

COLUMBIA DENTAL REVIEW



















COLUMBIA UNIVERSITY College of Dental Medicine

Volume 19 | 2013-2015





COLUMBIA DENTAL REVIEW 2013-2015

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Aim and Scope

The Columbia Dental Review (CDR) is an annual publication of Columbia University College of Dental Medicine (CDM). This journal is intended to be a clinical publication, featuring case presentations supported by substantial reviews of the relevant literature. It is a peer-reviewed journal, edited by the students of the school. The editors are selected on the basis of demonstrated clinical scholarship.

Authors are primarily CDM students from pre-doctoral and post-doctoral programs, CDM faculty and residents, and attendings from affiliated hospitals. Peer reviewers are selected primarily from the CDM faculty. Submissions undergo a blind peer review system whereby the authors are not known by the reviewers (at least two per manuscript). Instructions for authors wishing to submit articles for future editions of the CDR can be found on the last page of this journal. Opinions expressed by the authors do not necessarily represent the policies of Columbia University College of Dental Medicine.

Editors' Note

Dear Readers,

I am delighted to welcome you to the 2013-2015 edition of the Columbia Dental Review. The College of Dental Medicine has a long history of producing excellent research, and the goal of the Review is to share some of the innovative and collaborative work that take place at our school. Thank you to our team editors for their hard work, and I hope you enjoy the issue.

Sincerely, Alina O'Brien '17

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Sara D'Apolito Dworkin¹, Roseanna Graham, DDS, MA, PhD²

¹Class of 2015, College of Dental Medicine, Columbia University, New York, NY

²Associate Professor of Dental Medicine, Division of Operative Dentistry, College of Dental Medicine, Columbia University, New York, NY

Abstract

It is estimated that 70,000 to 100,000 people in the United States have sickle cell disease (SCD), with an incidence of 1 of every 500 births in African Americans and about 1 of 36,000 births among Hispanic Americans. SCD was once considered a childhood disease, but now more than 95% of those affected survive beyond age 18, many into their forties, fifties, and beyond. SCD has been associated with a variety of oral and dental manifestations, although whether these are directly related pathogenically or due to socioeconomic factors is not always entirely clear. Planning and performing dental and oral surgical procedures in individuals with SCD presents unique challenges. The purpose of this report is to review basic facts about SCD that the dentist should know as well as specific considerations in caring for adult patients with this condition.

Introduction

Medical Considerations:

Hemoglobin (Hgb), the oxygen carrying protein of the blood, is a tetramer of 4 proteins, 2 α -globin chains and 2 β -globin chains encoded by genes on different chromosomes.¹ Patients with SCD have a mutation of the gene that codes for the β globin chains, a single nucleotide substitution that replaces a normal hydrophilic glutamic acid



Institute; National Institutes of Health; U.S. Department of Health and Human Services.

with a hydrophobic valine residue. The abnormal Hgb that is formed, called Hgb S, tends to polymerize when oxygen tension in the blood or the tissues is low, forming a rigid polymer inside the red blood cell (RBC) membrane. The RBCs also dehydrate, become inflexible and deformed, producing the characteristic "sickled" shape. These abnormal RBCs adhere to the endothelial cell lining of the blood vessel causing obstruction, called vaso-occlusion. The major clinical features of SCD are caused by vaso-occlusion, leading to ischemia of tissues, infarction, and injury to multiple organs, often accompanied by severe painful "crises." There is also vascular inflammation, endothelial damage, and increased RBC destruction leading to severe anemia. Only patients that are homozygous for the Hgb S gene have SCD. Patients that are heterozygous and have only one copy of the Hgb S gene have what is called sickle cell trait, a benign condition without anemia found in 8% of African Americans. Sickle cell trait confers some protection from malaria, which accounts for the high prevalence of the Hgb S gene among people of African descent, particularly in equatorial Africa where malaria is endemic.²

Forty-nine states and the District of Columbia in the United States have mandatory newborn genetic screening for SCD, so most affected individuals born in the US will be detected at birth.² In most affected individuals, painful crises and progressive organ damage alternate with relative inactivity of the disease. Events that tend to trigger crises include infections, dehydration, stress, and extreme changes in temperature. Some of the more common complications of SCD disease include destruction of the spleen and an increased risk of infection, an enlarged heart from chronic anemia, skeletal deformities and growth disturbances, osteomyelitis and osteoporosis, and kidney disease. The acute chest syndrome is a potentially fatal condition with chest pain and lung damage that can be precipitated by infections or by surgical procedures. Cerebral vascular disease including hemorrhagic stroke affects more than 10% of people with SCD by 18 years of age.¹ SCD can also be associated with significant psychosocial problems due to frequent episodes of severe pain, hospitalizations, and physical disability.³

Effective treatments for SCD are limited, although the search for new approaches continues.⁴ Hydroxyurea is an anti-cancer agent that has been used for many years. It appears to reduce the production of Hgb S by inhibiting DNA synthesis, decreasing sickling.² During acute crises, the usual treatment is hydration and aggressive pain management; patients often require large doses of narcotics for pain control. In the past, most patients were given daily oral penicillin to reduce the chances of developing infections like pneumococcal pneumonia, the risk of which was increased because functionally they lack a spleen. More recently, with greater attention to vaccination, the number of patients receiving prophylactic penicillin is greatly reduced and often not used at all in the US in children over age 5.1 The only curative treatment is bone marrow transplantation which is done before organ failure occurs if it is to be useful.

A number of newer therapies are being investigated, including gene therapy, but these are not definitely shown to be beneficial.² The NIH summary statement available online at http://www.nhlbi.nih.gov/health/prof/blood/sickle/

sc_mngt.pdf is an excellent resource for health professionals caring for patients with SCD (3).

Oral Manifestations:

The association between dental caries and SCD has been investigated in different populations. Several investigators have compared African American adults with SCD to

controls.⁵⁻⁷ Patients with SCD tend to have a much greater prevalence of caries, but also tend to have lower social economic status, which may affect their access to care. There may also be a tendency for greater focus on their hematologic than on their dental condition, also affecting caries rates. Conversely, Fukuda and coworkers found a lower colonization rate with mutans streptococci and lower caries prevalence in pediatric SCD patients probably due to prophylactic penicillin therapy they received to prevent systemic infections.⁸ Whether this is still true now that penicillin is less widely used, at least in the United States, is not known. In summary, there are no clear data demonstrating that SCD actually predisposes to dental caries.

Therapies Under Investigation for SCD (2) Xanthine oxidase inhibitors (byproduct of DNA metabolism) Nitric Oxide generators (dilate blood vessels) Statins (lower cholesterol, reduce vascular damage) Monoclonal antibiodies (anti-inflammation) Vascular lubricants (help prevent RBCs plugging vessels) Antifungal agents (prevent activation of leukocytes)

Similarly, there are conflicting reports regarding an association between periodontal disease and SCD.⁹⁻¹¹ While some authors have reported increased plaque index, gingivitis index, and even bone loss in patients with SCD, many others have found no significant difference between patients with SCD and controls.^{9,11} In one recent study, there was no difference in serum cytokine profile in children with periodontal inflammation regardless of whether or not they had SCD, suggesting that there was no direct immunologic relationship between SCD and periodontal inflammation.¹² Instead, like dental caries, gingivitis in patients with SCD likely results from socioeconomic factors, poor oral hygiene, and a focus on non-oral hematologic health issues.

Other oral conditions have been more directly associated with SCD. Luna and colleagues reported the prevalence of malocclusion to be 63% in preschool children with SCD and 100% in 12 to 18 year olds with SCD.¹³ The most commonly reported abnormalities are increased overjet, greater teeth angulation and incisor separation, prognathism, and diastemas. These malformations are thought to result from expansion of the bone marrow in both the maxilla and the mandible due to increased red blood cell production. Dental pulp necrosis that is unrelated to caries is another condition that has been repeatedly associated with SCD. In one recent study, pulp necrosis was 8 times more frequent in clinically intact teeth in patients with SCD as compared to

controls in the absence of trauma by two methods of pulp vitality testing.¹⁴ Sickle shaped cells are visible in tooth sections of dental pulp a few days after a sickle cell crisis. Plugging of the small vessels of the pulp chamber can lead to infarction and necrosis of tissue and even cause periapical lucencies on x-rays.² This can be associated with pain; toothaches are more common in patients with SCD than in normal controls, but pulp necrosis can also be painless.² Neuropathies have also been described that can affect any nerve but have been most frequently reported to involve the mental nerve and result in either loss of sensation or paresthesias of the jaw.¹⁶ Finally, osteomyelitis of the maxilla and mandible have been reported in patients with SCD, probably also as a result of necrosis and secondary infection.² A variety of organisms cause osteomyelitis in SCD: staphylococci and E. coli are most common in the jaw.11

Table 2. Oral Manifestations of SCD				
Probably Directly Related to SCD	Probably Related to Socioeconomic Factors & Poor Oral Hygiene			
Malocclusion, overjet, prognathism, diasthesmas Delayed eruption Dental Pulp Necrosis/Toothache Radiographic laddering, calcifications, or lucencies Neuropathies (Mental Nerve) Osteomyelitis	Increased Caries Increased Periodontitis			

Case Report

A 26-year-old African American female presented to Columbia University Medical Center Dental Clinic for comprehensive dental care with a chief complaint of "I think I have a cavity." The patient's medical history was notable for sickle cell disease, diagnosed by screening at birth. She reported relatively mild painful crises that occur one to three times per year lasting less than a day. She has managed her pain mostly at home with intermittent use of prescription and over-the-counter analgesics; she denies chronic use of pain medications. Her last admission to the hospital for a painful vaso-occlusive crisis was in 1992. Her most serious complication of SCD occurred in 2010 when she developed a headache and was admitted to the hospital with a "brain hemorrhage." She was found to have had a subarachnoid hemorrhage, without evidence for an aneurysm. She recovered without residual neurologic deficits and has had no new CNS bleeding since that admission. There have been no other hospital admissions since 2010. She is considered to be functional without a spleen. Medications include folic acid that she takes once/day to aid in the production of new red blood cells. She takes Tylenol with codeine or ibuprofen as needed for pain.

