15 The Interprofessional Management of Geriatric Patients Undergoing Head and Neck Cancer Treatment in U.S. Nursing Homes
A dental approach toward interprofessional management, treatment planning and rehabilitation of diagnosed individuals undergoing cancer therapies is essential. Literature review focuses on presurgery oral hygiene instructions, pre-radiography/chemotherapy dental clearance, complications and management during radiotherapy/chemotherapy; post-radiotherapy/chemotherapy oral healthcare; and adjunctive measures.

24 Stress Relief through Ergonomics for Dental Professionals
Colleen A. Watson, D.D.S.; Anupama Sangadala, D.D.S.; Peter Marino, C.P.T.
Dentistry is a physically taxing profession. Chronic neck, shoulder and back pain among practitioners is not uncommon, but it needn’t be inevitable. Targeted exercises that can be done in the office or at home can strengthen muscles and help ward off injury or pain.

28 What Grows on Your Implants?
What happens to implants after they are introduced into the oral environment? Do they keep their sterility, or are they colonized by bacteria? These are among questions answered through a review of the literature aimed at providing a general overview of critical concepts in peri-implant microbiology.

33 Idiopathic Gingival Fibromatosis
The case of an adolescent patient with unilateral idiopathic gingival fibromatosis, a rare condition, is presented, along with a literature review of the condition and treatment.
Policymakers and legislators do a great disservice to the dental profession and to patients when they enable lesser-trained technicians to perform irreversible procedures independently, without the direct supervision of a dentist. The reduced education of midlevel providers (MLPs) leaves them only partially prepared to practice to the current standard of care of a dentist. While they might technically handle basic cases, they could place patients with more intricate and unusual needs at risk.

Proponents contend states should utilize MLPs to improve access to care for the underserved. However, engaging lesser-trained technicians to provide symptomatic care will not prevent future disease or remove the barriers to the utilization of existing care from dentists. As such, midlevel care does not serve patients’ best interests. Hence, implementing such a proposal violates dentistry’s contract with society, which, ultimately, will threaten dentistry’s status as a profession.

Current dental school curricula, accreditation standards, licensing, scope-of-practice laws and the legal standard of care all evolved to set a minimum quality level and protect the public. The Commission on Dental Accreditation (CODA) sets the minimum competencies dental schools must teach and students must master as a prerequisite for the D.D.S./D.M.D. degree and, ultimately, licensure. These competencies developed for a critical reason. They progressed and advanced to ensure practitioners will apply state-of-the-art scientific knowledge safely to the public. Courts look to the principles taught in dental curricula as a basis for setting the legal standard of care. These competencies, standards, regulations and laws place the oral healthcare decision-making authority in the hands of a licensed dentist, the individual in the best position to act in the patient’s best interest. Since these competencies and principles set a minimum standard of care, any program that incorporates only some, but not all, of the required standards, by definition, cannot certify its graduates competent to perform all the tasks reserved for a graduate of an accredited program.

MLPs generally receive an average of three years of dental education after high school. No doubt they learn “what” to do and “how” to do it. The key element of the advanced education and training of a doctor of dental surgery (or medicine) that distinguishes dentists from midlevel-trained technicians is the perspective attained in the broader context of the study of the biologic, dental, clinical and behavioral sciences. In essence, CODA competencies and the legal standard of care require that to earn the privilege and autonomy to perform irreversible procedures, dentists must not only possess the knowledge of “what” and “how” to perform, but also demonstrate the wisdom of understanding “why” conditions exist, “why” treatment should be rendered and “when” to take or not take certain action.

We can certainly teach MLPs the techniques to drill, fill and pull teeth. However, midlevel programs cannot prepare MLPs to competently interpret complex history, lab and radiographic findings, or manage patients with bleeding disorders, artificial heart valves, diabetes, oral malignancies and life-threatening infections, among others. We can teach, in a scaled down MLP course, techniques, observations and entry-level knowledge. We cannot develop in
Some advocates of MLPs claim such a system works in medicine, so it should succeed in dentistry. This argument fails, since the comparison is flawed. Dentistry stands as more of an unofficial surgical specialty of medicine and should be more appropriately compared to surgical medical specialties, not medicine in general. Medical MLPs, such as physician assistants and nurse practitioners, do not perform surgery on patients’ brains, hearts, eyes or feet. Policymakers who take the position that MLPs can perform fillings and extractions indirectly imply that dental surgery is somehow not as complex or important as surgery in other parts of the body, which, of course, is absurd.

We can all agree organized dentistry needs to work to increase access and utilization of oral healthcare services to the underserved. However, the MLP model in dentistry offers little more than a politically expedient proposal, which will not succeed because it fails to address the removal of key barriers to utilization, such as oral healthcare literacy and prevention.

Society bestows professional status upon dentistry contingent upon the dental profession’s commitment to act in the best interests of patients. Patients have a right to know they are protected and will receive the level of competency necessary for the safe delivery of oral healthcare. It seems unjust to take a position that makes potentially substandard care available to the underserved, when much more could and should be done to remove barriers to the utilization of available care.

Society expects dentistry to work with other professional organizations, government agencies and community groups to fight this fight. Together, we must not lose faith that, as we succeed in removing these barriers, the underserved will embrace our existing, high-quality oral healthcare system. All patients deserve access to dentists who not only know the “what” and “how,” but also the “why” and “when.”
Head and neck malignancies can be difficult to treat, especially in the geriatric population. A dental approach toward interprofessional management, treatment planning and rehabilitation of diagnosed individuals undergoing cancer therapies is essential. This literature review focuses primarily on: presurgery oral hygiene instructions; pre-radiotherapy/chemotherapy dental clearance; complications and management during radiotherapy/chemotherapy; post-radiotherapy/chemotherapy oral healthcare; and adjunctive measures. Each section aims to affirm that thorough evaluation is vital to understanding the assessment and safe management of patients undergoing oncology treatment. Furthermore, this project will help establish guidelines for interprofessional nursing home teams in regards to oral healthcare.

Head and neck cancer (HNC) constitutes less than 5% of all cancers, but it can have devastating outcomes in the lives of affected patients. In 2001, there were approximately 30,000 HNC-related deaths in the United States. It has been linked to several causes, including tobacco use and/or alcohol consumption. Eighty percent to ninety percent of head and neck cancers are due to tobacco and alcohol use. Traditionally, men over the age of 40 who smoke have the highest risk of developing HNC, squamous cell carcinoma (SCC). A recent study showed that development of oral cancer in smokers increases with age. Men who stopped smoking at 30 years of age had a 1.2% risk of developing SCC, while men 75 years of age and older who continued smoking had a 6.3% risk of developing cancer of the upper digestive tract.

The incidence of human papilloma virus (HPV)-related squamous cell carcinoma has increased in the last 20 to 30 years. This disease usually occurs in the region of the oropharynx in patients who are 45 years or younger, so it is not usually a risk factor in the geriatric population. HPV-related SCC is discovered at a later stage, but it responds better to radiation treatment compared to non-HPV-related squamous cell carcinoma. Deficiencies of vitamin A and iron, occupational exposure to toxic chemicals and genetic abnormalities have also been linked to the development of cancer in the head and neck. Immunosenescence, which is defined as the changes that occur in the immune system due to increased age, may cause an increase in the risk of cancer.

