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Gerald I. Drury, ms, dds, facd

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SOCIETY MEMBERSHIP INFORMATION

The purposes of the Western Society of Periodontology are to afford all practitioners of dentistry a sufficient opportunity for the free interchange of ideas in this field; to encourage the practice of periodontics both in prevention and treatment; and to encourage the study of periodontology and its relationship to other branches of dentistry and medicine. In addition to the continuing education provided, your membership includes a subscription to The Journal of the Western Society of Periodontology, Periodontal Abstracts. This is a quarterly publication providing literature reviews, original articles, and abstracts of current literature related to periodontology. Quarterly electronic newsletters include news of meeting sites and course information, as well as news of the WSP.

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Phone: __________________________ Fax: __________________________

DENTAL PRACTICE
[ ] Periodontics [ ] General Practice [ ] Hygienist [ ] Other Specialty: __________________________

RELATED HEALTH DISCIPLINE (NON-DENTIST)
[ ] Hygienist [ ] Assistant [ ] Other: __________________________

STUDENT (INCLUDE COPY OF STUDENT ID)
[ ] Dental [ ] Undergraduate [ ] Graduate [ ] Dental Hygiene Year of Graduation: __________
School: __________________________

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<th>Hygienist</th>
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Total Dues & Fees $________ $________ $________ $________ $________ $________

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EDITORIAL

Benefits of periodontists teaching periodontology to dental students

A new model in dentistry is “all-under-one-roof,” meaning that general dentists are not encouraged to refer to specialists, but rather to do it all themselves or have in-house specialists. In some schools, the discipline of periodontology is taught exclusively by general dentists and dental hygienists. As a result, new dental school graduates have adopted the mindset that the GPs’ and the periodontists’ shared responsibility for a patient’s periodontal care is optional. Unfortunately, not being exposed to periodontal specialists in school could lead to a less comprehensive knowledge-base in periodontology for students, which in turn could lead to inappropriate or incomplete patient care in practice.

It is important to try and reverse the “no-need-to-refer” mentality by encouraging more periodontists to become active in dental education. Accepting the status quo and doing nothing could negatively affect the long-term survival of the specialty.

Continuing periodontal education given by periodontists to both general dentists and dental hygienists is also valuable. This training should inform students of the complexities of periodontal disease and therapy, and it should demonstrate the benefits of working with a periodontist. Unfortunately, today we see some courses focusing strictly on how-to-do surgery or place dental implants. Some educators and clinicians feel strongly that because of time restraints, abbreviated hands-on postgraduate courses may not be comprehensive enough to promote competence, especially in more challenging clinical scenarios. As such, these courses could lead to a compromise in patient care.

If you have a passion for periodontics, what better way to express this passion than by sharing your enthusiasm and knowledge-base with dental students. If they sense how much you love periodontics, they will learn to love it as well. Once they learn to understand, love, and respect periodontics, your mentorship will have far-reaching benefits not only for the student, but to the communities where they will practice someday.

Aristotle once said, “Those who know, do. Those who understand, teach.” A student’s questions or comments will cause you, the periodontist, to search into (and thus, better understand) the subject at hand. It is this challenge of scientific inquiry, complemented by dialogue with students and other faculty, that will make you a better, more informed periodontist. By becoming a teacher, you will become a role model who can inspire and encourage students to be the best they can be. It is here where the periodontist can set the dental students in the right direction, giving them the bigger picture, and explaining to them the value of referring to and working with a periodontist. Being a teacher instills respect and admiration among your patients and your colleagues. Patients and referring dentists appreciate the fact that you teach others. It implies that you are an expert in your field. This can only nurture in them a trust and confidence in your decision-making abilities.

Being a teacher will afford you the ability to influence the thinking process of your students. You can make it clear to them that decision making ideally should be scientifically based and modified by personal experience. It should not be based upon emotion, hearsay, or weak scientific evidence. As time goes on you will be able to monitor the growth of your students, and by seeing how they improve with time, you will discover a great personal satisfaction. Your mentorship will make a difference.

There are several other reasons a periodontist should try to include some part-time teaching as an important aspect of his or her career. As you weigh your career options, I ask that you consider this quote from Winston Churchill: “We make a living by what we get, but we make a life by what we give.”
Overlap or integration? The reality of dental specialties

Abstract  In the United States dentists can choose to train and practice in nine recognized dental specialties, in addition to or instead of general dentistry. Specialty training requires a residency or an advanced education program. Current accreditation standards granted by the Commission on Dental Accreditation demand a certain degree of overlap among the specialties as well as with general dentistry.

We anticipate that the role of specialties in dentistry will change in five specific areas: 1. The overlap between specialty areas and general dentistry as well as specialty disciplines will continue to increase. 2. To better serve rural/underserved areas, generalists will increasingly need to deliver dental services that specialists traditionally provided. 3. The practice models of all dental providers, generalists and specialists alike, will change. 4. The number of specialties will increase due to several presently unrecognized oral health disciplines seeking American Dental Association recognition. 5. Implementation of the Affordable Care Act will lead to an increase in pediatric dental patients who are able to access specialty care, thereby increasing the demand for specialty pediatric services.

The authors contend that these changes will not endanger the existence of specialties but will impact the way specialists practice and serve the population.

Key Words: Specialties, Dental; Dental Education; Dental Education, Graduate; Commission on Dental Accreditation; American Dental Association

Introduction

The American Dental Association (ADA) recognized the first dental specialty in 1947. Since that time, the ADA has officially recognized nine specialty programs (in alphabetical order of adoption by ADA): Dental Public Health, Endodontics, Oral and Maxillofacial Surgery, Oral and Maxillofacial Pathology, Periodontics, Pediatric Dentistry, Oral and Maxillofacial Radiology, Orthodontics and Dentofacial Orthopedics, Prosthodontics (table 1). Although several other areas of dentistry require postdoctoral training and advanced knowledge and skills – such as Dental Anesthesiology, Dental Implantology, Geriatric Dentistry, Oral Medicine, Orofacial Pain, and Special Care Dentistry – they do not presently enjoy recognition by the ADA or the right to specialty title.