She has never been treated with hydroxyurea and has not required any recent transfusions. She was up to date on all immunizations and does not take penicillin or any other antibiotic routinely to prevent infections. She is allergic to latex and penicillin. Review of systems revealed occasional shortness of breath without a diagnosis of asthma or other lung disease. Her illness has not interfered with her healthcare: she has been compliant with her prior medical and dental care. On examination, her blood pressure was 136/80 mmHg and heart rate was 80 beats/min. Her dental history was notable from prior extractions of # 1, 16, 17, & 32. Her extraoral exam was within normal limits, there was no asymmetry, swelling, lymphadenopathy, or trismus. Her intraoral exam was also within normal limits. Oral cancer screening was negative. A periodontal exam revealed mild plaque-induced gingivitis. A restorative exam revealed staining, deep fissures, and plaque entrapment on the occlusal surfaces of #2, 3, 14, 15, 19, 30, 31. She had a peg lateral tooth at # 10 that had been built up with composite.

Her radiographs are shown in Figures 1 and 2. No active carious lesions were identified.



Figure 1 Molar and Premolar Bitewing and Central Incisor periapical views



Figure 2 Panoramic radiograph

In developing a treatment plan, due to the presence of deep fissures on her molars, sealants were recommended for #2, 3, 14, 15, 19, 30. However due to financial considerations, she elected to only proceed with a cleaning and application of a sealant to #19, the stained tooth that she thought had been affected by caries.

Discussion

As more and more patients with SCD are living longer with their illness, it is increasingly likely that dentists, oral surgeons, and other oral health care providers will be providing care for adults with this disease in their practices. Unfortunately, there remains a lack of consensus regarding many of the more complex issues in managing patients with SCD during procedures. The following discussion addresses some of the more common questions the dentist is likely to face.

In general, routine dental procedures can be safely performed in the dental office between crises, even in patients with SCD. A complete medical history should be taken in every patient including a list of complications, current and prior treatment, transfusions, frequency of crises, and pain management. Because patients may have received many transfusions, their risk of blood borne infections such as hepatitis or HIV is increased and should be inquired about or tested for, if appropriate. It may be reasonable to obtain a medical consult early in the course of evaluation and treatment, particularly if more invasive or surgical procedures are contemplated.²

Although the risk of caries and periodontitis are not definitely increased in patients with SCD, because infections of any type can trigger painful sickle cell crises, they must be aggressively managed. This may include systemic antibiotics and/or rinses. Most authors agree that restorations are preferred over extractions but extractions can be considered if other approaches are likely to fail.¹⁷ Osteomyelitis is a more serious deep tissue infection that has spread to involve the bone. Treatment with antibiotics is required and surgery may be needed as well. In such cases, early consultation and/or referral to an oral surgeon seem appropriate.²

One controversial issue in the management of patients with SCD during dental procedures relates to the need for prophylactic antibiotics. As discussed above, some young patients may be taking prophylactic penicillin to prevent systemic infections even in the absence of specific procedures, although this will be less likely in adults that have received all recommended vaccinations. Currently published guidelines do not specifically recommend that antibiotics be given to patients with SCD specifically for dental procedures. Tate et al. (2006) surveyed pediatric dentistry residency program directors and pediatric hematologists regarding their use of prophylactic antibiotics for children with SCD during dental procedures.¹⁵ In general, there was a lack of consensus regarding the need for antibiotic prophylaxis for children with SCD among respondents to the survey. Responses also varied depending on the type of procedure to be performed and as

to which antibiotic should be provided. The majority of dentists and hematologists felt that patients with heart disease or those undergoing extractions should receive prophylaxis, but most hematologists would only give penicillin, whereas amoxicillin was the drug of choice for most dentists. Those antibiotic choices held true across all responses. About half of the dentists and hematologists responded that prophylaxis was also indicated for people that were asplenic or being treated under general anesthesia; half would not give antibiotics to that same group of patients. Only a minority of respondents felt that prophylactic antibiotics were indicated for more minor procedures, but 15% of dentists and hematologist would give antibiotics to children with SCD even for tooth polishing. The problem results from a lack of data demonstrating that antibiotic prophylaxis is beneficial for patients with SCD undergoing dental procedures in the absence of definite signs of infection. Research is needed to provide clearer guidelines for the management of these patients.

A few other general guidelines have been suggested. There does not appear to be any reason to avoid local anesthetics or anesthetics containing vasoconstrictors even though vaso-occlusion is a known complication of SCD.² A recent retrospective review found that patients undergoing surgery could be successfully treated in the outpatient setting and without any special protocol.¹⁶ General recommendations included keeping the patient warm, warming all intravenous solutions prior to infusion, and maintaining good hydration and good oxygenation, which are recommended for all patients. Some authors recommend transfusing patients to a hemoglobin level of 10 mg/dl prior to surgery, although this recommendation is not based on the results of controlled



clinical trials.¹⁻² Finally, close attention to the patient's psychosocial history and family and social support network is indicated. Patients with SCD have a lifelong illness that is often punctuated with episodes of severe pain, hospitalizations, systemic complications, organ failure, and a shortened life expectancy. Not surprisingly, in some instances their illness and prior experiences with the health care system may have complicated their ability to obtain optimal care. It is important to discuss these issues with the person and their family and to take them into consideration when developing and implementing a comprehensive care plan.

Conclusion

Sickle Cell Disease is the most common genetic hematologic disease. With modern treatment, most survive into their adult years and many dentists will care for people with SCD. Patients with SCD are at increased risk for periodontal disease, caries, malocclusion, pulp necrosis, and osteomyelitis. Despite their illness, most patients with SCD can be successfully treated in the dental office, can receive local anesthesia and can even undergo more invasive procedures, including extractions and oral surgery, as long as procedures are performed when they are stable and not during or shortly after painful crises.

Whether or not patients with SCD benefit from antibiotic prophylaxis for dental procedures is uncertain; most experts do not recommend prophylaxis for routine procedures such as cleanings.

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Danielle Cook¹, Ilona Polur DMD, MPH, MSc², Sunil Wadhwa DDS, PhD³ ¹Class of 2015, College of Dental Medicine, Columbia University, New York, NY ²Orthodontic Resident, College of Dental Medicine, Columbia University, New York, NY ³Associate Professor of Dental Medicine, Division of Orthodontics, College of Dental Medicine, Columbia University, New York, NY

Abstract

An anterior open bite malocclusion poses challenges for both the patient and the orthodontist. An open bite prevents complete mastication of food prior to deglutination. Patients with masticatory dysfunction are more susceptible to gastrointestinal disorders.⁴ Patients seek treatment from an orthodontist to correct their open bite, in an effort to cure, or at least minimize, their gastrointestinal symptoms.

Introduction

The oral cavity is the entrance to the gastrointestinal system. Structures within the oral cavity, such as the teeth, tongue, and salivary glands, breakdown food and transport it to the stomach for further digestion. The muscles of mastication, which transfer force to the mandible and teeth, generate chewing force.³ Masticatory performance produces a high degree of variation in chewing force and strokes among the general population. "It is theorized that the insufficient breakdown of food and reduced exposure to saliva lead to inadequate pre-fermentation, impaired bolus formation, insufficient secretion of gastric juice acid and, finally, to digestive disorders."3 A recent study shows adults with class III malocclusion, which results in decreased bite force, occlusal contact, and masticatory efficacy, have more digestive complaints and gastrointestinal disorders.⁴ Likewise, an anterior open bite severely impedes biting-off function and mastication.³ Orthodontic treatment is indicated in patients with malocclusions, such as an anterior open bite, to increase masticatory efficacy and hopefully improve gastrointestinal disorders.³ Treatment of an anterior open bite requires a complete understanding of the etiology and accurate diagnoses. Etiologic factors contributing to an anterior open bite include: (1) abnormal skeletal development; (2) imbalances in the surrounding soft tissues and muscles; (3) malposition or displacement of anterior teeth: and (4) parafunctional habits.^{1,2} At the initial visit. complete diagnostic records are taken to establish a diagnosis and determine the etiology of malocclusion. These records typically include a complete medical and dental history, clinical examination, study models, intraoral and facial photographs, radiographs and cephalogram(s). Analyses of soft tissue and skeletal measurements performed on the cephalogram(s) are central to the diagnosis. Large skeletal deviations from the mean may indicate a need for surgical intervention.

Surgical correction of an anterior open bite overcomes the

restrictions posed by orthodontic treatment alone, allowing for larger corrective movements. Combined orthodontic and orthognathic surgical treatment manages the etiology of the establishes malocclusion, and а harmonious maxillary/mandibular dentoskeletal relationship through the coordination and alignment of arch forms. Surgical method selection and degree of movement are highly dependent on the nature and extent of skeletal, dental, soft tissue, and functional discrepancies. Postoperative management and orthodontic retention is essential to maintain the corrections obtained from combined surgical and orthodontic treatment.²

The following case report demonstrates the use of orthodontics and orthognathic surgery to correct an anterior open bite in an adult patient with gastrointestinal dysfunction.

Case Report

The patient, a Caucasian female, 36 years of age, presented to the Columbia University Orthodontic Residency Clinic with the chief complaint, "I have an open bite and was told by my gastroenterologist that it has affected my ability to completely chew my food. I am also bothered by my crowded teeth and lisp." The patient discussed severe constipation only alleviated by laxatives and hydrocolon cleanses. Her gastroenterologist attributed the constipation to incomplete mastication of her food. As a result, the patient sought out correction of her anterior open bite and malocclusion to alleviate her gastrointestinal symptoms.



Figure 1 Initial Composite Records

The patient reported routine dental care, previous orthodontic treatment, and denied any oral habits. At the initial visit, initial composite records were taken (Figure 1). Intraoral examination findings were noted: good oral hygiene, thin-scalloped pale pink gingiva, Class II right molar occlusion, super Class I left molar occlusion, one maxillary occlusal plane, two mandibular occlusal planes, maxillary midline coincident with the facial midline, mandibular midline 2 mm to the right of the maxillary midline, 3.5 mm overjet, and a 5 mm anterior open bite (Figure 1).