It has been postulated that by the year 2030, 20% of the overall population will be composed of individuals 65 years and older. The elderly, in particular, are at risk of developing cancer throughout the body, including the head and neck region. According to the American Cancer Society, people ages 55 and above represent 78% of all cancer diagnoses. Treatment modalities for
cancer, such as surgery, radiation and/or chemotherapy, can take a physical, psychological and financial toll on the affected individuals. Support from family, friends and nursing home staff can help these patients learn how to cope with their illness.

Nursing homes are facilities that provide long-term residential accommodations and/or healthcare for patients who do not require hospitalization but do require 24-hour assistance. According to the Centers for Disease Control and Prevention, in 2013, the United States had 15,700 nursing homes, with 1.4 million beds out of a possible 1.7 million being occupied. While nursing homes provide healthcare to ensure a better quality of life, oral care has been found to be a low priority. Nurses form an integral part of the interdisciplinary team caring for patients before, during and after treatment. Dental professionals can assist nurses with patients living in these facilities.

For this study, the journals reviewed were published in English between 1975 and 2015 and contained information about the various types of cancers that occur in the head and neck region, along with treatment modalities and complications. Literature regarding dental care in nursing homes was also included. Abstracts and continuing education course materials were excluded. Relevant websites and textbooks with information related to the incidence of cancer and the care of affected patients were also used. This review will discuss pre-surgery oral hygiene instructions, pre-radiology/chemotherapy dental clearance, during-radiology/chemotherapy dental complications and management, post-radiology/chemotherapy oral healthcare and adjunctive healthcare. The aim of this review is to explore guidelines for nursing home healthcare teams in regards to oral health and interprofessional collaboration.

**Presurgery Oral Hygiene**

The healthcare team at a nursing home comprises family, physicians, nursing staff, social workers, rehabilitation staff, physical therapists, occupational therapists, speech therapists and other non-medical personnel. The risk of squamous cell carcinoma increases after age 65, so it is important that all staff be aware of the clinical manifestations. These include red and white mucosal lesions that cannot be wiped away and which should undergo biopsy if present for more than two weeks. Non-healing ulcers present for more than two weeks should also be biopsied. HNC may present as ominous-appearing nodular growths, palpable swellings, constant sore throat and otitis media that do not respond to antibiotics, as well as non-trauma-induced and uncontrolled bleeding of the mucosa.

Once a patient has been diagnosed with cancer, it is important to increase oral hygiene measures. Cancer therapy can cause the oral cavity to undergo many changes, so it is best to establish a good regimen. Patients should be encouraged to cease all high-risk behaviors, such as smoking and excessive alcohol consumption.

**Dental Clearance prior to Radiation and Chemotherapy**

A comprehensive oral evaluation, prior to HNC treatment, is necessary to identify and eliminate active or potential oral sources
of infection. In cancer patients, the most frequently documented source of sepsis is the oral cavity. Therefore, it is essential to evaluate and address dental needs for geriatric patients receiving oncology treatment. An early assessment of oral status and means for providing care are critical in reducing potential complications associated with cancer therapy.

**Pre-treatment Comprehensive Oral Evaluation**

Ideally, the oral evaluation should occur several weeks prior to commencement of cancer treatment, to allow for adequate healing time. Medical consultation and thorough review of the patient’s dental history are needed to develop an appropriate treatment plan. The medical consultation should encompass information concerning the disease/condition and associated treatment protocol, immunosuppression status, medications, allergies and contact information for the patient’s oncologist. Dental health history must contain information regarding the patient’s previous dental care, symptomatic teeth, trauma, habits, fluoride exposure, caries risk assessment and oral hygiene. The assessment includes extraoral and intraoral clinical examinations, identification of existing infections and other compromised hard or soft issues, and an evaluation of relevant radiographs.

**Dental and Systemic Care prior to Oncology Therapy**

Upon completion of the oral examination, it is critical that the dentist communicate the findings and associated treatment plan to the oncologist. If the radiation oncologist determines that a delay in cancer treatment will affect the potential success of disease control and patient survivability, pre-cancer dental care may not be advisable. The main focus should be on existing infections, extractions, periodontal care and sources of tissue irritation (Table 1). In addition to a complete oral examination, a comprehensive geriatric assessment (CGA) should be completed. Geriatric patients often present with comorbidities, such as narrow arteries and decreased organ function, which may cause complications during surgery, radiation and chemotherapy. Chemotherapy-related toxicity is more common in elderly patients. This is caused by decreased liver and renal function, which allows abnormally high levels of chemotherapeutics to build up in the bloodstream. CGA is a multidisciplinary evaluation of the patient’s nutritional status, co-morbid medical conditions, cognition, psychological state and functional status. This assessment will help determine what type of treatment the patient will be able to withstand.

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**TABLE 1. Oral and Dental Care Prior to Cancer Therapy**

<table>
<thead>
<tr>
<th>Dental Care Considerations</th>
<th>Guidelines and Action</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Surgical Considerations</strong></td>
<td>Vital and viable teeth should be retained for function, aesthetics, and quality of life. Nonetheless, it is significant to eliminate possible sources of infection. Due to the increased risk of osteoradionecrosis in irradiated bone with dental extractions or untreated infection, it is generally advised to extract teeth with poor long-term prognosis prior to radiotherapy. Ideally, extractions should be undertaken up to two weeks before commencement of radiotherapy. Teeth that should be considered for extraction include: Extensive carious lesions with questionable pulpal status or involvement; Extensive periapical lesions; Moderate or advanced periodontal disease, with extensive attachment loss, bone loss and mobility or furcation involvement; Residual root tip that is radiolucent or if not fully covered by alveolar bone; Impacted or incompletely erupted teeth (third molars).</td>
</tr>
<tr>
<td><strong>Periodontal Considerations</strong></td>
<td>Scaling and prophylaxis with establishment and reinforcement of good oral hygiene and dietary advice. Deep scaling and root planing (PD &lt; 6 mm) should occur 14 days prior to radiotherapy for sufficient healing time. Recommended mouthrinse with aqueous alcohol-free chlorhexidine gluconate mouthwash for short-term use.</td>
</tr>
<tr>
<td><strong>Restorative Treatment</strong></td>
<td>Caries removal and restorations, smoothing of irregular teeth and sharp areas on restoration. Removal and replacement of defective restorations.</td>
</tr>
<tr>
<td><strong>Prosthetic Considerations</strong></td>
<td>Removable prostheses should be removed if any signs of ulceration. Ill-fitting dentures should be relined, repaired, or replaced to avoid irritation and tissue trauma.</td>
</tr>
<tr>
<td><strong>Orthodontic Appliances</strong></td>
<td>Treatment should be discontinued.</td>
</tr>
</tbody>
</table>
Dental Complications and Management during Radiation/Chemotherapy Treatment

Oral or oropharyngeal mucositis (OM), an inflammatory disease of the oral and oropharyngeal mucosa, is commonly induced by ionizing radiation during radiation therapy (RT). Within three weeks, mucosal ulcerations manifest and become confluent. These ulcerations may persist for up to six weeks after completion of RT and impair the patient’s ability to eat, speak and function properly. These lesions leave patients vulnerable to microbial invasion of the bloodstream, increasing their risk of acquiring local or systemic infections.