As each of the nine areas of specialty practice (table 1) has evolved from the general practice model of dentistry, the scope of practice has been expanded to include procedures beyond the training of the general practitioner. In many cases however, general practitioners are not precluded from utilizing techniques and performing procedures more frequently and often exclusively thought of as being within the realm of trained specialists. This, in combination with intraspecialty procedural overlap, contributes to the blurring of lines between specialty and general practice and the educational programs of both.

According to data published by ADA in 2013, 20% to 25% of dentists were in ADA-recognized specialty practices. Because of the 3:1 ratio of generalists to specialists, a well-established referral system is needed. In the past the relationship between general dentists and specialists has not always been mutually beneficial, for reasons that include the following:

1. Generalists vary greatly with regard to what they feel is within their scope of practice and when they feel it is appropriate to refer to a specialist.
2. With recent advances in technology and science, the understanding among generalists may vary extensively as to what types of procedures are performed by specialists.
3. Some generalists feel their role is to provide their patients with comprehensive care, including all disciplines of dentistry, due to the fact that they have limited referral resources.
4. Varying levels of communication issues exist between generalists and specialists regarding the direction and/or modification of treatment plans.
5. Often patients fail to understand the importance of returning to their generalist for treatment and lifelong prevention following specialty care.²

Contemporary factors influencing dentistry include an emphasis on interprofessional education (IPE), new dental colleges with community-based focuses, an increase in mid-level providers, increased implementation of corporate practice models, the luster economy, and rising student loan debt. These influences will have profound and significant effects on the future of dental education and the practice of dental specialties. We maintain that dental specialty transformations will center on the following issues (fig. 1):
1. Overlaps will continue between the scopes of practice of specialty areas and general dentistry, as well as the scopes of practice among specialty disciplines.
2. To better serve rural/underserved areas, generalists will increasingly deliver dental services that were traditionally delivered by specialists.
3. The practice models of many generalist and specialists are likely to change.
4. Several oral health disciplines are seeking ADA recognition as specialties, adding to the number of specialties.
5. Implementation of the Affordable Care Act (ACA) will increase the number of pediatric dental patients able to access specialty care, thereby growing the demand for specialty pediatric services.

<table>
<thead>
<tr>
<th>Dental Specialty</th>
<th>Founding Date</th>
<th>Date of Recognition by ADA Specialty Certifying Board</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dental Public Health</td>
<td>1950</td>
<td>1951</td>
</tr>
<tr>
<td>Endodontics</td>
<td>1956</td>
<td>1964</td>
</tr>
<tr>
<td>Oral and Maxillofacial Pathology</td>
<td>1948</td>
<td>1950</td>
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<td>Oral and Maxillofacial Radiology</td>
<td>1979</td>
<td>2000</td>
</tr>
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<td>Oral and Maxillofacial Surgery</td>
<td>1946</td>
<td>1948</td>
</tr>
<tr>
<td>Orthodontics and Dentofacial Orthopedics</td>
<td>1929</td>
<td>1950</td>
</tr>
<tr>
<td>Pediatric Dentistry</td>
<td>1940</td>
<td>1948</td>
</tr>
<tr>
<td>Periodontics</td>
<td>1940</td>
<td>1948</td>
</tr>
<tr>
<td>Prosthodontics</td>
<td>1946</td>
<td>1948</td>
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Source: www.ada.org/~/media/ADA/Education%20and%20Careers/Files/edel_2015_specialty_certifying_board_rpt.ashx

The Future of Dental Specialties

Overlapping Scopes of Practice

The first issue involves the overlap of the scopes of practice between generalists and specialists, as well as among specialists. Changes over time in the Commission on Dental Accreditation (CODA) standards for postgraduate education programs reflect multiple areas of overlap among the specialties (table 2).³ New competencies encouraging interspecialty collaboration, such as increased IPE experiences and increased research-intensive health science center involvement, have been added.

In a survey of all postgraduate dental directors in 1987, Landesman et al.³ found overlap among specialties ranging from 7% to 37%. Specifically, the researchers noted overlapping between Oral Maxillofacial Surgery and Periodontics, Pediatric Dentistry and Orthodontics, Endodontics and Prosthodontics, and Oral Maxillofacial Surgery and Prosthodontics, among others.
One area of significant overlap between the specialties and general dentists is dental implantology. Historically, oral surgeons generally placed osseointegrated titanium dental implants. However, organized periodontology groups determined that dental implant placement was within that specialty’s scope of practice in the 1990s. Today, a variety of dental practitioners – including general dentists, periodontists, prosthodontists, and endodontists – are placing implants. In fact, even predoctoral students are encroaching on the traditional ground of prosthodontists via the fabrication of implant-supported mandibular overdentures in persons with severe ridge resorption. Additionally, a majority of endodontists (57%) supported overlap in scope with their specialty when surveyed about implant placement. In practice, however, a limited number of endodontists (<10% nationally) have begun to place dental implants.

When general dentists were surveyed regarding implant placement by endodontists, 66% opposed the practice and 73% indicated that they would not refer patients to an endodontist for implant placement.

CODA standards drive this overlap to some extent. For example, the CODA standards for endodontic training programs mandate the clinical and didactic instruction of procedures traditionally reserved for prosthodontists, orthodontists, periodontists, etc., such as the placement of implants, the fabrication and installation of posts and cores, and the orthodontic extrusion of teeth (table 2). The current CODA standards require that prosthodontic residents receive surgical training to learn preprosthetic and implant procedures, training that has been traditionally part of the surgical specialties. Similarly, other CODA standards dictate that periodontal residents receive training in implant restorative procedures, activities that restorative dentists had addressed (table 2). These areas of conflict and overlap can be found during training, as well as when graduates move into specialty private practice.

