height	2.89 \pm 2.41	.005	2.58 \pm 3.10	.005	2.89 \pm 3.45	.05
L6 vertical height	1.14 \pm 1.32	.005	0.94 \pm 2.27	NS	1.47 \pm 1.29	.005

U1, maxillary incisor; L1, mandibular incisor; U6, maxillary molar; L6, mandibular molar; NS, not significant.

Conclusion

Clinicians should be comfortable with the fact that orthodontic treatment can lead to stable open-bite closure. At the same time, they must realize that contact between the incisors may not be obtained. **QA**

Zuroff JP, Chen S-H, Shapiro PA, et al. Orthodontic treatment of anterior open-bite malocclusion: stability 10 years postretention. *Am J Orthod Dentofacial Orthop* 2010;137:302.e1-302.e8.

A Quantitative Assessment of Root Resorption Over 16 Weeks

Root resorption is a common side effect of orthodontic treatment. Previous studies have shown that resorption ends either when the orthodontic force is discontinued or when it is reduced below a certain level, and that resorptive defects are repaired by the deposition of a new cementum or establishment of a new periodontal ligament. However, there has not yet been a quantitative 3-dimensional (3D) analysis of root resorption repair. Gonzales et al from Nagasaki University, Japan, assessed the volumetric and dimensional changes of root resorption at 2–16 weeks retention.

Sixty 10-week-old rats had a coil spring appliance placed between the left maxillary first molar and the incisors. A nearly constant force of approximately 50 gravitational forces was applied for 2 weeks. The amount of tooth movement was assessed using cephalograms, which were then digitized. The appliance was removed, and the rats were divided randomly into 6 groups, which were sacrificed at 0, 2, 4, 8, 12 and 16 weeks of retention. Resin was placed in the gap for retention in all



rats except for those in the 0-week group. After the left (experimental) and right (control) molars were extracted, a scanning electron microscope measured the mesial and distal surfaces of the distobuccal, distopalatal and mesial roots. Surface area, depth, volume and roughness of root resorption craters were all measured.

The area, depth and volume of the craters decreased and became smoother, beginning at 4 weeks and plateauing at 12 weeks. Reduction of resorption crater volume peaked at 16 weeks, at 69.5% for the distobuccal and 66.7% for the distopalatal roots. Surface roughness improved after 4 weeks in the distopalatal roots and after 8 weeks in the distobuccal roots. The mesial roots had much shallower pits and a volume recovery of 62.5% at 12 weeks. The healing patterns of the shallow pits on the mesial roots showed no differences, compared with the severe resorption on the distal roots.

Conclusion

The results of this study indicate that the repair process began after 4 weeks of passive retention following 2 weeks of force, suggesting that resorption and repair processes were balanced during the early retention period. Together, these results indicate that even if root resorption occurs, significant healing can take place. **Q1**

Gonzales C, Hotokozaka H, Darendeliler MA, Yoshida N. Repair of root resorption 2 to 16 weeks after the application of continuous forces on maxillary first molars in rats: a 2- and 3-dimensional quantitative evaluation. Am J Orthod Dentofacial Orthop 2010;137:477-485.

Use of the “Rhythmic Wire” to Treat an Occlusal Cant

The cant of the occlusal plane is the result of facial asymmetry, either in the jaws or between the vertical positions of anterior and posterior teeth. Typically, these cants can be improved by orthognathic surgery to correct the asymmetry. However, some asymmetries may be repaired by orthodontic treatment using skeletal anchorage. Kang et al from Kyunghee University, South Korea, developed a biomechanical system named “rhythmic wire” to correct the occlusal cant and reported on 2 cases.

The rhythmic wire consists of 2 miniscrews, an intrusion wire, an extrusion wire, a transpalatal arch and a lingual arch. The intrusion wire can be modified to provide the

exact amount of force needed for the patient; the points of attachment to the miniscrews can likewise be adjusted for the patient’s needs. The extrusion wire is clover-like in shape, with the half circles present to accept the miniscrew and attach to the main archwire. Manipulation of these loops leads to activation. The intrusion and extrusion wires are used simultaneously to maintain occlusal integrity. A transpalatal or lingual arch can be placed to minimize occlusal tipping.

The first patient who received the rhythmic wire treatment was a 20-year-old woman with a Class III facial asymmetry and a canted posterior occlusal plane; she refused surgical treatment. After achieving a Class I molar relationship and leveling each arch, a posterior occlusal cant was unmasked. Miniscrews were placed. An intrusion wire was placed on the maxillary posterior teeth and an extrusion wire on the mandibular right posterior teeth. Transpalatal and lingual arches were also placed. The occlusal cant was successfully corrected during a treatment period of 9 months.

The second patient was a 22-year-old woman with maxillary crowding and protruding lips, as well as an occlusal cant. Premolars were extracted to resolve the crowding and lip protrusion. After leveling, the rhythmic wire was applied to her right side, and the occlusal cant was corrected after 4 months. Treatment time was 18 months.

Conclusion

The rhythmic wire appliance seems to be a promising orthodontic treatment protocol to address occlusal cant. Further studies are needed to assess stability. **Q1**

Kang Y-G, Nam J-H, Park Y-G. Use of rhythmic wire system with miniscrews to correct occlusal-plane canting. Am J Orthod Dentofacial Orthop 2010;137:540-547.

IN THE NEXT ISSUE

- Children’s and mothers’ perceptions of malocclusion
- Changes in nasal volume after rapid maxillary expansion
- Posterior crossbite and sucking habits

Do you or your staff have any questions or comments about **Orthodontics Alert**? Please call or write our office. We would be happy to hear from you.

© 2010