Figure 2 Frontal Assessment, Smile Assessment, and Profile Assessment

A frontal assessment revealed the patient's face to be mesofacial with an average width nose and competent lips. Her transverse fifths were equal, but she had an increased lower facial third and her chin deviated slightly to the right. Smile assessment revealed a 90% maxillary incisor display and <10% mandibular incisor display. The patient had a medium-broad smile with a flat smile arc, no gingival display, and <10% buccal corridor display. A <10% buccal corridor display indicates that there is minimal negative space between the corner of the mouth and the most The profile posterior tooth visible during a smile. assessment demonstrated a straight profile, slightly upturned nose, average chin-throat angle, average nasolabial angle (normal = 100-105 degrees), and upper and lower lip retrusion relative to the E-line (normal = lower lip on E-line and upper lip 1 mm behind E-line) (Figure 2).

moderate crowding and a moderate Curve of Spee. As shown in Figure 3 and Table 1, the Bolton Analysis revealed slight maxillary overall and anterior tooth size excess. Space analysis confirmed crowding of 3.4 mm in the maxillary arch and 5.2 mm in the mandibular arch.

BOLTON ANALYSIS	Max	illa	Mandible	Discrepancy	Case Ratio	Ideal Ratio
Overall	95.1		85.2	-1.9	0.8951	0.9130
Anterior	47.3		35.5	-1.4	0.7495	0.7720
SPACE		Ava	ilable	Required	Differen	nce
ANALYS	515					
Maxilla		71.1	l	74.5	-3.4	
Mandible		58.0)	63.2	-5.2	
TRANSVER DIMENSIO	RSE N	Arch Ante	Width rior	Arch Width Posterior	Canine D	istance
Maxilla		31.5		45.6	32.7	
Mandible		31.4		44.3	24.0	

Tables 1a-c Bolton Analysis, Space Analysis, and Transverse Dimension

The panoramic radiograph showed complete permanent dentition with fully erupted third molars and bone level, bone density, and trabeculation all within normal limits. A Columbia Analysis of the lateral cephalogram was performed and patient values were compared with mean values. Interpretation of the measurements indicated a Class II skeletal relationship, Class II denture bases, hyperdivergent denture bases producing a skeletal open bite, long lower anterior face height, retroclined maxillary incisors, increased interincisal angle, and retroclined, retruded mandibular incisors. Additional information obtained from a COGS analysis of the lateral cephalogram revealed a prominent chin, short anterior mandibular dental height, long posterior maxillary dental height, and short posterior mandibular dental height (Figure 4, Table 2).



Figures 3 Patient models

Evaluation of the patient's study models revealed a symmetric maxilla with a parabolic, tapering arch form, moderate crowding, and a mild Curve of Spee. The mandible had a symmetric, parabolic arch form with



Figures 4a-b Panoramic radiograph and cephalograph

Assessments and analyses from pictures, models, and radiographs were collected to create a problem list, establish treatment objectives, and finalize a treatment plan.

COLUMBIA ANALYSIS						
Measurement	Value	Norm	Sig.	Interpretation		
SNA (*)	83.6	81.0				
SNB (")	78.2	78.0				
ANB (7)	5.4	3.0	*	Class II skeletal		
Wits Appraisal	3.1	-1.5	•	Class II denture bases		
SN - GoGn (")	32.8	32.0				
(SN-PP) (*)	5.1	8.2				
(PP-G+Gn) (?)	27.7	22.0	•	Hyperdivergent denture bases/ Skeletal open bite		
Y-Axis (SGn-SN)	68.5	67.0				
(S-Go/N-Mc) (%)	63.1	65.0				
(N-ANS/ANS-Me) (%)	68.2	80.0	•	Long lower anterior face height		
U1 - SN (')	88.9	103.5	**	Retroclined maxillary incisors		
(UI-LI) (*)	151.3	130.0	****	Increased interincisal angle		
LI - GoGn (')	87.1	93.0	*	Retroclined mandibular incisors		
(LI-APo) (mm)	-2.0	1.0	•	Retruded mandibular incisors		
L1 - NB (mm)	3.0	4.0				
Pog - NB (mm)	4.9	4.0				
Holdaway Angle (NB to H-line) (*)	6.1	8.0				
Holdaway Ratio (L1-NB:Pg-NB) (%)	0.6	1.0				

COGS ANALYSIS						
Measurement	Value	Norm	Sig.	Interpretation		
CRANIAL BASE						
Ar-PTM (HP) (mm)	29.8	32.8	•	Short posterior cranial base		
PTM-N (HP) (mm)	50.2	50.9				
HORIZONTAL (SKELETAL)						
N-A-Pg (")	5.7	2.6				
N-A (HP) (mm)	2.0	-2.0	•	Protrusive anterior maxilla		
N-B (HP) (mm)	-5.9	-6.9				
N-Pg (HP) (mm)	-1.6	-6.5	•	Prominent chin		
VERTICAL (SKELETAL/DENTAL)						
N-ANS (Perp HP) (mm)	48.4	50.0				
ANS-Me (Perp HP)(mm)	70.0	60.6	**	Long anterior lower third facial height		
PNS-N (Perp HP) (mm)	51.2	50.6				
Mand Plane - HP (")	26.6	24.2				
U1 -NF (Perp NF) (mm)	28.7	27.5				
L1 -MP (Perp MP) (non)	33.1	40.8	****	Short anterior mandibular dental height		
U6 -NF (Perp NF) (mm)	24.3	23.0	•	Long posterior maxillary dental height		
L6 -MP (Perp MP) (mm)	26.7	32.1	**	Short posterior mandibular dental height		
MAXILLA, MANDIBLE						
PNS-ANS (HP) (mm)	49.5	52.6				
Ar- Go (mm)	46.4	46.8				
Go-Pg (mm)	78.8	74.3				
B-Pg (MP) (mm)	8.5	7.2				
Ar-Go-Gn (")	118.8	122.0				
DENTAL						
OP-HP (*)	5.8	7.1				
A-B (OP) (num)	-3.1	0.4	•	Class II		
U1-NF (*)	93.9	112.5	***	Retroclined maxillary incisors		
LI-GoGn (')	87.1	95.5	•	Retroclined mandibular incisor		

Tables 2a-b Columbia Analysis and COGS Analysis on the pre-surgical cephalograph

In the vertical dimension, the soft tissue problem is an increased lower facial height; the skeletal issues are hyperdivergent dental bases, skeletal open bite, and long anterior lower third facial height; the dental concerns are an anterior open bite of 5 mm and a lateral open bite from 6 to 6. The anteroposterior dimension skeletal problems are class II relationship, protrusive anterior maxilla, and prominent bony chin. The dental issues are class II right

molar relationship, overjet of 3.5 mm, retroclined maxillary incisors, retroclined and retruded mandibular incisors, and multiple occlusal planes. The dental alignment concerns are the mandibular midline deviation of 2 mm to the right, moderate mandibular Curve of Spee, moderate maxillary crowding of 3.4 mm, and moderate mandibular crowding of 5.2 mm. Finally, in the transverse dimension, the soft tissue problem is the chin points to the right. These problem lists were referenced to establish the case's treatment objectives: correct the Class II skeletal open bite, achieve a Class I canine and molar relationship, achieve positive overjet and overbite, eliminate crowding in both arches, and retain the corrections (Table 3).

Problem List		Treatment Objectives			
Vertical Dimension	Soft Tissue	•Correct Class			
	 Increased lower facial third 	II skeletal			
	Skeletal	open hite			
	•Hyperdivergent dental bases •Skeletal open bite •Long anterior lower third facial height	Ex 11'1			
	Dental	•Establish			
	•Anterior open bite = 5 mm •Lateral open bite (6 to 6)	Class I canine and molar			
Anteroposterior	Skeletal	relationship			
Dimension	•Class II •Protrusive anterior maxilla •Prominent bony chin				
	Dental	•Achieve			
	•Class II molar (right side) •OJ = 3.5 mm •Retroclined maxillary incisors •Retroclined and retruded manibular incisors •Multiple occlusal	positive overjet and overbite			
	planes Alignment: •Mandibular midline deviated 2 mm to the right •Moderate mandibular curve of spee •Moderate maxillary crowding = 3.4 mm •Moderate mandibular crowding = 5.2 mm	•Eliminate crowding			
Transverse Dimension	Soft Tissue •Chin points to the right				

Table 3 Problem list and treatment objectives

Treatment to improve the patient's soft tissue, skeletal, and dental discrepancies was accomplished via pre-surgical orthodontics, orthognatic surgery, and post-surgical orthodontics. The pre-surgical orthodontic treatment sequence began with third molar extractions to minimize surgical interference. Orthodontic treatment was performed using a straightwire appliance system. Ceramic brackets were bonded to the teeth and a series of wires were used to level and align the dentition, alleviate crowding in both arches, and coordinate the upper and lower arches. Arch wires were built up to 19x25 SS with crimpable hooks for surgery.

The surgical plan included a two-jaw surgery. The surgical

team performed a one-piece LeFort 1 osteotomy. This included 5 mm of posterior impaction and 2 mm of maxillary advancement to the maxilla. An intraoral vertical ramus osteotomy was performed to asymmetrically advance and rotate the mandible 1 mm to the left and allow for autorotation of the mandibular complex. Posterior impaction of the maxilla, followed by autorotation of the mandible, served to close the anterior open bite and achieve several millimeters of overbite. The maxilla was advanced slightly to compensate for autorotation of the mandible and establish a Class I molar and canine occlusion bilaterally, with proper overiet. In addition, the mandible was rotated asymmetrically to correct midline discrepancy and achieve a proper occlusal relationship. These movements also served to improve the soft tissue profile.

Minor orthodontics was required post-surgically, after healing. Pre-surgical orthodontics alleviated the crowding in both dental arches; however, it produced flaring of the mandibular incisors. During the surgical correction, the dentition was placed into Class I molar and canine Minimal overjet was present due to relationships. mandibular incisor flaring. Lower IPR was used to reduce flaring and increase overjet while maintaining molar and canine relationship achieved during surgery. Settling and detailing of the occlusion was performed. The patient is completing this currently phase of treatment. Post-orthodontic retention will include a lower fixed retainer, an upper Hawley retainer, and a positioner.



Figure 5 Superimposition of initial, pre-surgical, and post-surgical cephalogram tracings to demonstrate skeletal and dental changes

Discussion

The treatment plan addressed the patient's specific diagnoses with pre-surgical orthodontics, orthognatic surgery, and post-surgical orthodontics. The changes achieved from pre-surgical orthodontics and surgical treatment can be observed in the cephalograph tracings and superimpositions in Figure 5.