Additionally, significant overlap exists between orthodontics and pediatric dentistry. Although ethical concerns may arise when one specialty is treating patients outside the scope of its accredited educational program, orthodontics and pediatric dentistry have much in common because both deal with a similar population base and both seek to improve the health and aesthetics of children and adolescents. Yet historically the perceived overreaching of each specialty program into the other’s territory has caused consternation as far back as 1966, when Sydney Kohn wrote the article “Can Pedodontics and Orthodontics be Combined in Practice?” He purported that the scope of pediatric dentistry had expanded beyond behavior management and dental caries to include guidance of the dentition into normal occlusion.
### Table 2: Areas of Overlap Among American Dental Association-Recognized Dental Specialties as directed by the Respective Commission on Dental Accreditation (CODA) Standard

<table>
<thead>
<tr>
<th>Dental Specialty</th>
<th>CODA Standard Number</th>
<th>CODA Standard Description That Presents Overlap With Other Specialties</th>
<th>Overlapping Specialties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endodontics</td>
<td>4-10b</td>
<td>The educational program must provide clinical and didactic instruction in placement of intraradicular restorations and cores in endodontically treated teeth; when the patient is referred, this treatment is accomplished in consultation with the restorative dentist</td>
<td>Prosthodontics</td>
</tr>
<tr>
<td>Pediatric Dentistry</td>
<td>4-8a</td>
<td>Clinical Experiences: Clinical experiences must enable students/residents to achieve competency in: Diagnosis of dental, skeletal, and functional abnormalities in the primary, mixed, and young permanent dentition stages of the developing occlusion; and</td>
<td>Orthodontics</td>
</tr>
<tr>
<td></td>
<td>4-8b</td>
<td>Treatment of those conditions that can be corrected or significantly improved by evidence-based early interventions which might require guidance of eruption, space supervision, and interceptive orthodontic treatments. These transitional malocclusion conditions include, the recognition, diagnosis, appropriate referral and/or focused management of: 1. Space maintenance and arch perimeter control associated with the early loss of primary and young permanent teeth; 2. Transverse arch dimensional problems involving simple posterior crossbites; 3. Anterior crossbite discrepancies associated with localized dentoalveolar crossbite displacement and functional anterior shifts (e.g. pseudo-Class III); 4. Anterior spacing with or without dental protrusion</td>
<td>Orthodontics</td>
</tr>
<tr>
<td>Periodontics</td>
<td>4-10.2d</td>
<td>Clinical training in dental implant therapy to the level of competency must include provisionalization of dental implants</td>
<td>Prosthodontics</td>
</tr>
<tr>
<td></td>
<td>4-11</td>
<td>The educational program must provide training for the student/resident in the methods of pain control and sedation to achieve: a. In-depth knowledge in all areas of minimal, moderate and deep sedation as prescribed by the ADA Guidelines for Teaching Pain Control and Sedation to Dentists and Dental Students; and b. Clinical training to the level of competency in adult minimal enteral and moderate parenteral sedation as prescribed by the ADA Guidelines for Teaching Pain Control and Sedation to Dentists and Dental Students</td>
<td>OMFS</td>
</tr>
<tr>
<td>Prosthodontics</td>
<td>4-16</td>
<td>Students/Residents must participate in all phases of implant treatment including implant placement.</td>
<td>Periodontics</td>
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<tr>
<td></td>
<td>4-17</td>
<td>Students/Residents must be exposed to preprosthetic surgical procedures  Intent: Surgical procedures should include contouring of residual ridges, gingival recontouring, placement of dental implants, and removal of teeth</td>
<td>OMFS</td>
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To better serve rural and other underserved areas, generalists will increasingly need to provide dental services traditionally delivered by specialists.

The past 15 years have witnessed an exponential increase in the number of new dental colleges opening within the United States. Between 1997 and 2015, 13 new dental schools have opened their doors. This increase in new schools was almost double the number of dental schools that were closed between 1986 and 2001. Additionally, although the number of dental school applicants has remained stable since 2007, the number of first-time enrollees has increased by 15.8%. This trend has alarmed oral healthcare professionals: "It is concerning that at a time when utilization of dental services has remained flat and 37% of general practice dentists report they are not busy enough, we are producing more dentists."

In the past, most dental schools were affiliated with academic medical centers and/or traditional allopathic medical schools. In contrast, many of the new dental schools are affiliated with osteopathic medical institutions. The osteopathic or holistic approach centers on primary care and not necessarily specialty care. A community-based approach to dental education theoretically teaches students to manage all areas of oral healthcare. This primary focus on comprehensive patient care includes procedures that have historically been referred to specialists.

An important component of dental education is learning when to attempt to treat a complex case and when to refer patients to a specialist. The ADA Council on Dental Practice requires that "appropriate referrals are an integral part of complete quality healthcare management." Despite the implementation of this requirement, in many cases procedures are not properly outsourced. The current periodontal landscape is indicative of this failure to utilize specialty consultation. Current periodontal literature states that despite the fact that periodontal disease prevalence and severity have not decreased dramatically over the past 20 years, the number of referrals to periodontists has decreased overall while today's referrals involve patients with more severe disease and a greater need for dental extractions. The decline in the periodontal referral pattern is a result of general dentists providing increased periodontal services to patients than in the past.

The American Academy of Periodontology acknowledges this trend and believes that in the future most treatment for slight to moderate periodontal diseases will be rendered by generalists and auxiliaries. Therefore, general dentists and hygienists should receive ongoing training so they can maintain an acceptable standard of periodontal care for their patients. The importance of teaching dentists and dental students to collaborate with periodontists is paramount to the future of periodontics. For instance, 61.9% of surveyed dentists reported that they felt confident in their skills to diagnose aggressive periodontitis, but about one-third (36.6%) were not confident in treating advanced periodontitis. Although generalists may perform any procedure they feel comfortable with, they must be aware of the accepted standard of care and when to refer their patients to specialists. However, research has shown that referrals are not always based on the clinical condition of the patient, but sometimes stem from the relationship between the general practitioner and the specialist. Specialists encourage referrals through helping to educate generalists and by encouraging better communication between the two parties.

According to the American Academy of Pediatric Dentistry (AAPD), an ethical obligation exists to provide treatment to patients with oral and systemic diseases or disabilities whose treatment needs are beyond the skills of the practitioner; therefore, generalists must refer these patients if they feel unsuited to provide the necessary treatment. The organization's policy statement states "Dentists have an ethical obligation to provide therapy for patients with oral disease or refer for treatment patients whose needs are beyond the skills of the practitioner."