Therapeutic treatments, including soft laser and cryotherapy, show increasing evidence of effectiveness in preventing and managing OM. Lack of significant evidence, however, has limited their approval or utilization.

OM treatment is associated with symptom management. As pain is typically present, treatment begins with topical analgesics or anesthetics, such as viscous lidocaine to help with OM. Some clinicians will prescribe “magic mouthwash” to alleviate the pain associated with OM. There are many different formulas used to make magic mouthwash. Palifermin is the only FDA-approved growth factor or cytokine-approved medication to treat oral mucositis. Alternating non-opioid oral analgesics, such as ibuprofen and Tylenol, is recommended if topical application is insufficient. If pain persists, opioids may be added, starting with the lowest effective dose and increasing as needed.

Low-level laser therapy (LLLT) is a new modality, which may be used to reduce the effects of mucositis in patients treated with RT. In a recent study by Gautam et al., LLLT treatment of the oral cavity prior to RT showed decreased OM, oral pain, weight loss and the need for analgesic in elderly patients with HNC.

Xerostomia

Salivary glands are sensitive to RT. Xerostomia may manifest due to inflammation, fibrosis or degeneration of salivary glands. Decreased flow is continuous throughout RT and may persist post-treatment, increasing the risk of infections and the development of dental caries. Current treatments for xerostomia hope to increase the existing salivary flow or replace lost secretions, maintain proper oral hygiene, control dental caries that may be present and treat any arising infections. The presence or absence of residual oral cavity secretions determines appropriate treatment.

Xerostomia treatments include muscarinic acetylcholine agonists, salivary substitutes or stimulants, acupuncture and hyperbaric oxygen therapy (HBOT). Some examples of muscarinic acetylcholine agonists are pilocarpine and cevimeline. The continued administration of topical pilocarpine lozenges has been found to be superior to other treatments for improving unstimulated and stimulated salivary flow rates. Alternative treatments include mechanical, gustatory or electrical salivary stimulants. If salivary secretion stimulation fails, mouthwash or saliva substitutes that mimic natural saliva may be prescribed. Because of the increased risk for dental caries and infections, patients require frequent dental visits. Patients must be active in managing xerostomia by performing daily self-examinations for the presence of any white, red or dark-pigmented lesions, ulcerations or tooth decay.

Infections

Radiation-induced xerostomia and mucosal ulcerations increase the risk of viral, bacterial or fungal infections. Common bacterial infections involve species of Staphylococci and Streptococci, Klebsiella pneumonia, Pseudomonas aeruginosa and Escherichia coli. The most common infection is oral candidiasis (OC), an opportunistic fungal infection primarily associated with Candida albicans. The two types of acute OC found in this population are pseudomembranous and erythematous. Patients suffering from pseudomembranous OC may present with wipeable, white, patchy lesions, while erythematous OC manifests in the oral cavity as red diffused lesions on the oral mucosa. Frequently coexisting during RT, OC is often mistaken as oropharyngeal mucositis. Common symptoms are generalized burning sensations and pain.

The treatment for OC is topical antifungal medication. Systemic antifungals are administered for more invasive infections. Antifungal agents that are fully absorbed from the GI tract, such as fluconazole, ketoconazole and itraconazole, appear to be more effective in preventing OC.

Trismus and Fibrosis

Radiation-induced fibrosis and ischemia may lead to trismus during or post-RT. Unmanaged trismus may cause difficulty in swallowing. The main treatment for increasing mouth-opening is a constant exercise regimen. Nursing home patients experiencing difficulty with exercising independently may manage exercise routines with the help of staff. Modified, custom-made mouth-opening devices could be an alternative treatment.

Post-radiation/chemotherapy Complications and Management

Long-term complications of radiotherapy and chemotherapy include xerostomia, osteoradionecrosis, rampant caries and radiation-induced sarcomas. Severe cases of xerostomia can cause difficulty in speech and swallowing, making everyday tasks troublesome.

Residents in nursing homes might experience extreme discomfort with removable prostheses because saliva promotes bonding between the interface of prosthesis and the oral/gingival tissue. Xerostomia treatment includes salivary stimulants, mouth moisteners and parasympathomimetic drugs. Side effects might be sweating, headache, rhinitis, dizziness and urinary fre-
Persistent xerostomia can lead to rampant caries. Effective preventive therapies include maintenance of good oral hygiene, the use of fluoride and chlorhexidine rinse. Conventional glass ionomers are the restorative material of choice because of their bond strength and fluoride release.

Most cases of osteoradionecrosis occur as the result of traumatic incidents, such as tooth extraction, biopsies, periodontal disease, subgingival scaling or ill-fitting prostheses. After radiotherapy, edentulous patients should not wear dentures for at least one year. Dental implants can be placed successfully in irradiated bone 12 to 18 months after completion of radiotherapy. Although rare, treatment with radiation can cause post-radiation sarcomas. Therefore, any suspicious lesion should be sent for biopsy. If the lesion is found to be malignant, surgical resection is often the main treatment of choice. The oral and maxillofacial surgeon can aid in post-radiation/chemotherapy therapy by helping patients through the rehabilitation process.

Prostheses are essential to help patients regain normal function and improve facial aesthetics. Prostheses include dentures, as well as treatments for other portions of the face and neck. Because tissues actively heal and change after surgery, a close follow-up of the fit of the prostheses and assessment of functional jaw improvement is recommended. Patients, with the help of the nursing staff, should perform frequent oral examinations to identify any abnormal changes occurring in the oral cavity. The dentist can help by performing monthly oral examinations for residents for the first six months after completion of their treatment(s) and semiannually thereafter. An oral medicine specialist should be notified whenever oral pathology is suspected.

**Adjuvant Treatment**

Innovative cancer treatments are keeping patients alive longer, resulting in complex disabilities, including fibrosis of irradiated tissue, trismus, dermatitis, and severe, acute mucositis and oro-pharyngeal. Radiation-induced tissue damage occurs from injury to the endothelial cells lining small blood vessels, resulting in inflammation, ischemia and interstitial edema. Edema in the head and neck causes facial disfigurement; in severe cases, swelling of eyelids and lips can lead to difficulties in eating, as well as impaired vision. Traditional nursing measures, such as compression garments, ambulation and elevation, contribute to a reduction in lymphedema. Radiation dermatitis symptoms may be alleviated by skin care instructions, the use of aloe vera gels and water-based lotions, avoiding chemical irritants, and limiting sun and wind exposure. Massage and position changes can alleviate the pressure sores of bedridden patients.