Pre-surgical orthodontics resulted in flaring of the incisors,

extrusion of the lower molars, and slight counterclockwise rotation of the mandible. The degree of flaring of the mandibular incisors is indicted by the Li-GoGn angle. Pre-surgical orthodontics moved the mandibular incisors from retroclined to a proclined and flared position, increasing the measurement from 87 to 109. The ideal measurement is 92. The excess flare resulted because 5.3 mm of crowding was alleviated without premolar extraction. To bring the Li-GoGn angle closer to 92, and to increase overjet, lower IPR was performed post-surgically. Another acceptable treatment option to alleviate the mandibular crowding of 5.3 mm is bilateral first premolar extraction. This option would provide better incisor angle position, but would finish with molar occlusion in Class III. In addition to Class III molar relationship, this option was not selected due to soft tissue considerations. The patient presented with a collapsed profile and lip position. Extraction of two mandibular premolars would exacerbate these soft tissue problems. Therefore, non-extraction treatment was chosen to improve lip position and avoid Class III molar occlusion.

The surgery produced the following skeletal changes: posterior impaction of the maxilla, counterclockwise rotation of the mandible, and slight changes to the mandibular body and ramus length. A Columbia analysis and COGS analysis of the post-surgical cephalogram confirmed many of these changes (Table 4).

The skeletal changes allowed for correction of the Class II skeletal open bite. Achieving a Class I molar and canine relationship by closing the anterior open bite and establishing appropriate interdental and interarch alignment, corrected the malocclusion. Interpreting research cited in the introduction, the improvement in occlusion can lead to improved mastication, either curing, or at least alleviating, gastrointestinal symptoms. the patient's However. improvement in chewing function after orthodontic and/or orthognathic intervention is controversial in the literature. Several studies have reported improvement in masticatory efficacy after treatment. However, other studies found that improvement in mastication took substantial time and never reached the level of untreated patients with normal occlusion. This time may be an adaption period, in which the patient is adjusting to the new occlusion produced from orthodontic and/or orthognathic treatment.³

Different studies illustrate a controversy in the effectiveness of treating malocclusions to alleviate gastrointestinal disorders.³ Recent discussion with the patient revealed a self-reported improvement in her masticatory efficacy. She expressed an increased ability to completely chew her food following orthodontic treatment and orthognathic surgery. Additionally, she indicated diminished gastrointestinal problems, although not confirmed by her gastroenterologist. The patient said her constipation completely subsided, and that she no longer uses drugs or therapy to pass her bowels.

The patient is pleased with her orthodontic and orthognathic treatment, reporting that it addressed her concerns and complaints.

COLUMBIA ANALYSIS					
Measurement	Value	Initial	Sig.	Interpretation	
SNA (")	81.8	83.6			
SNB (")	79.9	78.2			
ANB (")	1.8	5.4			
Wits Appraisal	-3.1	3.1			
SN - GoGn (")	31.0	32.8			
(SN-PP) (*)	5.1	5.1			
(PP-GoGn) (°)	21.7	27.7			
Y-Axis (SGn-SN)	68.5	68.5			
(S-Go/N-Me) (%)	63.1	63.1			
(N-ANS/ANS-Me) (%)	75.3	68.2			
U1 - SN (*)	101.6	88.9			
(UI-LI)(?)	117.2	151.3	**	Decreased interincisal angle	
LI - GoGn (7)	109.0	87.1	**	Proclined mandibular incisors	
(L1-APo) (mm)	4.3	-2.0	*	Protruded maxillary incisors	
L1 - NB (mm)	8.5	3.0	**	Protruded mandibular incisors	
Pog - NB (mm)	4.9	4.9			
Holdaway Angle (NB to H-line) (")	12.6	6.1	•	Increased facial convexity	
Holdaway Ratio (L1-NB:Pg-NB) (%)	0.6	0.6			

COGS ANALYSIS						
Measurement	Value	Initial	Sig.	Interpretation		
CRANIAL BASE						
Ar-PTM (HP) (mm)	30.2	29.8	•	Short posterior cranial base		
PTM-N (HP) (mm)	51.1	50.2				
HORIZONTAL (SKELETAL)						
N-A-Pg (")	1.7	5.7				
N-A (HP) (mm)	-0.5	2.0				
N-B (HP) (mm)	-6.7	-5.9				
N-Pg (HP) (mm)	-2.5	-1.6				
VERTICAL (SKELETAL/DENTAL)						
N-ANS (Perp HP) (mm)	49.2	48.4				
ANS-Mc (Perp HP)(mm)	64.0	70.0				
PNS-N (Perp HP) (mm)	47.6	51.2	•	Short posterior middle third facial height		
Mand Plane - HP (")	25.4	26.6				
UI -NF (Perp NF) (mm)	29.6	28.7	*	Long anterior maxillary dental height		
L1 -MP (Perp MP) (mm)	34.2	33.1	***	Short anterior mandibular dental height		
U6 -NF (Perp NF) (mm)	24.5	24.3	*	Long posterior maxillary dental height		
L6 -MP (Perp MP) (mm)	27.7	26.7	**	Short posterior mandibular dental height		
MAXILLA, MANDIBLE						
PNS-ANS (HP) (mm)	49.8	49.5				
Ar- Go (mm)	41.3	46.4	**	Decreased mandibular ramal length		
Go-Pg (mm)	82.3	78.8	*	Increased mandibular body length		
B-Pg (MP) (mm)	9.2	8.5	*	Prominent chin		
Ar-Go-Gn (*)	115.1	118.8	*	Decreased gonial angle		
DENTAL						
OP- HP (')	10.9	5.8	•	Steepened occlasal plane		
A-B (OP) (mm)	3.1	-3.1				
U1-NF (*)	111.2	93.9				
LI-GoGn (")	109.0	87.1	**	Proclined mandibular invisor		

Tables 4a-b Columbia Analysis and COGS Analysis on the post-surgical cephalograph

Conclusion

Improvement in the patient's masticatory efficacy and gastrointestinal problems indicates the orthodontic and orthognathic treatment were beneficial. This report illustrates a case in which correction of a patient's

malocclusion alleviated the gastrointestinal dysfunction. Although this case was successful, other case reports and studies have displayed controversial results. There is a need for more research on this topic to determine if orthodontic treatment to correct malocclusions can help to alleviate, or possibly cure, gastrointestinal disorders.

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Indications for Splinting Implant Restorations: A Clinical Report

Elana Lowell¹, Vicky Evangelidis-Sakellson DDS, MPH², John Evans DDS³, Francis Oh DDS, MS, MA³ ¹Class of 2014, College of Dental Medicine, Columbia University, New York, NY

²Professor of Dental Medicine, Division of Operative Dentistry, College of Dental Medicine, Columbia University, New York, NY ³Assistant Professor of Dental Medicine, Division of Prosthodontics, College of Dental Medicine, Columbia University, New York, NY

Abstract

While the concept of splinting weak dentition is well documented and practiced, splinting of dental implant-supported prostheses is controversial in modern dentistry. Some research suggests that splinting implant advantageous restorations may be under certain circumstances, such as for short or narrow implants, crown-to-implant ratios greater than 1:1, and angled implants. This article reports a case of a patient who presented to the College of Dental Medicine with narrow implants of varying angulations in the position of teeth #18, 19, 20, and 22. This case details the subsequent restoration of implants using a splinted rigid FPD. The purpose of sharing this case is to explore the indications and management of splinting implant restorations.

Introduction

In modern dentistry, the concept of splinting weak dentitions together to support each other is a well-studied topic that is also commonly practiced. However, as we are relatively new to implant dentistry in comparison to treating natural teeth, several in vitro studies have reported conflicting results for splinting implant units in regard to minimizing the stress transfer to the restoration and supporting bone.¹⁻⁴

Initially, the concept of splinting implants originated from splinting teeth, where the assumption was that joined units improve the resistance to forces and alter the center of rotation.³ However, some argue that a concept that works on natural dentition cannot be transferred directly to implant dentistry due to differences in mechanics.⁴ Glantz et al documented unexpectedly high functional bending moments on implants on maximum biting and chewing in a conventional cross-arch splinted restoration. Vigolo and Zaccaria5 evaluated 144 splinted and non-splinted implants in 32 patients. The authors found no difference in marginal bone loss between the two designs.

However, splinting of implants may be indicated for short or narrow implants, crown-to-implant ratios greater than 1:1, angled implants, high loading forces, and immediate function.⁶⁻⁷

Case Report

A 90-year-old female patient was referred to Senior Clinic by external Periodontist for evaluation of restorative needs. The patient's medical history revealed that patient had been diagnosed with osteoporosis and received biannual subcutaneous injections of Prolia® (Denosumab). Teeth #18 and #19 presented as implant retained restorations. A review of the dental history indicated that #18 and #19 implants were placed in January 2010, the implants were restored as splinted #18 and #19 likely due to angulation. In addition, further review revealed that implant fixtures for teeth #20 and #22 as well as "AlloOss" bone grafts were performed in July and September 2013, respectively. At this point, the amount of bone loss around implant fixture #20 was reviewed and diagnosed as 'restorable' bv periodontists. If deemed 'non-restorable,' then the implant fixture would have to be re-implanted, or another restoration option presented to the patient.

Clinical and radiographic examinations revealed 4 narrow Nobel Select implants of varying angulations in the positions of teeth #18, 19, 20, and 22. Tooth #19 had an open margin at the interface between the implant and PFM cylinder with a possible fractured screw (Figures 1, 2).



Figure 1 Patient radiograph reveals #19 with an open margin at interface between implant and PFM cylinder



Figure 2 #20 implant fixture with bone loss

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Clinical Procedure

After gathering of preliminary data, clinical, and radiographic examinations, it was noted that 1) the fixtures were narrow, 2) the crown-to-implant ratio was greater than 1:1, and 3) the angulation of the implants was not ideal. After consultation with periodontists and prosthodontists, the decision was made to utilize all four implants and splint them to fabricate a 5-unit FPD (#18-19-20-X-22). It was felt that this treatment option would distribute forces more evenly than single tooth supported restorations. A screw-retained design was chosen for accessibility.