Some practitioners are concerned whether future students trained in a generalist system will receive the appropriate education in when a referral is necessary. Jarosz et al. demonstrated that a correlation may exist between dentists’ referral patterns and their exposure to a specialty – both clinically and didactically – during their dental school training.

The third transformation we anticipate relates to definitive changes in the practice models of all dental providers, generalists and specialists alike. Among the factors influencing practice models are high levels of educational debt.

Student loan debt is approaching $1 trillion, and is the only type of consumer debt that has grown since 2008. In the fourth quarter of 2012, student loan debt eclipsed both automobile loans and credit card debt ($660 billion), making student loans the second largest form of consumer debt after mortgages. Student loan balances almost tripled between 2004 and 2012 due to increasing numbers of borrowers and higher balances per person.

The number of borrowers that are past due on their student debt is approximately 17%, which represents a 7% increase from 2004. Furthermore, the transition rate of borrowers in repayment from current to delinquent has been rising since 2008, from 6% to 9%. Cobb et al. also showed that today's dental graduates must repay, on aver-
Increasing Number of Specialties

age, larger education loans than dentists in earlier cohorts. This significant debt may reduce the number of dental students pursuing postdoctoral education. Also, as an example of other affects, they speculated that higher debt could lead new dentists to try to retain more patients for periodontal treatment and maintenance rather than refer patients to periodontists. Because of a dentist’s financial considerations, some periodontal patients may receive care from less experienced dentists who do not understand the need for specialist intervention.

Additionally, the current economic situation and the amount of debt acquired by dental students have led to newly graduated specialists practicing in general dentistry offices. Schwartz outlined the advantages of specialists working in generalist offices in 2007. Benefits of such cooperation include better communication between dentists and specialists; a comfortable and familiar environment for the patient, resulting in less stress; and enhanced patient trust and loyalty for the general dentist who provides oversight on all aspects of treatment. Patient health records may all be maintained in one facility, improving access and preventing information security breaches. Patients may prefer one-stop shopping where all services, health records, and billing issues are provided under the same roof. Schwartz also noted that such a practice design presents some unique challenges that include the generalist’s staff requiring additional training to assist the specialists and communicate with patients, the need for a clear understanding of job descriptions, proper informed consent, guardianship, and the need for appropriate financial arrangements between the generalist and the specialist.

Dental practice has long mirrored the medical model, most recently demonstrated by the transition from solo practices to group practices, corporate practices, and alternative practice models. Just as physicians in the 1980s formed independent practice associations to compete with large medical groups, dentists may need to consider doing the same. In analyzing its data on individual dentists, the ADA Health Policy Resources Center (HPRC) has concluded that the rate of solo practitioners is falling: In 2010, 69% of dentists were solo practitioners compared with 76% in 2006. One reason for the decrease of solo practices is that many graduates do not have the resources to purchase their own practices.

Some ADA-recognized specialty organizations are also closely monitoring the impact of large group practices on their membership. The American Association of Orthodontists (AAO) surveyed 2009–2011 graduates and found that 16% of respondents were practicing in nontraditional settings, defined as either an interdisciplinary practice or a practice where they are employees or independent contractors. The AAO executive director commented, “Overall, our membership is still at 69% in solo practice, 16% in partnerships, 6% percent in associateships, 4% in interdisciplinary practice, and 5% in large corporate practice.” The traditional orthodontic practice includes a single practitioner or a single practitioner with an associate or two and is community based. We are following trends whereby recent graduates are moving into larger group-type practices and multidisciplinary practices due to economic factors, such as the need to start practicing right away to finance educational debt and the fact that fewer orthodontists are retiring because of the economy.

The practice model of generalists is also undergoing changes. According to the HPRC, the number of large dental group practices has risen 25% in just over 2 years. Corporate practices thrive on efficiencies of scale and marketing. They can negotiate discounts with suppliers and laboratories, as well as reimbursement rates with insurance companies. As noted earlier, the economy is also having an impact. One-stop dentistry for the whole family appeals to much of the population. As this model continues to grow, the need for specialists within corporate practices will increase.

Additionally, interest is growing in the incorporation of nondentist providers into the oral healthcare team. One category of provider, dental therapists, may help increase the utilization and the productivity of general practice dentists. Specifically, a dental therapist can complete routine restorative care so the general practice dentist can focus on complex care such as implants, root canals, complex prosthodontic cases, and exodontia. This use of an advanced practice provider may decrease referrals to specialists because the collaborating generalist delivers more complex care that historically would have been referred to a specialist.

Dental care delivery will continue to evolve while the current economy and educational debt load of graduates will result in changing practice models for both generalists and specialists. The authors recommend that the dental community embrace changing practice models, as well as adapt its current thinking and education system to better equip future dentists to provide quality care. To do so will require the engagement of specialists and generalists.

The fourth transformation relates to an increase in the number of specialties in the future. In 1933, the field of medicine recognized only four specialties: dermatology, obstetrics/gynecology, ophthalmology, and otolaryngology. At that time, the American Medical Association (AMA) controlled the specialty recognition process and prevented new and emerging medical specialties—a cardiology and pediatrics—from receiving medical specialty recognition. As opposition mounted within these emerging medical specialties, the American Board of Medical
Specialties (ABMS) was formed, independent from AMA oversight. Accordingly, the ABMS has recognized 24 medical specialties to date. Concern has recently risen over medicine being too specialized as a result of the AMA losing control of the process. However, when a process is inoperative, the natural state of affairs is that alternative processes will eventually emerge.