Patients should be aware of support services, such as physical, manual and occupational therapy, to reduce deconditioning and muscle atrophy. Manual therapy includes passive/active stretching and joint manipulation to increase range of motion (ROM) and reduce inflammation, hypoxia and contractile tensions. A novel technique is trigger-point dry-needleling, which decreases pain and increases cervical ROM and blood flow to the site in patients having upper myofascial pain. Various jaw ROM exercises and mechanical assistance devices, such as Therabite (Atos Medical, Sweden), can help increase ROM. Fibrosis can result in impaired movement of the muscles of mastication, tongue, pharyngeal constrictors and larynx, resulting in swallowing dysfunction and risk for aspiration. Tongue-stretching, as an adjunct to the supraglottic swallowing maneuver, helps with coordination of chewing and swallowing.

Prevention counseling in oral hygiene, nutrition, alcohol and smoking should be offered. Smoking after a cancer diagnosis decreases the effectiveness of radiotherapy, shortens survival time and increase the risks of recurrence, second primary malignancies and treatment complication. Cryotherapy (e.g., sucking on ice chips) can also lower the incidence of mucositis during infusions of chemotherapeutic agents by causing local vasoconstriction, thus reducing exposure of cells to the drug. Pain associated with mucositis can be alleviated by using mouthrinses (Table 2) and gargling several times a day with warm salt water or a baking soda solution.
### TABLE 2.
Natural Adjunctive Mouthrinse Recommendations for Mucositis Secondary to Chemotherapy and/or Radiation for Cancer Treatment

<table>
<thead>
<tr>
<th>Management/Therapy</th>
<th>Patient Diagnosis</th>
<th>Results</th>
<th>Type Study/Level Evidence</th>
<th>Author/Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rinse containing olive leaf extract (OLE) or benzydamine hydrochloride</td>
<td>Chemotherapy-induced mucositis — 25 patients given mouthrinse with OLE, 25 patients given mouthrinse with benzydamine hydrochloride, 25 patients given placebo mouthrinse.</td>
<td>Oral mucositis rates and severity were lower in OLE and Benzydamine groups compared to placebo. Decrease in proinflammatory cytokine production.</td>
<td>Double-blind RCT, Level I</td>
<td>Ahmed (2012)14</td>
</tr>
<tr>
<td>Calendula officinalis (English marigold) flowers extract mouthwash as oral gel on radiation-induced oropharyngeal mucositis (OM)</td>
<td>38 patients with HNC undergoing radiotherapy (60 Gy) or concurrent chemoradiotherapy were randomly assigned to receive either 2% calendula extract mouthwash or placebo (20 patients in each group).</td>
<td>OMAS scores were significantly lower in calendula group compared to placebo at week 2, 3 and 6 of the study. According to repeated measures ANOVA test, the differences between OMAS of calendula and placebo during the weeks of evaluation were statistically significant (p&lt;0.001).</td>
<td>RCT, Level I</td>
<td>Babaee (2013)77</td>
</tr>
<tr>
<td>Korean red ginseng (liquid concentrate) only Radiotherapy only RT+ KRG group</td>
<td>(20 Gy) Radiation-induced oral mucositis.</td>
<td>Rats in RT+ KRG group had less severe mucositis, fewer ulcerative mucosal lesions on the tongue, less hair loss, less rapid decrease in weight than did the RT only group.</td>
<td>RCT, Level I</td>
<td>Chang (2014)78</td>
</tr>
<tr>
<td>Dioctahedral smectite (natural absorbent clay of non-systemic specific aluminomagnesium silicate) and iodine glycerin (DSIG) cream vs. topical mouthrinse (composed of saline, gentamicin and Vitamin B18 y.o. and older with pathological confirmed malignant tumors or malignant hematological diseases, 130 intensive chemotherapy or stem cells transplantation induced OM. 67 patients received topical mouthrinse and 63 patients received DSIG cream treatment.</td>
<td>A favorable, lower oral assessment guideline (OAG) score was observed in DSIG cream treated patients. The iodine glycerin may function as an antifungal/antibacterial and decrease repair time. From day 2-5 topical mouthrinse patients had a higher OAG score than DSIG treated. “The mouthrinse shows a protective function prior to OM appearance.”</td>
<td>Prospective RCT, Level I</td>
<td>Lin (2015)79</td>
<td></td>
</tr>
<tr>
<td>Curcumin mouthwash</td>
<td>20 adult cancer patients with radiochemotherapy OM randomly divided into 2 groups.</td>
<td>Curcumin mouthwash was found to be better than chlorhexidine mouthwash in terms of rapid wound healing and better patient compliance.</td>
<td>RCT, Level I</td>
<td>Patil (2015)80</td>
</tr>
<tr>
<td>13 received an aloe vera mouthwash, 13 received benzydamine mouthwash.</td>
<td>25 HNC patients (receiving at least 50 Gy) with radiation-induced mucositis.</td>
<td>Aloe vera mouthwash was as beneficial as benzydamine mouthwash in alleviating the severity of radiation-induced mucositis and showed no side effects.</td>
<td>Triple Blind RCT, Level I</td>
<td>Sahebjamee (2015)81</td>
</tr>
<tr>
<td>16 received polaprezinc, 15 received azulene oral rinse (control).</td>
<td>31 HNC patients with radiotherapy or radiochemotherapy OM.</td>
<td>Incidence rate of mucositis, pain, xerostomia and taste disturbance was lower in polaprezinc group than control.</td>
<td>Prospective RCT, Level I</td>
<td>Watanabe (2010)82</td>
</tr>
</tbody>
</table>

**RCT:** Randomized Control Trial  
**Gy:** Grays  
**OMAS:** Oral Mucositis Assessment Scale  
**HNC:** Head and Neck Cancer  
**OM:** Oropharyngeal Mucositis  
**KRG:** Korean Red Ginseng  
**RT:** Radiation therapy
HNC patients are at high risk for malnutrition due to taste alterations, xerostomia from medications, parotid atrophy and radiation-induced diarrhea (RID).

The diagnosis of diminished swallowing function and odynophagia (painful swallowing) can be made by a speech language pathologist and treated by means of postures to control the bolus and other swallowing maneuvers. Twenty-nine percent to sixty-six percent of patients will experience severe oral mucositis during treatment, which is why alternative ways to provide nutrition need to be found. Bolus modification by altering foods (mashed, pureed, thickened [fluids]) may make them safer to swallow. Feeding tubes can also offer additional nutritional support post-treatment, when oral consumption is too painful.

Psychological support and speech rehabilitation can greatly improve the HNC patient’s mental health. Frequently used alternatives include selenium, relaxation techniques, prayer, vitamin C, meditation and distraction. Mild-to-moderate exercise can promote energy and boost quality of life and mood, despite feelings of tiredness. Care plans should be tailored to meet the needs of each individual.

**References**

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Stress Relief through Ergonomics for Dental Professionals

Colleen A. Watson, D.D.S.; Anupama Sangadala, D.D.S.; Peter Marino, C.P.T.