An open tray impression was taken of #18, 19, 20, and 22 impression copings (Figure 3). A framework was made from noble metal. Upon try-in, the framework had to be sectioned between #18 and #19, and #19 and #20-X-21 for passive sitting (Figure 4). The framework was soldered using GC pattern resin (Figure 5).



Figure 3 Open tray impression copings



Figure 4 Framework sectioned between #18 and #19, and #19 and #20-X-21 for passive sitting



Figure 5 Framework was soldered using GC pattern resin

A glazed and finished PFM FPD was torqued to 35 N/cm. Screw holes were covered with nylon tape and composite. Occlusion was adjusted to ensure MI, even distribution of occlusion on FPD, and composite was out of occlusion (Figures 6, 7).



Figures 6, 7 Radiograph and clinical photograph of FPD #18-19-20-X-22 torqued in

A precise occlusal adjustment was made prior to delivery and torque, to minimize occlusal interference and to maximize correct force distribution. Group function was verified for laterotrusion, while anterior-guided posterior disclusion was verified during protrusion. (Figures 8, 9).



Figure 8 Group-function verified during laterotrusion



Figure 9 Anterior-guided posterior disclusion verified during protrusive movement

Implant fixtures, especially the ones with exposed surfaces, are under care of a periodontist, to try to establish and maintain soft-tissue attachment.

Discussion

A 90-year-old patient came to our clinic after treatment by a dentist outside the College of Dental Medicine. Her treatment plan was largely dictated by her pre-existing implant fixtures. It was decided that a splinted restoration would serve the patient better than single-unit implants given the non-ideal crown-to-root ratio and the size of the implants. Splinting of all teeth does pose a challenge in maintenance for most patients, as it is easier to maintain oral hygiene in single fixture restorations.⁸ Another advantage of non-splinted implants is the elimination of

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large prostheses with large quantities of ceramic and metal, which may reduce the risk of veneer and framework fracture.⁵ In addition, it is easier to achieve passive sitting with non-splinted multiple screw-retained units that reduce static preload forces on implants, and single-unit implants are easier to repair than splinted units.²

However, as presented in this case report, when presented with less than ideal implant fixture placement, splinting implant fixtures with a rigid FPD may improve the resistance to forces and alter the center of rotation of the joined units. Among the indications reviewed in introduction, 1) narrow implants, 2) crown-to-implant ratios >1:1, and 3) angled implants were found in the present case. It should also be noted that the implant fixtures in this case were not splinted because of bone loss around #20, as a compromised implant with bone loss it not an indication for splinting.

Conclusion

The utility of splinting implant fixtures is not conclusively established. The following three concepts must be kept in mind when considering splinting implant fixtures:

1. Implant restorations should not be splinted under the assumption that "since it worked on nature dentition, it must work on implants," since the bio-mechanics are different.

2. Whenever possible, do not splint implant restorations for a) ease of cleaning, b) minimize bulkiness of porcelain reducing chance of fracture, c) ease of repair, and d) ease of passive sitting reducing static preload forces on implants.

3. However, when implant fixtures are not ideally placed, including a) short or narrow implants, b) crown-to-implant ratios greater than 1:1, c) angled implants, d) high loading forces, and e) need for immediate function, then splinting of implant restoration may be indicated to improve the resistance to forces and alter the center of rotation of the joined units.

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Management of a Full-Arch Complex Case Transferred Without Adequate Treatment Plan and Sequence: A Clinical Report

Stephen Boss¹, Mary Lee Kordes DDS², Vicky Evangelidis-Sakellson DDS, MPH³, Francis Oh DDS, MS, MA⁴ ¹Class of 2014, College of Dental Medicine, Columbia University, New York, NY

²Assistant Professor of Dental Medicine, Division of Operative Dentistry, College of Dental Medicine, Columbia University, New York, NY

³Professor of Dental Medicine, Division of Operative Dentistry, College of Dental Medicine, Columbia University, New York, NY ⁴Assistant Professor of Dental Medicine, Division of Prosthodontics, College of Dental Medicine, Columbia University, New York, NY

Abstract

Patient data collection, appropriate diagnosis and treatment planning are critical factors in treating complex patients. In the case presented here, the initial treatment plan did not meet the patient's functional needs and caused confusion about possible oral health outcomes. Thorough new data collection and documentation, including articulated study models, resulted in a diagnosis and treatment plan that addressed the clinical findings and the patient's expectations.

Introduction

This report describes the restoration of a fully edentulous maxilla with progressively complex prosthesis designs and repeated procedural adjustments to accommodate a patient's changing expectations and improve satisfaction.

An extensive amount of research has been conducted on implants and edentulous rehabilitation; almost all include a consistent and fully executed treatment plan.¹ Insightful forethought allows the dentist to guide surgical planning for the best restorative outcomes and allows the patient to receive the best esthetic results of their prostheses throughout the entire course of treatment.² The importance of consistent and complete documentation of treatment planning and sequencing cannot be overemphasized. The importance grows exponentially when dealing with a complex case that involves loss of anatomic landmark and irreversible surgical procedures.

Before a treatment plan and sequence of care can be determined, accurate data collection must be performed. Important variables include correct the patient's emotional concerns, motivators, dental IQ, House's classification, and financial resources. A thorough history will minimize the potential for change in patient expectations and demands during completion of the treatment plan. Once the examination is complete, the diagnosis, etiology, the treatment plan, sequence, and the patient's signed agreement to the plan must be documented. In this clinical report, we also describe the utility of an "appointment work schedule" for managing a complex case.

Clinical Report

The patient's chief complaint on initial presentation was that

"my bridge is loose". Examination revealed a FPD from teeth #6-11, with #6, 10, and 11 as abutment teeth (Figure 1, 2). The FPD was depressible and #6, 10, and 11 were diagnosed as "hopeless" and treatment planned for extraction. #15 was restorable with a "guarded" prognosis but this was not helpful to overall restoration plan. Extraction and immediate delivery of interim CD was agreed upon by the treating dental student and the patient, however, an alternative final restoration plan was not discussed; the patient's expected that the immediate CD would be her final restoration.



Figure 1 Initial presentation; panoramic radiograph



Figure 2 Initial Presentation; periapical radiographs

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An immediate CD was delivered following extraction of #6, 10, 11, and 15 (Figure 3). Soon after, the patient complained that the palatal aspect of the denture was over-extended. The palatal area was reduced but the patient was not satisfied.

Since the patient was not satisfied with the fit and comfort of the immediate CD, the student dentist propose a metal reinforced overdenture supported by 4 implants. Four 3i implant fixtures were placed on sites #4, 6, 11, and 14. Upon follow-up examination, the implant on #11 was thought to be failing and a "relief implant" was placed on site #12. However, both #11 and 12 were successfully osseointegrated at a later follow up.

At the latter visit, the patient complained of "inability to sleep edentulous" and stated that that she didn't want to remove her prosthesis at night. The treatment plan was modified again to a fixed restoration. Two additional implants were placed at #5 and 13, making a total of 7 implant fixtures (Figure 3). Implants could not be placed further posterior due to the limitation of severely pneumatized sinuses; use of a surgical guide to dictate fixture placement was not documented.

Clinical Procedure

At the time of transfer of care to the authors the patient had 7 implant fixtures, a fractured interim CD and was confused and concerned. A repeat, full diagnostic work-up, including complete documentation of all patient findings, properly mounted and articulated casts, and a full diagnosis with new treatment plan and sequence were executed. The patient was provided with an "appointment work-schedule", outlining what procedures would be done at each appointment, how many appointments were needed, and the timing of appointments (Figure 4).

A major disadvantage in treating this complex transferred patient was the complete loss of any useful anatomic landmarks. Since the patient's initial maximal inter-cuspation relationship was not recorded, both the vertical and horizontal relationships between arches was lost. A new CR record and vertical dimension had to be established and the position, depth, and angulations of the existing implant fixtures evaluated. An open tray impression technique was used to fabricate a final cast (Figure 5).

The final cast was fabricated with Silky Rock stone using the vacuum mix method. Because of the large number of implant fixtures, the position, depth, and angulation of implant analogs needed to be precisely correlated with corresponding intraoral fixtures. First, impression copings were placed back on the final cast (Figure 6). A verification



Figure 3 A total of 7 implants placed on maxillae

	Procedures	Duration Until Next Visit
	TPS 1: Data collection: patient Interview, Max/Mand alginate impression,	
Visit 1	interocclusal record, and repair broken CD	1 week
Lab	Pour the casts, make Max base plate and wax rim	
	TPS 2: Finalize and sign TP. Using Max base plate, take facebow transfer. Discuss	
Visit 2	alternative options with patient. Take CR record.	1 week
	Mount the casts on articulator. Order implant parts for impression taking, prepare	
Lab	tray.	
Visit 3	Open tray impression of all Max implants.	1 week
	Pour the impression impression with soft tissue and silky rock. Check with faculty.	
Lab	Connect impression copings with dental floos and GC pattern resin material	
	Transfer connected impression copings to verify accuracy of final casts fabricated.	
	Select teeth shade for provisionals. Modify base plate made previously, and use it	
Visit 4	to establish correct vertical	3 weeks
	Mount Max final cast using new CR record at correct vertical. Send the articulated	
	casts to lab to fabricate denture base + teeth set-up to establish dimensional	
Lab	record	
	Try-in "fixed" denture base + teeth set-up. Adjust teeth set-up to correct lip	
Visit 5	support, buccal corridor, canine guidance, and esthetics.	3 weeks
	Send dimentional record to lab to fabricate custom abutments, fixed provisionals,	
Lab	and metal framework	
	Seat custom abutments, try-in metal framework, verify with radiographs. Adjust	
Visit 6	and deliver fixed FPD provisional	4 weeks
Lab		•
	Evaluate how patient functions with fixed FPD provisional. Make adjustment to	
	provisional FPD. Take alginate impression as dimentional record. Pick up metal	
Visit 7	framework with impression. Take new interocclusal record as needed.	3 weeks
Lab	Send the pick up impression out to lab for porclain overlay	
Visit 8	Deliver the final prosthesis with Temp Bond after adjustment	1 week
Visit 9	Follow-up. Take impression for Nightguard	2 weeks
Lab	Send out lab case for nightguard	
		Total duration of
Visit 10	Deliver nightguard and put patient on recall, and on Featherstone protocp;	treatment = 19-22 weeks

Figure 4 Appointment work-schedule shared with the patient.