By comparison, during the past 40 years dentistry has brought in only one new dental specialty, Oral and Maxillofacial Radiology. Because knowledge and patient-oriented therapeutics are advancing quickly, we suggest that new specialties should be considered. The following groups are currently not recognized but have expressed interest in acquiring CODA recognition in the future:

DENTAL ANESTHESIOLOGY: The study of how to relieve pain through advanced use of local and general anesthesia techniques. The ADA House of Delegates rejected this field’s attempt for recognition as a dental specialty in October 2012.27

GERIATRIC DENTISTRY: The delivery of dental care to older adults, including the diagnosis, prevention, and treatment of problems associated with normal aging and age-related diseases as part of an interdisciplinary team with other healthcare professionals. Currently, this specialty is not recognized in the United States; however, Brazil recently recognized it formally.28

ORAL MEDICINE: Concerned with the oral healthcare of medically complex patients and with the diagnosis and nonsurgical management of medically related disorders or conditions affecting the oral and maxillofacial region. The American Academy of Oral Medicine has stated that providing the specialty with ADA recognition should help patients’ ability to find experts who can provide successful diagnoses and therapies.29,30

OROFACIAL PAIN: Includes the assessment, diagnosis, and treatment of patients with complex chronic orofacial pain and dysfunction disorders, oral motor and jaw behavior disorders, and chronic head and neck pain, as well as the pursuit of knowledge of the underlying pathophysiology and mechanisms of these disorders. The American Academy of Orofacial Pain submitted an application for recognition as a dental specialty to the ADA in 1999. In February 2008, CODA adopted a resolution to establish an accreditation process for orofacial pain advanced general dentistry education programs. Orofacial pain programs are currently applying for and becoming accredited by CODA.31

SPECIAL NEEDS DENTISTRY OR SPECIAL CARE DENTISTRY: Concerned with the oral health of people with intellectual disabilities or who are affected by other medical, physical, or psychiatric issues. This specialty is not recognized in the United States but is in the United Kingdom.

Dental professionals must give consideration to supporting the recognition of additional specialty programs to increase access to care for the most complex and challenging patients, who may not be receiving appropriate care through our current system of practice.

The ACA is the fifth factor with a potential impact on the future of dental specialties. The ACA will increase the number of pediatric dental patients able to access specialty care because pediatric dental care is one of ten essential health benefits that must be offered to families as a part of the law. The ACA is expected to provide comprehensive dental benefits to an estimated 8.7 million children by 2018. Roughly one-third of this increase is expected to come from patients covered via Medicaid and two-thirds from patients with private dental benefits. The ACA mandate will reduce the number of children without dental benefits by about 55% relative to 2010 levels.29 Because the use of dental care is closely tied to the availability of dental benefits, the expansion of dental benefits is expected to generate an additional 13.8 million pediatric dentistry visits per year, about 20% of which will be financed by Medicaid.32 However, the increase in visits to pediatric dentists is not expected to translate into a significant increase in visits to orthodontists because Medicaid guidelines limited orthodontic coverage to medically necessary care.

The level of the increase in visits to pediatric dental specialists may be diminished as ACA implementation continues to evolve. One factor relates to whether pediatric dental benefits are included as a part of a qualified medical health plan (embedded) or if they are offered as a stand-alone dental plan that is purchased in conjunction with a qualified medical health plan. The answer will impact the amount of deductibles and out-of-pocket expenses that are applied to pediatric dental coverage.32 Additionally, federal law dictates that when a pediatric dental benefit is offered in an exchange on a stand-alone basis, employers and individuals are not required to purchase it.

The following conclusions about the future of dental specialties are based on the above review of the literature:
1. Overlap will continue between the scopes of practice of specialty areas and general dentistry, as well as among specialty disciplines.
2. To better serve rural/underserved areas, generalists will increasingly need to deliver dental services that traditionally have been provided by specialists.
3. The practice models of many generalist and specialists are likely to change.
4. Several presently unrecognized oral health disciplines are seeking ADA recognition as specialties. Therefore, we anticipate an increase in the number of specialties in the future.
5. Implementation of the ACA will increase the number of pediatric dental patients who will be able to access specialty care, thereby raising the demand for specialty pediatric services.

Significant information available – both evidence-based and anecdotal – supports the idea that the dental profession and dental education are at a crossroads. Professionals must invest their energies into steering the field over the next 20 years.

Additionally, when thinking beyond oral health professions, new dual or multispecialty certificate programs that include interprofessional healthcare teams may prove valuable in managing access-to-care issues and the proposed changes in dental education and IPE. Oral medicine specialists have begun partnerships with physicians and other healthcare providers serving the chronically ill in hospital or outpatient settings. Geriatric care dentists working with gerontologists or special needs dentists teaming with psychologists and mental health professionals represent other possible combined programs. Hence, the need for specialty programs will remain in order to meet the demands of our changing world.

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REVIEW STUDIES

• REVIEW / Implants

**Alveolar bone architecture: a systematic review and meta-analysis**

**BACKGROUND** The study purpose was to evaluate bone microarchitecture at the different regions of the human oral cavity and the anatomic/intrinsic factors that could influence them.

**METHODS** Electronic and manual literature searches with PICO question and outcome measures were conducted. Problem: complete/partial edentulous ridges with nonatrophic ridges; Intervention: direct bone microstructure assessment in living individuals or human cadavers; Comparison: anatomic sites maxillary vs. mandibular, anterior vs. posterior; Outcome: primary outcome was total bone volume (TBV) which measures bone gain/loss. Secondary parameters included trabecular thickness, trabecular spacing, trabecular number, and trabecular pattern. Other parameters included structural model index (measures plate or rod-like trabeculae), degree of anisotropy (the most important component of biological strength, bone mineral density, and microscopic bone composition). Articles were included if they were randomized controlled prospective, cohort or case studies, which measured bone volume. Factors retrieved from the studies included study design, number of biopsies, specimen, age, sex, location, vertical dimension, horizontal dimension, atrophy condition, thickness of cortical plate, and woven and lamellar bone percentage. 24 articles met the criteria out of the original 800 articles. All articles were prospective or retrospective aimed at studying alveolar bone density.

**RESULTS** TBV in maxillary/mandibular anterior sites was higher than those of posterior sites and higher in living individuals vs. cadavers. Total bone volume was lower in atrophic sites compared with nonatrophic sites.