ABSTRACT

As most practitioners probably know from experience, dentistry is a physically taxing profession. Long hours spent with our heads bent over to get those crown preps just right can leave us with tense and aching muscles. Along with limited sleep, bad posture and not enough time to get to the gym, these workplace habits can leave us with chronic neck, shoulder and back pain in no time. Although limited research in occupational therapy has been specifically targeted towards dental professionals, there have been extensive studies on developing exercises to strengthen the muscles that support joints and spines. While exercises that require special machinery or gym memberships might not be realistic, considering most professionals’ time restraints, we have compiled a few exercises to try anywhere, anytime.

Next time a patient cancels or you go home a little early, maybe you can squeeze in a few repetitions to help ward off injury or pain that often seems inevitable as a dental professional.

Begin by assembling the following basic equipment:

- Kettle bell. (Choose a weight appropriate for comfort and ability.)
- Rubber tubing.
- Yoga mat.
- Light dumbbells.
Upper Back and Shoulder Training

One Arm Row

Hold the kettle bell in your right hand by the handle. With your back straight and spine neutral, bend forward at the waist to a 90-degree angle. Extend your opposite (left) leg back. Extend kettle bell toward the floor and then pull it back up toward your body, until your wrist reaches your side. Repeat for 10 repetitions, then switch arms and do the same on the opposite side, extending the opposite leg. In addition to working the upper back and shoulders this exercise also works on the core muscles and balance—it is okay to wobble a little; you are training your core also. When you find you are no longer challenged and are able to balance yourself fairly well, you can increase the weight. Recommend 3 sets of 10 repetitions per side.

Bridge Pull-over with Kettle Bell

This exercise will work to strengthen the core muscles, which include both the abdominal and upper back muscles. Both sets of muscles should be balanced in strength to maintain optimal posture. It will also strengthen the shoulders, triceps and rotator cuff muscles, which are often sites of injury.

Lie on your back on the mat with your knees bent and feet flat on the floor. Hold the kettle bell centered over your body with both hands in a way that your thumbs hook through the handle and your fingers can grab the handles from the sides. Raise and maintain your hips off the floor, forming a slanting bridge with your body. Extend your arms holding the kettle bell straight away from your body. Now rotate your shoulders above your head, keeping your arms straight, so that the handle of the kettle bell touches the floor above your head. Bring the kettle bell back and maintain tension until the kettle bell reaches above the abdomen while maintaining your hips upward the entire time. Without rest, rotate the shoulders to bring the handle to the floor above your head once again. Repeat 10 times. This will work the muscles mentioned above. A variation on this is to bend at the elbow; this will eliminate the triceps from working and focus more on the back. Recommend 3 sets of 10 repetitions.

The Plank

This exercise strengthens the entire core region. Lie face down on the mat, supporting your body weight with only your toes, elbows and forearms touching the ground. Your body will be held straight, with your spine and neck linear and neutral. You may choose to keep your hands held together. Maintain tension in your midsection and do not allow your abdominals to sink towards the floor or for the hips to be out of line with the body. Another variation of this exercise includes balancing face down on only your toes and palms of your hands on the mat, with your arms extended straight to support your body weight. Hold this position for 30 seconds.

Rotator Cuff Exercises

This exercise will use resistance tubing, which includes handles. One end of the rubber tubing should be secured to a non-moving object or surface, such as a door hinge, heavy table or fixed furniture. Tubes come in a variety of resistance strengths, which should correspond with the participant’s strength and ability, as appropriate. The participant will be standing during this exercise; the rubber tubing should be secured at about waist level. For exercising the external rotation motion, hold the free handle of the rubber tubing with the hand furthest from the secured end. The tubing should extend in front of your body. With the elbow next to your side, use a rotating motion to pull the handle across your body horizontally. The elbow should remain stationary, with only the forearm and hand moving across the body in a perpendicular
fashion. You will feel the tension increase the further you pull. For exercising the internal rotator cuff muscles, switch to the opposite hand and perform the same motion, moving internally across your body. Alternate both internal and external rotation with each hand, performing 3 sets of 10 repetitions per arm.

For another shoulder and rotator cuff exercise, hold one lightweight dumbbell in each hand while standing, with palms facing inwards towards your body. Keeping the arms straight and extended in front of you, raise your arms up to shoulder level, keeping wrists neutral. Return to starting position. Repeat this exercise for 3 sets of 10 repetitions.

**Forearm Exercises**

To work the top side of your forearms (wrist extensors), using lightweight dumbbells, appropriate to your strength, hold one dumbbell in each hand. Elbows and upper arms should be relaxed by your sides, and forearms should be extended in front of your body, at a 90-degree angle. Palms should be facing down toward the floor. Rotate your hands and wrists gently downward and back up. Perform 3 sets of 10 repetitions.

To exercise the internal part of the forearm muscles, hold one lightweight dumbbell in each hand and relax arms by your sides with palms facing out in front of your body. Rotate the hands and wrists upwards gently and back down. Perform 3 sets of 10 repetitions of this exercise as well.

**Between Patients—No Equipment Necessary**

**Tricep Stretch**

Extend one arm above your head, elbow bent, with the forearm extending back behind the neck and trapezius muscle. Use your opposite hand to stabilize this stretch by gently bringing your bent elbow deeper into the stretch. Switch arms and hold this stretch on each side for 30 seconds.

**Neck Stretch**

With shoulders neutral, gently tilt your head at the neck, bringing your ear over the adjacent shoulder. You may use the hand on that side to stabilize your head in this stretch, gently without pulling. To get an even deeper stretch, hold your opposite arm at your side, with the wrist flexed upward, palm facing down. Hold this stretch for 20 to 30 seconds; repeat on the other side.

**Forearm Stretch**

Stand with one arm extended straight in front of you at shoulder level. Rotate the wrist downwards so that your palm is facing your body. You may use your other hand to gently extend your wrist rotation in this stretch. Then, rotate the wrist upwards, so that your palm is facing away from your body. Hold this stretch in a similar way. Switch to stretch your opposite forearm, holding each stretch for 20 to 30 seconds.

**Pectoral Muscle Stretch (Chest)**

Stand centered in a doorway. Extend your arms out to your sides, bent at the elbows with palms facing forward. Hold on to the sides of the doorway in this position, keeping elbows parallel to the floor. Holding your body steady, lean forward into the stretch.

**Stretch Exercises**

**Child’s Pose**

This stretch will focus on your full back and shoulders. Kneel on the mat and place your hands about two feet in front of your knees, shoulder width apart, palms down, on the mat. Bring your hips back to rest above your ankles, keeping your arms extended overhead on the mat. You may choose to rest your forehead on
the mat as well. In another variation, to focus this stretch mostly on the back and less on the shoulders, you may bring your arms to your sides with your palms facing up behind you.

**Conclusion**

The shoulders, lower back, rotator cuffs and core muscles are most affected by poor posture. The best way to help alleviate chronic pain is to maintain a healthy lifestyle, including exercise, hydration, nutrition and sleep. These exercises can be incorporated easily into any lifestyle and adjusted according to personal preferences and physical abilities. Developing supporting muscles can help prevent muscular imbalances and undue joint stress over time.

Queries about this article can be sent Dr. Watson at caw2008@nyu.edu.