Figure 5 Final impression with polyether impression material (Impregum) and G-mask soft tissue shroud

jig was fabricated with dental floss and GC pattern resin to confirm the master cast. Connected impression copings

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were transferred to the patient's mouth to verify passive sitting and positioning (Figure 7a, 7b).



Figure 6 Final cast with impression copings





Figures 7a-b Impression copings were connected on the final cast and then transferred to the patient's fixtures to verify the accuracy of the analog position, depth, and orientation on the final cast

In order to mount the final cast and opposing cast on the articulator, an "open faced" base plate was fabricated (Figure 8). Adequate vertical space was established using phonetics testing. The patient's CR position was next recorded using Dawson's bimanual manipulation and then verified with Anderson and Tanner's chin point guidance technique.³ An interocclusal record was taken with Blu-mousse registration material and the lower cast was mounted on a Panadent articulator using facebow transfer.



Figure 8 "Open-faced" based plate for mounting

Although the treatment plan was for a fixed final restoration, a removable denture base with teeth was fabricated to establish the general position of the teeth and the arch dimension. This information was used to create a dimensional jig to fabricate the fixed provisional prosthesis. The mounted casts were sent to the lab to fabricate a base plate and teeth set-up. The lab was instructed to incorporate two fixed provisional abutments into the base plate for accurate positioning and to not change the mounted relationship of the casts (Figure 9).



Figure 9 Base plate with wax teeth set-up, with 2 fixed provisional abutment for accurate positioning; necessary to create a dimensional jig prior to fabrication of fixed prosthesis since no dimensional information of maxillary dentition was recorded prior to extraction

Teeth set-up in wax was modified intra-orally to establish proper lip support, arch-form, mid-line, canine position, lip-line, and buccal corridor space (Figure 10). This provided the proper dimensions for the fixed maxillary prosthesis, instead of relying on the position of mandibular dentition alone. A canine-guided posterior disclusion was selected as the occlusion scheme for the final restoration.



Figure 10 Base-plate with teeth set-up is adjusted intra-orally to establish correct dimension of maxillary prosthesis prior to fabrication of fixed FPD provisional prosthesis.

The next lab prescription was to fabricate 1) angled custom abutments for each implant fixture, 2) splinted full-arch FPD metal framework, with metal occlusal stop for maintenance of vertical dimension, in noble metal for cement-retained restoration, and 3) full-arch acrylic provisional FPD with lingual metal support.

Unfortunately, the case could not be completed by the second treating dental student. At subsequent visits the full seating of the individual custom abutments and

Management of a Full-Arch Complex Case Transferred Without Adequate Treatment Plan and Sequence: A Clinical Report

accompanying metal framework for the full-arch FPD metal framework will be verified. An all-acrylic provisional FPD will be delivered on the custom abutments as a temporary prosthesis as the vertical dimension, canine-guide posterior disclusion occlusion scheme, phonetics, and esthetics are evaluated. Next, a final pick-up impression of the metal framework, with impression of the adjusted fixed provisional FPD will be sent to the lab to fabricate the final ceramic-metal restoration.

Discussion

The complexity of this case resulted primarily from the multiple modifications in treatment from the first partially formulated and documented treatment plan. Replacing a patient's dentition with a removable restoration may often fail to gain patient acceptance. Implant supported restorations require careful treatment planning in order to deliver a functional and esthetic prosthesis. Initial failure to accurately determine the patient's expectations is likely to lead to difficulties in reaching an acceptable result. Assessing a patient's emotional concerns and motivators for dental treatment, including House's classification of patient attitudes (philosophical, indifferent, exacting, hysterical, etc.) can help the dentist to meet patients' expectations. This is particularly important with complex treatment plans that span more than a year.⁴ When restoring a fully edentulous maxilla, the dental arch form, ridge form, palatal vault shape and size, soft-hard tissue relationship, palatal sensitivity, muscle tone and control, tongue position and size1 must all be taken into consideration during treatment planning. The palatal throat form, or the relationship between the soft palate and the hard palate, as classified by House can be broken down into three subdivisions to determine the outcome. In complex cases, evaluating either the palatal throat form or the palatal sensitivity of the patient will influence the planning of the case.¹ Another component of treatment planning in a complex case that should be considered is establishing an "appointment work schedule." The work schedule provides an overall timeline for completion of the treatment including a step-by-step description of what will occur at each appointment, the total number of appointments, and the time between appointments. The schedule helps the dental student to prepare for each appointment. The schedule helps the patient to be an active participant in their care, and to understand how missed appointments can negatively impact both the duration and quality of care.

Conclusion

Using the clinical verification techniques described above, a revised treatment plan was developed, a detailed "appointment work schedule" generated, and a complex case was successfully managed. This case report illustrates the importance of careful, patient sensitive treatment

planning and sequencing to meet patient expectations and provide the highest possible level of care.

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Mandibular Ameloblastoma Resection with Fibular Reconstruction and Osseoimplants

Jean Kim¹, Joel M. Friedman DDS²

¹Class of 2015, College of Dental Medicine, Columbia University, New York, NY

²Associate Professor of Clinical Surgery, Oral and Maxillofacial Surgery Department, Weill Cornell Medical College/New York-Presbyterian Hospital, New York, NY

Abstract

An ameloblastoma is a rare lesion that can be encountered in the posterior mandible. This neoplasm is often described in literature as "benign, but locally aggressive," thus surgical excision is usually required due to possible expansion of the lesion, which may interfere with surrounding structures such as teeth and soft tissue. More serious problems can arise if the ameloblastoma invades into other regions such as the lateral pharyngeal space if the tumor traveled medially or into the intracranial space through the temporal fossa if the tumor traveled superiorly in the mandible. Furthermore, the tumor can have malignant potential and inherently metastatic potential.

In the following case, reconstructive surgery with a free fibula graft was performed immediately following segmental resection of a cystic ameloblastoma tumor in the left posterior mandible. After a period of healing, implants were placed to return the patient's dentition to full function.

Introduction

There are many tumors and cysts involving the posterior mandible that characteristically appear as a circular radiolucency on radiographs; they include myxomas, hemangiomas, central giant cell granulomas, radicular cysts, keratocystic odontogenic tumors, and last but not least, ameloblastomas. They are the second most common odontogenic tumor in North America behind odontomas.¹ Ameloblastoma derives its name from the fact that its cells histologically resemble ameloblasts, and is possibly derived from these cells of the enamel organ.² There is currently no clear cause of ameloblastoma, but several causative factors have been proposed, including nonspecific irritating factors such as extraction, caries, trauma, infection, inflammation or tooth eruption, nutritional deficit disorders, and viral pathogenesis.³ This tumor does not appear to have any gender predilection and has peak incidence from the 3rd to 5th decades of life.4 It is five times more commonly seen in the mandible than the maxilla; a large percentage of mandibular cases occur in the posterior area near the molars and along the angle and ramus.⁵ The most common symptom is a hard swelling near the site of pathology, although there commonly are no signs or symptoms because they grow slowly; these lesions may only be discovered after a routine dental radiograph.

The ideal treatment for an ameloblastoma is one that minimizes recurrence, decreases damage to donor site,

and restores function and appearance of the jaw and teeth. Thus, due to its potential for local destruction and recurrence, radical surgical therapy such as resection of the mandible may be indicated. Once a portion of the mandible is resected, a graft must be placed to replace the missing section of the jaw; one option is a free fibula autograft. Once the graft is placed and healing occurs, including osseointegration and vascularization of the newly constructed mandible, implants can be placed to complete dental rehabilitation.

Case Report

A 20-year-old Caucasian female patient presented to the Weill Cornell Oral & Maxillofacial Surgery and Dentistry clinic with a history of left-sided mandibular ameloblastoma of the posterior body and ramus. The patient had no symptoms related to the mass at presentation. Her general dentist found the lesion after a routine radiograph and referred her to an oral and maxillofacial surgeon. Upon examination of a panoramic radiograph and CT scan, a 2.0 x 1.7 x 1.9cm multilocular cystic lesion was noted between teeth #18 and #17 with thinning of the inner cortex. The lesion was expansile and posteriorly displaced tooth #17, and the radiolucency extended up along the ascending ramus. Anteriorly, the lesion was less defined as it extended along the inferior aspect of the roots of tooth #18 and tooth #19 (Figure 1). Clinical oral evaluation revealed fullness of the left posterior mandible and ramus consistent with a jaw tumor. She had minimal pain to palpation and sensation in the mental region was normal, indicating that the inferior alveolar nerve was most likely not affected.



Figure 1 Radiograph taken at initial visit

The treatment plan included left segmental mandibuloectomy with reconstruction using a right fibula osteocutaneous free flap graft. The fibular and mandibular osteotomies were planned using Medical Modeling imaging software (Figures 2, 3). During the surgical procedure,

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fibular osteotomies were made approximately 6cm proximal to the lateral malleolus and 6cm distal to the articulation of the fibula with the knee using pre-fabricated fibula cutting guides. The bone graft along with peroneal vessels and skin paddle were harvested to replace the affected mandibular component. After extraction of tooth #17, a 2.3mm pre-bent titanium plate was adapted over the lesion from the left mandibular body to the posterior ramus using bicortical nonlocking screws, and the bony lesion was resected using a pre-made osteotomy guide. Maxillo-manidbular fixation (MMF) of the remnant mandible with the maxilla was accomplished using MMF screws and elastic bands. The free fibula flap was then secured onto the titanium plate with five bicortical locking screws, and the reconstruction plate with fibula flap were secured onto the pre-drilled mandible. The inferior border of the fibula flap graft was intentionally placed about 5mm higher than the inferior border of the native mandible to compensate for height difference. Then, microanastomoses were created by suturing the peroneal artery to the facial artery, and coupling the larger of the peroneal veins with the facial vein.