**DISCUSSION** Bone density has been a crucial factor in implant osseointegration. In bone regeneration osteocyte lacunar density changes, they control resorption of the matrix and have sensors for biomechanical loading for remodeling. In fracture healing (an implant placement) lacunar density is twice as high in woven bone compared with lamellar bone. Results from this study showed TBV based on location and atrophy negatively influences TBV. Bone volume should not be based just of location; CBCT should be used to also assess architecture.

**CONCLUSIONS** No differences were seen in TBV in regards to anatomic location. There was a correlation in which atrophied bone showed a lower TBV when compared with nonatrophic sites. [AGG]


**Dimensional changes after immediate implant placement with or without simultaneous regenerative procedures: a systematic review and meta-analysis**

**BACKGROUND** This study analyzed alveolar ridge volume changes after immediate implant placement, with or without a regenerative technique.

**METHODS** An electronic search conducted using Medline and Embase to investigate the effect of immediate implant placement on ridge dimensional changes. Weighted mean changes (WMC) between baseline and follow-up time were calculated and subgroup analysis was performed per study design, evaluation method, and regenerative strategies.

**RESULTS** After immediate implant placement alone, WMC of RCTs showed a loss in width and height of 1.1 mm. After flapless immediate implant placement with immediate provisionalization and a graft, WMC showed a loss in width and height of 1.02 mm and 0.79 mm, while after flapped immediate implant placement and a graft, WMC showed a gain of 1.79 mm. After immediate implant placement plus a non resorbable membrane, WMC showed a loss in height of 0.07 mm. After immediate implant placement plus a resorbable membrane and a graft WMC showed a gain in height of 1.09 mm.

**CONCLUSIONS** Immediate implant placement does not seem to counteract alveolar ridge modelling after tooth extraction. However, conclusive statements regarding the efficacy of a concomitant regenerative technique in preventing the amount of alveolar reduction cannot be made with the current evidence. [SH]

Systematic review of soft tissue alterations and aesthetic outcomes following immediate implant placement and restoration of single implants in the anterior maxilla

**Background** Immediate placement of an implant into a fresh extraction socket reduces overall treatment time, as socket healing and osseointegration occur simultaneously. Combined with immediate restoration, this can mean less time, fewer procedures, and higher patient satisfaction. Reviews show that survival rates for immediate placement and restoration can rival those of traditional protocols, but aesthetic outcomes are still inconclusive. This systematic review aims to assess soft tissue dimensional changes with the immediate placement/restoration protocol for single teeth in the maxillary anterior.

**Methods** A literature search was conducted for prospective studies (RCTs, clinical trials, cohort studies, case-control studies, and case series) with a minimum of 10 human subjects and a minimum follow-up time of 1 yr. Mid-facial and papillary soft tissue changes were recorded and the data pooled. Flap employment, tissue biotype, and use of CTG were analyzed as variables that might influence tissue changes.

**Results** 19 studies met the criteria for inclusion, including data on 472 patients with 485 implants. Mid-facial tissue showed a mean overall recession of 0.27 mm after a follow-up of 1 to 5 yr. Most of these changes happened in the period between placement and definitive restoration. In the year following placement of the definitive restoration, a slight regrowth (0.04 mm) was seen. 5 studies showed a small (0.01 mm) loss of midfacial height after 1 yr. Papillary tissue showed a mean overall recession of 0.23 mm at final follow-up. Again, most changes happened between placement and final restoration. Papillary regrowth was seen in the year following final restoration (0.13 mm) and up to final follow-up (0.07 mm). Thin biotype did not show a negative effect on soft tissue change. CTG with bone graft showed no benefit over bone graft alone. The use of a flap did not show any detrimental effect on soft tissue change. Regarding the incidence of advanced (>1 mm) tissue change, this analysis excluded high-risk cases and use of CTG. The pooled data showed an incidence of 11.02% of advanced midfacial recession from 4 studies. 11% of patients were not satisfied with their restorations after a 2 to 8 yr follow-up.

**Discussion** It was interesting that while a thick biotype is often a prerequisite for immediate placement and restoration, this review showed no correlation with biotype and tissue recession. Likewise, flapless surgery appears to confer no advantage on tissue outcomes, though it may be advantageous to use a flapless technique when trying to provisionalize. From the data available, the authors could not determine whether a bone graft in the space between the implant and socket wall conferred an advantage, but it seems that simultaneous CTG gave no advantage. Mean values for midfacial and papillary recession were similar to those from other reviews. Interestingly, tissue rebound was seen for both in the year following final restoration.

**Conclusions** Immediate placement and restoration appears to give minimal changes in marginal tissue, regardless of biotype, flap design, and grafting.


**Review / Surgical**

Piezoelectric surgery vs rotary instruments for lateral maxillary sinus floor elevation: a systematic review and meta-analysis of intra- and postoperative complications

**Background** Though the lateral window sinus augmentation is a highly predictable and successful procedure for site development, there are several complications that can accompany that technique. Those include damage to adjacent teeth, alveolar ridge fracture, and bleeding related to injury to the arterial anastomoses at the lateral sinus wall area. But perforation of the membrane is still the most common complication, reported up to 58.3% prevalence. Bone cutting instruments, such as a high-speed hand piece, lack precise tactile sensitivity when determining cutting depth, thus may lead to iatrogenic injury to surrounding vital structures. Overheating of bone for over 1 min can generate up to 47° and cause bone necrosis. Use of piezoelectric devices (PEDs) is a newer widespread method of atraumatic cutting without trauma to vital structures. PEDs also require a prolonged operator time compared with conventional drills. The purpose of this study was to evaluate the use of PEDs in comparison with conventional drills with respect to intraoperative complications, operating time, and failure rate of oral implants placed in the posterior maxilla after lateral window sinus augmentation. This systematic review set out to answer 3 questions: Does the use of piezoelectric surgery minimize membrane perforations; require reasonable time; and improve survival rate of oral implants?