**REFERENCES**


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**Anupama Sangadala**

**Mr. Marino**

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Find Out What Your Practice Is Worth. Call Today!
Implant dentistry is a prominent topic within dentistry today. Implants are often the treatment of choice when dealing with the edentulous or partially edentulous mouth. Technology within this subject is growing, and the number of implants placed annually is growing exponentially. Despite the high rate of success, it is possible for the area around an implant to become infected, thus leading to potential failure due to inflammation-related bone resorption. The infection and consequent inflammation around an osseointegrated implant is called peri-implant mucositis, when affecting only the soft tissues, or peri-implantitis, when the disease affects the surrounding supporting bone. Microorganisms are the major players in initiation of this disease. The accumulation of gram-negative anaerobic bacteria is what causes the initiation of the breakdown of the supporting tissues of an implant. There are always bacteria in the oral cavity regardless if it is in a healthy or diseased state. In a healthy state, at any site in the oral cavity, there are pioneer bacteria. Pioneer bacteria are the first colonizers to a specific surface in the oral cavity. They are the first bacteria to engage receptors to adhere to the surface.

The pioneer organisms provide a favorable environment and produce metabolic signals to attract future adhering bacteria. As more bacteria attach, a biofilm is created. The signals and messages that bacteria use to communicate between one another is a phenomenon called quorum sensing. Quorum sensing is defined as the regulation of gene expression in response to fluctuations in cell population density. Bacteria use autoinducers (hormone-like molecules) to communicate with each other. The bacteria detect, release, produce and respond to these molecules. When there is a disruption in the biofilm, the bacteria use this technique to regulate themselves and their interaction. They also regulate the number of certain bacteria in the environment when this occurs. This is most likely when the bacterial community changes from gram-positive to gram-negative in the case of peri-implantitis. This communication process has been found in gram-negative bacteria, which are the conductors of specific events in the infection process and formation of biofilms.
Quorum sensing has also been found to be used by gram-positive bacteria. The autoinducers that gram-negative bacteria use are acylated homoserine lactones, and gram-positive micro-organisms use processed oligo-peptides to communicate. In a study done on periodontal pathogens that produce quorum sensing, signal molecules *P. intermedia*, *F. nucleatum*, and *P. gingivalis* were all found to produce these autoinducer type signals. These latter mentioned bacteria, responsible for the development of periodontal disease, are also prevalent in peri-implantitis cases. This provides evidence that peri-implant microflora use quorum sensing to communicate with each other and that this technique is most likely responsible for the change from implant health to disease.

As soon as the implant is introduced to the oral cavity, salivary proteins bind to it and a pellicle is formed. This allows the pioneer organisms to bind to the implant and secondary colonizers follow. Examples of these primary organisms are members of the streptococcus family such as *S. sanguinis*. Once these bacteria adhere, a biofilm is able to form on the implant surface. Biofilms are composed of numerous different bacteria. They are polymicrobial, with a key feature being that each different type of bacteria requires space and nutrients to thrive. In a healthy state, the bacteria within this biofilm are in equilibrium with each other. A disturbance within this equilibrium can lead to a diseased state by allowing a more dominant type of bacteria to persistently grow.

The properties of the implant surfaces, such as surface energy and roughness, allow the bacteria to adhere and, because of surface roughness, natural forces, such as saliva flow, cannot remove the bacteria from the surface irregularities of the implant.

There are different types of bacteria found around healthy and diseased implants.

**Microflora at Healthy Sites**
Gram-positive bacteria are the microflora associated with healthy implant sites, and *S. sanguinis* is one of the primary organisms found in this population of microorganisms. A study done on the adhesion of this microorganism to rough titanium surfaces demonstrated how readily it adhered to the surface. Another study analyzed the microorganisms around implants in patients who were healthy, not smokers, and did not have compromised periodontal health. The micro-organisms mainly found in this study were gram-positive cocci, *B. fragilis*, and *Prevotellaaceae*.

A study completed at Harvard School of Dental Medicine described the microflora detected around successfully osseointegrated implants. The most prevalent species found were oral strep-
A review of different biofilms associated with implants suggested that members of the yellow and purple complexes are associated with peri-implant health. Yellow complexes are made up of the streptococcus family, which are primary colonizers, and purple complexes consist of A. odontolyticus and V. parvula. Oral streptococci species were the type of bacteria found most frequently at healthy implant sites.

**Microflora at Diseased Sites**

The presence of large quantities of gram-negative bacteria is the culprit for peri-implantitis infections. In peri-implantitis, there is a greater number of red and orange complex microorganisms. Red complex organisms consist of P. gingivalis, T. denticola and T. forsythia. Orange complex organisms consist of P. intermedia and F. nucleatum. An early study from Rams et al. showed that, while the microbial population surrounding healthy implants had high rates of coccoid gram-positive cells and few spirochetes, there was an inversion tendency with increasing probing depth (PD) and gingival inflammation.

In most of the human studies assessing the peri-implant microbiota, there is a consistently high incidence of *Prevotellaceae*

<table>
<thead>
<tr>
<th>TABLE 1. Healthy Implants*</th>
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<tbody>
<tr>
<td><strong>Author</strong></td>
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<tr>
<td>Shahabouee et al.</td>
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<td>Mombelli et al.</td>
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<td>Shibli et al.</td>
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* most significant studies

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<th>TABLE 2. Diseased Implants*</th>
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<tr>
<td><strong>Author</strong></td>
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<tr>
<td>Casado et al.</td>
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<tr>
<td>Mombelli &amp; Decaillet</td>
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<td>Heuer et al</td>
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<td>Shibli et al</td>
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<td>Leonhardt et al</td>
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<td>Costerton et al</td>
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<td>Rasperini et al</td>
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<td>Aughun M, Connors et al</td>
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<tr>
<td>Albertini et al</td>
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<td>Botero et al</td>
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</table>

* most significant studies
(P. intermedia, P. buccae, P. oralis, P. melaninigenica, P. denticola, P. nigriscens), Porphyromonas gingivalis, Fusobacterium nucleatum, Tannerella forsythia and Treponema denticola in diseased implants, as well as coccoid gram-positives cells in healthy implants.\textsuperscript{21-27} These findings have been confirmed by experimental studies on ligature-induced peri-implantitis on animal models, in which the characteristic shift in the microbial flora has been confirmed.\textsuperscript{28-30}

High numbers of A. actinomycetemcomitans and E. corrodens can be also found at diseased implant sites.\textsuperscript{13} However, the finding of A. actinomycetemcomitans is inconstant within the findings of the different studies. This might be due to the individual composition of the oral microflora of the patients included in the studies.\textsuperscript{22,23} When local factors in a biofilm change, favoring the growth of bacterial pathogens and virulence factors, the initial progression to peri-implantitis is believed to be established.\textsuperscript{31} From the analysis of several studies concerning the microflora that adhere to and is found around implants and implant material, there is a trend that can be observed in the type of gram-negative bacteria that were reported in the above studies. Staphylococcus species were found in two different studies to adhere readily to titanium surfaces.\textsuperscript{32,33} Consistent with these studies, different staphylococcus species were found around diseased implant sites in vivo studies.\textsuperscript{23,34}