Figure 2 Planning of fibula graft



Figure 3 Final graft

After 18 months of non-incidental healing, the patient presented for an implant consult to replace teeth #18 and #19. Two 3i 4.0×11.5 mm implants were placed in the area of the left reconstructed mandible (Figure 4). After healing abutments were placed, the patient eventually received a 3-unit fixed prosthesis for the implants.



Figure 4 Post-#18 and #19 implant placement

Discussion

Appropriate treatment modalities for ameloblastoma are controversial in that a conservative approach may be favored, understandably, versus a more radical one. The conservative approach includes enucleation and curettage. Enucleation involves separating the lesion from the bone, with preservation of bone, taking advantage of the fact that the lesion is encapsulated within a connective tissue envelope that is derived from the lesion or surrounding bone. Similarly, curettage is removal of the lesion, with preservation of bone, by directly scraping away the lesion from the bone with absence of any encapsulating connective tissue derived from the lesion or surrounding bone. The so-called radical approach includes resection where a portion of bone surrounding the lesion is excised in addition to the lesion itself. Segmental resection is removal of a portion of bone with continuity defect; in other words, the piece of bone that is excised discontinues a length of bone leaving free edges of bone on either end. Marginal resection is removal of bone without continuity defect; there is no complete disconnection of bone. Segmental resection should be performed when there is thinning of the inferior or posterior border of the mandible, as was described in this case.7

In a study of Sehdev et al, a total of 92 patients were reviewed: 72 patients with mandibular tumors and 20 patients with maxillary tumors. 100% of the maxillary tumors and 90% of the mandibular tumors that were conservatively treated by curettage recurred. In fact, 9 out of the 92 patients died as a result of complications related to recurrence of the ameloblastoma lesion.⁸ Radical mandibular surgery, on the other hand, was associated with only an 8.7% recurrence rate.⁹ For a small lesion, simple

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enucleation and curettage may be adequate, but for larger neoplasms, such as this case, the benefits of resection outweigh the risks. With extensive lesions, if bone were attempted to be preserved by modest treatment, only a small amount of marginal bone would remain increasing risk for fracture.¹⁰ Therefore, a segmental resection was planned as opposed to a marginal mandibulectomy. Despite high recurrence rates, some surgeons still advocate a conservative approach, especially for young patients in whom growth and development is still occurring and for elderly patients to avoid surgical complications.⁹

When determining treatment approach for any pathological disease, conservative treatment is generally more desirable, but in the case of ameloblastoma, simple enucleation and curettage procedures can lead to higher recurrence rates of the tumor and possible malignant development, in contrast to a more radical approach such as segmental mandibulectomy.³ Especially in a young, healthy patient such at the one presented in this case, drastic therapy can be considered to prevent recurrence and ensure full removal of affected bone and tissue. Consequently, lateral segmental mandibulectomy followed by reconstruction using a free fibula flap was the treatment of choice in this case. Especially with the tumor invading into the 1st and 2nd molars and ramus, the anterior dentition and posterior jaw were being compromised at the expense of the ameloblastoma, warranting complete removal of the section of afflicted mandible.

Ameloblastomas tend to infiltrate trabeculae of the cancellous bone on the lesion's periphery before bone resorption may become apparent radiographically. This means that if one attempted to remove the tumor via enucleation or curettage using the visible tumor margin as a guide, some neoplastic cells may be left behind leading to recurrence. Unfortunately, most ameloblastoma lesions originate centrally, as opposed to peripherally, thus surgery requires bony invasion resulting in deformation of normal structure. In mandibular tumors, the end result is frequently loss of the continuity of the mandible, necessitating reconstructive techniques.¹² Once the mandible has been segmented, immediate reconstruction with a graft is important because "dead space" can accumulate fluids that may cause infection; also, the space can contract leading to functional and esthetic issues. There is less infection, scarring, contraction, and morbidity with immediate reconstruction.

The free fibula flap was first utilized for mandibular reconstruction in 1989 by David A. Hidalgo, M.D., and is a graft of choice for jaw reconstruction along with the iliac flap. The fibula flap is widely accepted for reconstruction of mandibular defects because of its adequate length and amenability to dental implants. ¹⁴

After the graft is placed and healed, dental rehabilitation is the next and final step in returning the patient back to optimal function and esthetics. Without any dental rehabilitation, such as a fixed prosthesis or a removable partial denture, noticeable mandibular asymmetries may be seen and decrease patient satisfaction.⁶ Resorption rates tend to be greater with grafts, so implants are a better option than RPDs.¹⁴ The recommended time for implant placement into healed grafts is at least 4-8 months after surgery. There are instances where implants are placed at the time of the initial resection and reconstruction surgery; however, immediate implants are still a novel idea that requires further research.¹⁴ Another benefit of the fibula flap is that the quality of the bone is more cortical than the ileum, which provides a better foundation for dental implant anchorage.

Conclusion

Segmental resection of the mandible is currently the treatment of choice for large cystic ameloblastomas with little surrounding bone, as demonstrated in this case. Ideally, one would not prefer to remove an entire section of natural bone, but there are multiple considerations that require elective resection of the mandible, as discussed in this article. For smaller lesions, curettage and enucleation, cryotherapy, or marginal resection could be sufficient to eradicate the ameloblastoma and reduce chance for future recurrence.

In the future, non-surgical approaches may be plausible; for example, one recent research study conducted by Sauk et. al demonstrated that specific SHH signaling molecules and the PI3K/Akt/mTOR pathway are involved in ameloblastoma cell proliferation. The goal is for chemotherapy to target such pathways to eliminate the disease without surgical intervention.¹²

The main objective after resection and reconstruction of the mandible is to restore the patient's jaw function and appearance. With the use of grafts and implants, it is possible to restore the patient's oral and maxillofacial health and improve the patient's quality of life.

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Placement of Glass Ionomer as an Interproximal Sealant: A Case Report

Divya Khera¹, Shantanu Lal DDS²

¹Class of 2015, College of Dental Medicine, Columbia University, New York, NY

²Associate Professor of Dental Medicine, Division of Pediatric Dentistry, College of Dental Medicine, Columbia University, New York, NY

Abstract

Dental caries is reported to be the most common chronic childhood disease worldwide.^{1, 7} The World Health Organization considers dental sealants to be the most effective and least invasive primary preventive measure.² However, while dental sealants remain a mainstay for pit and fissure caries prevention, there have been no similar advances for smooth surface (interproximal) caries prevention, which account for approximately 58.8 to 77.5% of the total caries burden.^{14, 15, 16} The objective of this case report is to present a non-invasive technique that enhances clinical access and prevents caries formation on a vulnerable interproximal tooth surface through sealant application.

Introduction

Dental caries remains the most common chronic disease that is neither self-limited nor treatable by antibiotics.¹ Worldwide, 60-90% of school children and nearly 100% of adults have been diagnosed with caries.² While data extrapolated from the 1991 NHANES study and the U.S. Census Bureau Report have reported increases in preventative procedures and an overall decrease in dental caries among adolescents, the disease remains prevalent. Moreover, for children aged 2-5 years, dental caries in primary teeth is on the rise.⁴

Dental researchers and the dental industry have strived to find practical, non-invasive means for both caries prevention and treatment. Today, dental sealants are considered the primary preventive and least invasive measure for pit and fissure caries prevention.^{6, 7} Sealants create a protective barrier from microorganisms found within bacterial biofilm.⁸ While this benefits mainly occlusal pits and fissures, there is no direct interproximal preventative effect, even though such smooth-surface lesions account for approximately 28-48% of caries in children on average across different ethnic backgrounds.^{14, 15}

Recently, a resin infiltration system was introduced that offers a micro-invasive alternative to treat non-cavitated proximal lesions.^{3, 9} This technique is based on the use of capillary force to transport a high-viscosity resin with higher penetration coefficient into enamel microstructure.³ The multi-step technique involves plastic strip isolation, selected surface etching (15% hydrochloric acid) for 2 minutes, rinse and dry, 95% ethanol and air-drying, resin infiltration with syringe, polymerization, and infiltrant re-application and polymerization.¹⁰ The research determined that, ultimately, infiltration was an effective therapy for early proximal lesions.¹⁰ While this method has been used to treat already formed lesions, its use has not been explored in terms of a preventative alternative (e.g. sealant) to proximal decay.



Figure 1 Icon perforated mesh foil

In the current study, a novel ICON interproximal perforated mesh foil (Figure 1) was used to deliver a layer of resin-modified glass ionomer (RMGI) protective sealant material onto a vulnerable proximal tooth surface. This method eliminates the multiple steps (etching, infiltrating, etc.) recommended by the Icon system while directly chemically bonding RMGI to the proximal tooth surface. Glass ionomer cements are known for their ability to chemicallv bind to tooth structure, hydrophilic moisture-tolerant nature, and fluoride release.¹¹ The fluoride ions taken up by the enamel make the tooth less susceptible to the bacterial acid challenge and facilitates remineralization.¹² Glass ionomer sealants have been proven particularly effective relative to resin-based sealants, as the latter will fail if incomplete isolation and/or salivary contamination occurs.¹² The aim of this protocol was to evaluate the efficacy of a proximal sealant for the preventative aspect of dental practice and the reduction of a major component of the caries disease burden.

Case Report

Background: This report highlights the potential application of interproximal sealants and is part of an ongoing research protocol (IRB – AAAM2564). A 9-year-old female presented with her mother for comprehensive care to the undergraduate pediatric dentistry clinic. The patient had a history of previously treated caries and poor oral hygeine. Clinical and radiographic examination showed existing caries on the distal surfaces of #J and #K. The mesial surface of #19 remained intact with no signs of incipient lesions.

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Given the patient's history and present clinical findings, she was assessed as high caries risk. Research has shown that proximal caries in contact with a healthy adjacent tooth surfaces increases one's risk of developing new caries.¹³ Therefore, the patient could significantly benefit from interproximal sealant placement particularly to protect the mesial surface of erupted permanent molar #19. Patient and parental consent were obtained to participate in this case report.