**Methods** Only 4 articles met inclusion criteria and were included in the review.

**Results** Rate of membrane perforation was reported in all included trials; perforation size was described in only 2 trials. The overall meta-analysis found no significant difference between the 2 techniques in the rate of membrane perforation. In operat-
Long-term effect of four surgical periodontal therapies and one non-surgical therapy: a systematic review and meta-analysis

BACKGROUND The end-point of eliminating pathogenic biofilm and creating a biologically acceptable root surface may be achieved surgically or nonsurgically. It has been assumed that the results obtained in terms of PD and CAL change depend on the method of treatment and the initial probing depth. Long-term data has shown that both surgical and nonsurgical periodontal treatment may yield good PD reduction and CAL gain for initially moderate and deep pockets, but tend to favor surgical treatment. The effects on initially shallow pockets have been mixed. This study aims to evaluate the long-term (>2 yr) effect of surgical therapies (MWF, OS, OFD, SC) and nonsurgical therapy in treating PD with different initial probing depths.

METHODS Prospective, controlled clinical trials involving at least 10 patients diagnosed with chP were included. They also must have at least 2 yr of follow-up and report PD and CAL change. The primary outcome was CAL gain, and the secondary outcome was PD reduction. The percentages of these outcomes were stratified by initial probing depth (1–3, 4–6, 7+ mm), meta-analyzed, and reported based on treatment modality.

RESULTS 8 studies met the inclusion criteria. 7 studies involved the MWF, 3 involved OS, 2 involved OFD, and 1 involved SC. All used SRP as the nonsurgical treatment. All patients in the studies received regular periodontal maintenance every 3 to 6 mo following therapy. CAL changes (percent difference for SRP, MWF, and OS, respectively): in 1 to 3 mm PD, treatment resulted in 23.2%, 39.4%, and 61.39% attachment loss. In 4 to 6 mm PD, treatment resulted in 8.4%, 6.5%, and 5.22% gain. In 7+ mm PD, treatment resulted in 9.8%, 14.2%, and 9.38% gain. PD changes (percent difference for SRP, MWF, and OS respectively): in 1 to 3 mm PD, treatment resulted in 2.5%, 3.3%, and 6.3% increase. In 4 to 6 mm PD, treatment resulted in 18.7%, 25.4%, and 30.8% reduction. In 7+ mm PD, treatment resulted in 21.6%, 33.1%, and 42.8% reduction.

DISCUSSION In shallow PD, both surgical and nonsurgical treatment resulted in a loss of CAL. In modPD, MWF had significantly higher PD reduction than SRP. However, surgical therapy resulted in significantly greater AL than SRP. No significant difference was found in PD reduction between SRP and OS for modPD. In deep PD, OS had significantly higher PD reduction than SRP. No significant difference was found between SRP and MWF for deep PD. The authors make the following conclusions for clinical practice: in initially moderate PD, SRP is preferable because it might result in less CAL loss, and if deep PD...
is present and indicated for surgery, OS results in higher PD reduction than other treatments. They also propose the critical probing depths of 5.4 mm as the cutoff for surgical intervention. While certainly useful, these results have already been well elucidated in studies by Becker, Kaldahl, and Ramfjord.

CONCLUSIONS Neither SRP nor surgical treatment are indicated for shallow PD. SRP is a better first intervention for moderate PD. OS is the most effective treatment for deep PD.


CLINICAL STUDIES

Prevalence and predictive factors for peri-implant disease and implant failure: a cross-sectional analysis

BACKGROUND Periimplant diseases have been classified as either periimplant mucositis or periimplantitis, with both described as infectious diseases. Periimplant mucositis is an inflammation around the implant and associated with BoP. Periimplantitis is defined by the similar features but with BL beyond normal remodeling after connection of the implant abutment interface. Prevalence of periimplant mucositis is around 63.4% of individuals and 30.7% of all implants; periimplantitis of 18.8% of individuals and 9.6% of implants. Poor OH, history of PD, and smoking are greater risk factors. The purpose of this study was to identify possible risk factors for implant loss and periimplant diseases and to use those risk factors to form a predictive model for periimplantitis and implant loss.

METHODS 225 implants were placed in 96 patients at baseline. Implants were restored with cement or screw-retained prosthesis. Patient charts included date of placement, brand, dimensions, staging, graft use or not, antibiotic use, smoking status, and health status at placement. A comprehensive periodontal examination was performed using a periodontal probe to record PD and AL at 6 sites per tooth or implant; a radiograph and photograph were taken of each implant. Recession, keratinized tissue (KT), and restoration type (cement or screw-retained) were recorded for each implant. Periimplant mucositis is defined as the presence of BoP and/or gingival inflammation with no evidence of radiographic BL beyond normal remodeling. Periimplantitis was defined as the presence of BoP and/or suppuration, with 2 mm of detectable BL after initial remodeling, and PD of 4 mm. 4 patients presented for the exam that had lost the implant of interest and were not included in the study.

RESULTS The implant failure rates were 19 of 225 (8.4%) which is 16 of the 96 patients (16.7%) of patients. Those patients who had failed implants, 18 of the 19 implants were from patients with periodontitis at placement. There were significant associations between implant failure and diabetes at baseline and at the time of the follow-up examination and between implant failure and immediate implant loading. In addition, the risk of implant failure was significantly greater as the implant increased in diameter. No associations were found between implant failure and smoking status, restoration type, use of antibiotics at the time of implant placement. Patient-level prevalence of periimplant mucositis and periimplantitis was 48% and 26%, respectively. The implant-level prevalence of periimplant mucositis at the follow-up examination was 33% and periimplantitis prevalence was 16%.

DISCUSSION Among the implants examined, the prevalence of periimplantitis was somewhat higher in patients with mild periodontitis at the time of placement than those who were healthy or had gingivitis. The association with mild periodontitis was statistically significant. Associations with moderate and severe periodontitis at baseline were not statistically significant. The prevalence of periimplantitis was significantly associated with severe periodontitis at follow-up compared with healthy status or gingivitis.

CONCLUSIONS This predictive model found greater risk of periimplantitis or implant loss associated with diabetes at the time of implant placement, periodontal disease at the time of implant placement, younger patients at the time of placement, and larger-diameter implants.