The presence of gram-positive species is not surprising considering the “initiator” function that these bacteria have on the establishment of a pathogenic biofilm. Species such as P. gingivalis and P. intermedia were almost always found in studies focusing on diseased peri-implant tissues.\textsuperscript{17,21-23,35,36} A. actinomycetemcomitans was also a frequent, although inconstant, finding among the studies analyzed.\textsuperscript{15,22,23,36,37} T. denticola, Fusobacterium spp, and T. forsythia were found in some studies as well.\textsuperscript{17,31,36}

The colonization of the implant’s surface by the microbial species starts as soon as 30 minutes after implant placement. And the bacteria load stays the same for the first week. Between the first and 12th week after surgery, the bacterial load becomes significantly higher for several species, such as P. gingivalis, T. forsythia and T. denticola. At 12 months, the bacterial load appears to be significantly higher for some species, in particular, T. forsythia and, to a lesser extent, P. gingivalis.\textsuperscript{26}

In conclusion, the bacterial composition of the peri-implant biofilm closely resembles that of the neighboring teeth, which implies that the microbial flora on natural teeth is the reservoir for the biofilm formation around implants. In the same way, the qualitative composition of the biofilm microflora in peri-implantitis resembles that of periodontitis, which explains why patients with active periodontal disease are at higher risk for peri-implantitis.

However, a few clinical studies on humans have shown the presence of non-periodontal microbial species, such as P. seudomonas aeuruginosa, Candida albicans and Staphylococcus aureus, around diseased implants.\textsuperscript{23,24} In particular, Albertini et al.\textsuperscript{24} found, in two patients out of 33, complete absence of periodontal microorganisms commonly found in periodontitis. A different study, aimed at assessing the presence of certain viruses in peri-implantitis sites, has found a high prevalence of human cytomegalovirus and Epstein-Barr virus in subgingival plaque of peri-implant diseased sites, suggesting a possible pathogenic role of these viruses in peri-implantitis.\textsuperscript{28}

Conclusions

Peri-implantitis can be prevented in most cases. Maintaining good oral hygiene, mainly plaque control, is an important measure that can be taken to prevent this infection. This was shown in a study that displayed that patients with good oral hygiene tended to keep their implants longer.\textsuperscript{39} Recall visits are crucial for peri-implant infection prevention. These visits should include examination, re-evaluation, diagnosis, motivation, reinstruction, instrumentation, treatment of infected sites, polishing, fluoridation and determining recall interval, as stated in this study. The use of an antiseptic mouthwash daily after placement of an implant is another proven effective preventative treatment of peri-implantitis.\textsuperscript{40} Mouthrinses like chlorhexidine and those that contain essential oils increase the effectiveness of plaque control as well. Chlorhexidine often has negative side effects, like enamel...
staining. Using an essential oil mouthrinse does not demonstrate the same side effects.

Taking the proper preventative measures to prevent peri-implantitis is crucial because the implant is inevitably surrounded by a bacteria-containing biofilm. Due to the presence of the diverse amount of bacteria in the oral cavity and the saliva that the implant is immediately exposed to, a biofilm will always form on and around the implant. Maintaining proper oral hygiene is a way to keep the biofilm around the implant in good equilibrium so that disruption does not occur. And without disruption, there will not be a shift from the gram-positive harmless bacteria to the disease-causing gram-negative bacteria.

Queries about this article can be sent to Dr. Valente at nicolaal@buffalo.edu.

REFERENCES

Idiopathic Gingival Fibromatosis

A Case Report and Review of the Literature


ABSTRACT

Gingival fibromatosis is a rare condition that is characterized by progressive, varying expansion of submucosal gingival connective tissue. The authors present the case of an adolescent patient with unilateral idiopathic gingival fibromatosis, along with a literature review of the condition and treatment.

There are few case reports in the recent dental literature covering gingival fibromatosis, a rare benign condition characterized by a slow, progressive enlargement in the connective tissue elements of the gingival corium. Gingival enlargements originate from local irritation, certain medications, genetic syndromes and/or inheritance.

Hereditary gingival fibromatosis is prevalent in 1 in 750,000 people and is phenotypically equal among males and females. A diagnostic distinction is made between hereditary gingival fibromatosis and idiopathic gingival fibromatosis (IGF), the latter being a diagnosis of exclusion, with no family history and no outward cause. Clinically, the gingival enlargement is normal in color, of firm consistency and varies in degree of growth. The authors present the clinical, radiographic and histopathological key features of a patient with IGF, along with a review of the dental literature.

Case Description

A 10-year-old black male in excellent health was seen in December 2013 by the oral pathologist for a “gingival swelling.” During the intraoral examination, palpation revealed the presence of a firm, pink, well-perfused, right unilateral, painless, non-erythematous gingival enlargement. The upper and lower right oral mucosa was pink, well-perfused, with unilateral, painless, non-erythematous gingival enlargement. Although the patient was aware of the mass, questioning indicated he had no associated symptoms.

A panoramic radiograph was performed and revealed a slightly hyperostotic border of the right mandible, with no visual expansion (Figure 1). An aspiration was performed to determine if the enlargement was soft tissue or bony in origin. A tentative diagnosis of hyperplastic gingiva was made, and the patient was asked to return for normal periodic oral hygiene maintenance.

Three years later, the patient, still in excellent health, presented for a “gingival swelling” with associated sensitivity upon toothbrushing and mastication. Intraoral examination and pal-
pation revealed the presence of a firm, pink, well-perfused, right unilateral, painless, non-erythematous gingival enlargement and thick voluminous accretions on the smooth and occlusal surfaces of the permanent teeth (Figure 2). Follow-up periapical radiographs revealed no pathology or abnormalities.

Given the patient’s history, an incisional biopsy was performed for histopathology. The gingival enlargement histologically proved to be gingival fibromatosis (Figure 3) or IGF, based on lack of family history. Neither palisading nor streaming of cells (indicative of neuromas or neurilemomas) nor sparsely distributed neuronal axons (typical of neurofibroma) were observed in the tissue. The surface epithelium appeared to be a benign-appearing, stratified, squamous epithelium with overlying keratotic material and thin, elongated rete pegs.

Subgingival scaling and prophylaxis were completed. The authors believe that an additional transitory source of discomfort may have been the normal eruption of the second permanent molars. The family declined surgery to remove excess gingival tissue, and periodic oral hygiene maintenance follow-up was made.

**Review of the Literature**

Most of our understanding of gingival fibromatosis originates from case reports, and treatment often depends upon the degree of gingival enlargement. With respect to hereditary gingival fibromatosis, the majority demonstrate an autosomal dominant mode of inheritance, with differences in disease extent and presentation concomitant with a syndrome or an isolated finding. Mutations on chromosome 2, resulting in early termination of a protein, have been identified as one cause. Alternate chromosomes have since been identified in syndromic forms.

In syndromic forms, the most common characteristic of hereditary gingival fibromatosis is hypertrichosis. Associated findings include syndromic deafness, growth hormone deficiency, hyper-

Figure 1. Panoramic radiograph of child in mixed dentition with no pathology or abnormality noted.