Figure 2 Sealant discharge from the Icon perforated mesh foil



Figure 3 Separator placed between the teeth



Figure 4 Placement of sealant using ICON technology and resin modified glass ionomer

Procedure: After completion of a full clinical exam, intact yet vulnerable proximal surfaces were noted. Once the proximal site was identified, the spacing available was evaluated. An orthodontic elastic separator was placed between teeth K and #19 (Figure 3) to allow for adequate space maintenance in the interim period between appointments. At the next visit, through cotton roll isolation and utilization of the low-speed suction, the ICON interproximal foil was placed between teeth K and 19 (Figure 4). The DMG ICON infiltration product has been used in previous studies with success.⁶ The ICON's unique foil sieve is one-sided, enabling sealant discharge onto the desired surface only (Figure 2).

After adequate isolation, the foil was placed with the sieve facing the mesial of #19. The applicator tube was filled with resin-modified glass ionomer and was then pushed through the sieve (Figure 2). Unlike conventional resin-based sealant material, glass ionomer is moisture-friendly and fluoride releasing. The steps needed for resin-based sealants such as acid etching, application of primer, or bonding agent are not required. Once placed, the glass ionomer sealant infiltrate was held in place for 2-3 minutes for an initial set. The patient was then asked to gently bite on a cotton roll for another 3-4 minutes until completion of the setting reaction.

Clinically, the sealant was present and contoured to the mesial surface of #19 (Figure 5). Excess cement was removed and the patient was discharged with no complications and routine oral hygiene maintenance instructions were given.



Figure 5 Clinical presence of GI interproximal sealant

Discussion

Comprising approximately 39% of childhood decay by age 12, interproximal caries make up a significant part of a chronic disease burden afflicting children worldwide.³ Upon placement of a glass ionomer interproximal sealant via ICON technology, the sealant remained intact clinically. On

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the patient's next routine dental visit (6-12 months), new bitewing radiographs will be taken to assess whether the glass ionomer is still present interproximally. Glass ionomer material has numerous advantages in terms of moisture tolerability, chemical bonding, and fluoride release. Thus, use of such a material as an interproximal sealant could have important implications for tooth protection and caries prevention. Continued presence of the sealant will show that the glass ionomer is as effective as the more common ICON multistep infiltrate system in preventing caries in that region.

This protocol is an ongoing investigation; the relative value of glass ionomer interproximal sealants will be better evaluated upon application to a greater sample size, initial radiographic data (6-12 months), and statistical analysis have been completed. From the current case study, researchers have noted that future application should involve use of a radiopaque glass ionomer cement so that radiographic analysis can be adequately assessed.

Conclusion

Injecting RMGI through the ICON's proximal, perforated mesh foil, a glass ionomer sealant placed interproximally has significant potential, allowing for possible smooth surface caries prevention. This technique warrants further investigation.

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Treatment of Dental Sequelae in Childhood Cancer Survivors: A Case Report

Stephany Liu¹, Cecilia Kolstad DMD², Richard K. Yoon DDS³ ¹Class of 2015, College of Dental Medicine, Columbia University, New York, NY ² Pediatric Dental Resident, College of Dental Medicine, Columbia University, New York, NY ³Associate Professor of Dental Medicine, Division of Pediatric Dentistry, College of Dental Medicine, Columbia University, New York NY

Abstract

Dental considerations for survivors of pediatric cancer therapy can be significant due to changes induced by treatment, which may include surgery, radiotherapy, and combination chemotherapy. Patients are at greater risk for developmental changes in the oral cavity, especially when exposed at a younger age. Changes can include dental agenesis, microdontia, incomplete enamel calcification, and salivary changes.

Introduction

Treatment of childhood cancer has vastly improved due to successes in surgery, radiotherapy, and combination chemotherapy.¹ Overall survival rate of patients treated with childhood cancer is now in the range of 80 to 90%.^{2,4} However, treatment with radiation and chemotherapy can have lasting damage, especially when administered to the pediatric patient during a time of development. Severity of dental complications depends on tumor diagnosis, length and type of therapy exposure, and age of treatment.² Possible dental changes include agenesis, microdontia, dental hypoplasia, and hypocalcification.³ In addition, patients may experience salivary changes such as xerostomia, which may predispose them to dental caries and periodontal disease.¹

In the case presented, the patient was diagnosed with anaplastic ependymoma at age 2. This is the third most common brain tumor found in children, representing about brain tumors.^{5, 6} 6-10% of childhood Anaplastic ependymomas have poor prognosis compared to classical ependymomas.⁶ This tumor is especially difficult to treat in pediatric patients due to its location, which predominantly arises from the fourth ventricle. Surgical removal is the most important prognostic factor but complete resection can be challenging.⁵ Other limitations include use of radiation therapy and chemotherapy due to potentially irreversible changes it can have in pediatric patients, such as functional impairment of the developing brain.⁶

Case report

A 9-year-old male presented with his guardian to the Columbia Pediatric Dental Clinic for a recall examination. His medical history was significant for an anaplastic ependymoma located on the left parietal-occipital lobe, which was diagnosed at age 2.5. He was treated with resection and chemotherapy later that year, in July 2005. The patient received autologous stem rescue in 2006. Local recurrence was discovered in 2007 and treated with resection. At this time, the patient was treated with radiation and completed therapy in May 2007.

Presently, the patient has incomplete hearing loss and requires bilateral hearing aids. He is currently cancer free and has no other medical problems. Along with routine examination, prophylaxis, and fluoride treatment, a panoramic radiograph was taken and revealed blunted roots, agenesis of multiple teeth, and microdonts (Figure 1). Tooth #2, #4, #13, #15, and #18 were absent and tooth #20, #29, and #31 were microdonts. Exfoliation of tooth #K and #T were impeded due to only partial resorption of the mesial roots by tooth #20 and #29, respectively (Figures 2,3). It was recommended that tooth #K and #T be extracted.



Figure 1 Panoramic radiograph taken at initial visit

After the first visit, the patient presented for two follow-up visits for the extractions. After obtaining adequate anesthesia, tooth #K and #T were extracted with no complications.

The patient was then referred to the Columbia Orthodontic Dental Clinic for evaluation. Presently, orthodontic treatment for this patient is not feasible due to stunted root development. Therefore, a possible treatment alternative includes fabricating a space maintainer to allow for full eruption of tooth #20 and #21 without mesial tipping of tooth #19 and #30, followed by prosthetic treatment of tooth #20 and #21 to build up the size of their crowns. The treatment plan for the agenesis of tooth #4 and #13 involves the retention of their primary tooth predecessors. It is possible that in the future tooth #A and #J may require extraction with placement of implants. However, the patient's history of radiation therapy would need to be considered for the placement and prognosis of the implants.

Treatment of Dental Sequelae in Childhood Cancer Survivors: A Case Report



Figure 2 Periapical radiograph showing mesial root resorption of tooth #K



Figure 3 Periapical radiograph showing mesial root resorption of tooth#7

Discussion

Dental considerations for survivors of pediatric cancer therapy can be significant and require long- term follow up. The age at which cancer treatment begins plays a significant role. Typically, the younger the patient is, the greater the risk of damage to developing oral structures.⁴

Radiation can damage tooth buds during development, inhibiting processes involved in odotontogenesis and amelogenesis.¹ This can result in dental agenesis, microdontia, dental and enamel hypoplasia, and root stunting. Root stunting can be especially detrimental since dental eruption patters can be affected, possibly causing future loss of the tooth.⁴ In addition, patients who exhibit stunted root patterns may not be suitable candidates for orthodontic treatment due to inadequate anchorage.⁴

Microdontia is another common side effect, ranging from 10% after conventional chemotherapy to 78% after stem cell transplantation.⁷ Microdontia of premolars and permanent molars occurs most commonly in children exposed to chemotherapy before the age of 3.⁸ Exposure during early stages of odontogenesis is strongly correlated to development of microdontia, whereas later exposure results in less damage to the tooth bud.⁸

Patients who have undergone cancer therapy are also at greater caries risk. Radiation to the head and neck can cause lasting damage to the salivary glands. Dosage and extent of involvement effects whether normal function of salivary glands can be regained. When salivary gland function is impaired, an acidic oral environment may develop, promoting colonization of caries-related microflora.^{1,3} While chemotherapy can also affect salivary glands during treatment, dryness of the mouth typically lasts for only a short period after completion of treatment.⁴

Conclusion

Management of patients who have received cancer treatment requires unique considerations. Patients who have been treated should have frequent follow-up visits to the dentist in order to receive timely treatment and minimize dental and periodontal disease.

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Instruction for Authors

The Columbia Dental Review seeks to address topics of clinical concern. The Editorial Board welcomes articles from students, faculty, and attendings from affiliated hospitals of the College of Dental Medicine of Columbia University.

The case report should be organized in the following manner:

Abstract

The abstract summarizes the principal points of the case report and specific conclusions that may have emerged in the discussion. It should be limited to less than 250 words.

Author Information

A description of each author's degrees, titles, department, and affiliation should be given.

Information

The introduction should provide a brief description of the topic, as well as any relevant epidemiology and current opinion as documented in the literature.

Case Report

A description of the case(s), including pertinent photographs.

Discussion

A thorough review of the literature, including other reported cases that are relevant to the case(s) presented or reported.

Conclusion

Based on the present case(s) and the discussion.

References

The authors should be listed in the order in which they appear in the articles. In the case of multiple authors, all authors' names must be given.

Within the text, citations of these references should appear as follows:

Potassium channel-blockers serve as therapeutic agents to interfere with bone resorption of periodontal disease.^{1,2,3}

In the References Section the references should be listed in the order in which they were cited in the text and with the corresponding number.

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Valverde P, Kawai T, Taubman MA (2005) Potassium channel-blockers as therapeutic agents to interfere with bone resorption of periodontal disease. J Dent Res 84: 488-499.

To cite a chapter in a book (in References section):

Cowin SC, Luo G (1997) Modeling of ingrowth into implant cavities along the bone implant surface. In: Osseointegration in Skeletal Reconstruction and Joint Replacement (PI Brånemark, BL Rydevik, R Skalak, Eds) Chicago, Quintessence Publishing Co, Inc, pp 57-72.

To cite a book (in References section):

Drake RL, Vogl W, Mitchell AWM (2005) Gray's Anatomy for Students. Philadelphia, Elsevier.

To cite a website (in References section): American Dental Association. Estrogenic effects of Bisphe- nol A lacking in dental sealants. ADA Position Statement. 2000. Available at: "www.ada.org/prac/position/seal-est. html". Accessed April 4, 2005.

Figures and Manuscripts

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