Figure 2. Clinical photo demonstrating pink, well-perfused, unilateral, buccal-lingual gingival overgrowth on upper and lower right quadrants. Positive, thick voluminous accretions noted throughout, particularly on posterior occlusal surfaces and lingual smooth surfaces.

Figure 3. Histology (40x micrograph) revealed densely collagenous fibrous connective tissue sparsely populated with fibroblasts. Surface epithelium was observed to be benign-appearing, stratified, squamous epithelium with overlying keratotic material and thin, elongated rete pegs.
Syndromes Associated with Gingival Fibromatosis\textsuperscript{4,6,8,11}

<table>
<thead>
<tr>
<th>Syndrome or Condition</th>
<th>Inheritance</th>
<th>Summary of Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gingival Fibromatosis</td>
<td>AD/AR</td>
<td>Hypertrichosis, intellectual disability, muscular hypotonia</td>
</tr>
<tr>
<td>Zimmerman-Laband</td>
<td>AD</td>
<td>Syndactyly, hypoplasia of the nails and terminal phalanges, joint hyperextension, hepatosplenomegaly</td>
</tr>
<tr>
<td>Cross</td>
<td>AR</td>
<td>Microphthalmia, hypopigmentation, intellectual disability, cloudy corneas, athetosis</td>
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<tr>
<td>Juvenile Hyaline Fibromatosis</td>
<td>AR</td>
<td>Multiple subcutaneous hyaline fibromas, osteolysis of terminal phalanges, osteolytic/osteoclastic skeletal lesions, sclerodermiform atrophy, stunted growth, premature death</td>
</tr>
<tr>
<td>Rutherford</td>
<td>AD</td>
<td>Delayed tooth eruption, cornal dystrophy, intellectual disability, dentigerous cysts</td>
</tr>
<tr>
<td>Ramon</td>
<td>AR</td>
<td>Cherubism, intellectual disability, epilepsy, hypertrichosis, stunted growth, juvenile rheumatoid arthritis, cataract abnormalities</td>
</tr>
<tr>
<td>Jones</td>
<td>AD</td>
<td>Progressive deafness</td>
</tr>
<tr>
<td>Costello</td>
<td>AD</td>
<td>Delayed development, loose skin folds, large mouth, arthrogryposis, and hypertrophic cardiomyopathy, papillomas</td>
</tr>
<tr>
<td>Tetrarameila</td>
<td>AR</td>
<td>Absence of all four limbs, underdeveloped lungs</td>
</tr>
<tr>
<td>Prune-belly</td>
<td>X-linked</td>
<td>Absence of abdominal muscles, cryptorchism, urinary tract abnormalities, club foot, facial dimorphism</td>
</tr>
<tr>
<td>Neurofibromatosis Type I</td>
<td>AD</td>
<td>Café au lait, lisch nodules, hypertension, stunted growth, macrocephaly</td>
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<tr>
<td>Donohue</td>
<td>AR</td>
<td>Hirsutism, acanthosis nigricans, large mouth, thick lips, hepatic cholestasis, lack of lymphatic tissue, distended abdomen</td>
</tr>
<tr>
<td>Schinzel-Giedion</td>
<td>AR</td>
<td>Hypertrichosis, ataxia, abnormal fontanelles, macroGLOSSIA, hyperetolism, skeletal abnormalities, mental retardation</td>
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<td>Cowden</td>
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<td>Hamartomas, neoplasms</td>
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<td>Goltz-Gorlin</td>
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<td>AD</td>
<td>Hamartomas of brain, kidney, skin, heart, eyes, mental retardation</td>
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<td>Francois</td>
<td>AD/AR</td>
<td>Xanthomatos nodules, coronal dystrophy</td>
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</table>

*AD autosomal dominant; **AR autosomal recessive

telorism, intellectual disability, supernumerary teeth and generalized aggressive periodontitis. Table 1 presents syndromes associated with gingival fibromatosis and include Zimmerman-Laband, Cross, juvenile hyaline fibromatosis, Rutherford, Ramon, Jones, Costello, Tetrarameila, Prune-belly and neurofibromatosis type 1.\textsuperscript{4,6,8,11}

Table 2 summarizes 21 reported cases of both hereditary (non-syndromic) gingival fibromatosis and IGF, as well as dental treatment performed. Clinically, both hereditary and IGF range from localized (maxillary tuberosities and labial gingiva around the mandibular molars) to the more common generalized presentation (bilateral, affecting labia, lingual and palatal gingiva).\textsuperscript{3,6} Typically painless, the gingival tissues are normal in color, with a firm, stippled consistency.\textsuperscript{1,11} While plaque build-up may contribute to gingival inflammation and enlargement, the severity of gingival fibromatosis is dependent upon the penetrance of the associated gene.\textsuperscript{8,11,17} Pseudopockets and periodontal issues are a derivative of an inability to maintain oral hygiene, as radiographically the alveolar bone remains unaffected.\textsuperscript{1,18}

Gingival enlargement results from an increase in extracellular matrix.\textsuperscript{4} Histologic section usually shows hyperkeratotic epithelium with elongated rete ridges and increased parallel collagen fiber bundles with few fibroblasts. Increased presence of fibroblasts suggests an increased chance of recurrence. Inflammatory cells may be seen in areas of pseudopockets but are local findings.\textsuperscript{1,19}

Gingival enlargement is graded on extent and degree: grade zero (none); grade one (interdental papilla alone); grade two (pa-pilla and marginal gingiva); grade three (covering greater than three-quarters of the crown).\textsuperscript{1,19} Growth prominence occurs during transitional exchange periods of the dentition, but can occur with primary dentition eruption as well, with little to no growth seen in adolescence.\textsuperscript{5,21} In a rare case, gingival fibromatosis was present at birth; however, it appears the presence of teeth is essential given the noted changes during eruptive periods. Edentulous areas demonstrate a recession of the condition.\textsuperscript{1,19,22} Gingival enlargement can extend to the mucogingival junction and cause delayed eruption, ectopic eruption, overretained primary teeth, difficulty in mastication, and/or changes in facial appearance (e.g., lip protrusion).\textsuperscript{6,11,23} Varying degrees of severity have both esthetic and functional consequences.

Minimal enlargement is treated with scaling, prophylaxis and oral hygiene maintenance with periodic follow-up.\textsuperscript{6,7} Advanced enlargement requires removal of excess tissue, while in the most severe cases, in conjunction with aggressive periodontitis, extractions and excision of tissue may be required.\textsuperscript{6,24} Removal of bulk tissue involves gingoectomy (external or internal bevel) with gingivoplasty, apically positioned flaps, electrocautery or diode lasers.\textsuperscript{6,25-27,29}

Treatment involves minimizing the risk of recurrence and interference with mastication, speech, primary tooth retention and psychological ramifications.\textsuperscript{6} Recurrence tends to occur in children and adolescent patients. Consequently, the recommenda-
tion for surgical intervention is upon eruption of the permanent dentition. In this case, the patient did not want to pursue gingivectomy and gingivotomy at this time.

Queries about this article can be sent to Dr. Yoon at rky1@cumc.columbia.edu.

References