Treatment of peri-implant bone defects with platelet-rich fibrin

BACKGROUND The study aim was to examine the clinical effectiveness of PRF application in peri-implant bony defects compared with unfilled controls.
**Methods** 19 patients (8 women, 11 men) with two or more nonadjacent implants with PD >5 mm, and/or suppuration, and radiographic bone loss >2 mm were included within the study (n=38 implants). In a patient, 1 implant would be randomly assigned to the control (flap surgery) group and the other would be assigned to the test group (flap surgery+PRF treatment). Periimplant examination included PD, CAL, KM (keratinized mucosa level), recession, plaque level (PL), suppuration, BoP were measured. PRF was prepared using the Choukroun’s protocol and modified into PRF plugs and membranes. Bone defects were measured intrasurgically and classified per the Schwarz criteria. Implant surfaces were decontaminated and detoxified using a PeriBrush and 4% pH 1 citric acid solution for 3 min or tetracycline HCl solution. No additional treatments were applied to control group Test group received PRF plugs placed over suprabony components of the defect. The flaps were then replaced and sutured and the patients were given postop instructions. Metronidazole 500 mg t.i.d. for 7 d was prescribed.

**Results** Mean PL and BoP remained unchanged at all evaluation periods which were conducted at 3 and 6 mo. PD levels of the PRF group at 6 mo were a mean of 3.30 mm, which was statistically significantly lower than control. Reductions of both groups were found at 6 mo evaluation. PRF group showed significantly greater gain in CAL. Recession and KM for either group was not significantly different.

**Discussion** The results of this study showed that periimplant defects treated with PRF was clinically more effective that with access flap surgery alone. Regardless of defect dimension and configuration it was shown that PRF reduced PD levels and increased CAL. From this study, the author suggests that PRF can be an inexpensive and effective way to treat periimplant bone defects. [DL]


**Food impaction and periodontal peri-implant tissue conditions in relation to the embrasure dimensions between implant-supported fixed dental prostheses and adjacent teeth: a cross-sectional study**

**Background** The study aim was to evaluate food impaction and periodontal periimplant tissue conditions in relation to embrasure dimensions between implant-supported FDPs and adjacent teeth.

**Methods** 100 patients were included in the study. FDPs were fabricated after 3 to 6 mo of healing. 204 implants supporting 150 FDPs were studied where 97 FDPs were single implants, 43 were by 1 implant, 9 by 3 implants, and 1 by 4 implants. 215 proximal embrasures between implant and teeth were studied; the mean follow-up time was 55 mo post FDP delivery. Clinical assessment, radiographic assessments, patient assessments, and statistical analyses were completed.

**Results** Food impaction was reported in 44.7% embrasures. Proximal contact loss significantly influenced food impaction, and patient satisfaction was significantly influenced by food impaction in the proximal embrasures. Out of the embrasure analyses, surface area was the only significant factor influencing food impaction. Periodontal periimplant mucosal conditions were not different between the food impaction and impaction groups in the univariate analysis.

**Discussion** A previous study showed papilla fill between implants and teeth being correlated to food impaction. However, this study does not show any significant relationship between food impaction and papilla fill. The reason for this may be due to the dichotomized grouping of the papilla in this study.

**Conclusions** Food impaction between implant-supported FDPs and adjacent teeth occurred more frequently when the proximal contact was lost and ESA increased. [DVI]


**Short implants placed with or without grafting in atrophic sinuses: the 3-year results of a prospective randomized controlled study**

**Background** The aim of the study was to compare the clinical and radiographic outcome of short implants (8 mm) placed in residual bone height of <4 mm or more when osteotome sinus floor elevation is done with or without grafting.

**Methods** All treatment procedures were conducted in a private practice setting. The control group used Bio-Oss and the test group did not use any graft. After 8 wk of healing, impressions were taken and crowns fabricated. Standardized periapical radiographs were taken immediately after surgery, at 8 wk, and 1 and 3 yr. The graft height above the implant was measure in the control group.

**Results** 12 patients were enrolled and 37 sites were treated. 17 implants were placed without grafting and 20 with. The mean healing time was 2.6 mo. The overall implant success rate was 91.9% after 3 yr, 94.1% for the test group and 90.0% for the control group.

**Conclusions** This study showed that short, tapered implants can be placed with good primary stability in atrophic maxillae. Grafting is not necessary to attain a osseous bone gain of 4.1 mm, however, greater osseous bone gain is achieved when grafting is inserted. [RP]
Implant-supported mandibular overdentures can minimize mandibular bone resorption in edentulous patients: results of a long-term radiologic evaluation

**BACKGROUND** Supported by the theoretical Wolff law, which states that changes in function lead to changes in structure, it has been suggested that functional loading and light irritative stimuli could lead to changes in bone architecture and volume. As such, many feel that loading mandibular implants could stimulate bone apposition in the distal area of the osseous crest. Studies of this principle have yielded mixed results. A study by Jacobs found minimal resorption in patients wearing a fixed prosthesis, but increased resorption in patients wearing an overdenture compared with a conventional denture. Betts found bone apposition in patients with fixed restorations on transmandibular implants. De Jong found lower resorption rates when 4 implants were used to support an overdenture rather than 2. The heterogeneity of these results inspired this study, which aims to radiographically assess bone height changes in the posterior mandible after loading with an overdenture supported by 2 or 4 implants.

**METHODS** 110 patients were selected from the ongoing Breda Implant Overdenture Study. One-third of the BIOS patients received overdentures on 2 implants with ball attachments, one-third received overdentures on 2 implants with a single bar, and one-third received “mainly implant-supported overdentures on 4 implants.” 82 of the patients could be included in the study 18 yr after initial treatment. The number of radiographs per patient varied from 3 to 21, with a mean of 8. The mean follow-up time ranged from 1 to 17 yr, with a mean of 10.5 yr. All radiographs were evaluated 4 times by the same observer in random order. The length of the implant was used to calculate the height of the mandible in the designated area.

**RESULTS** The average bone height difference before and after treatment was 0.51 mm (reduction), which was statistically significant. The subjects showed great variation in bone loss and apposition over time and a clear pattern could not be identified.

**DISCUSSION** The authors conclude that the study gives no support to the idea of bone apposition in response to overdenture wear, but the amount of bone resorption remains clinically insignificant. In the context of other studies, this agrees with the findings of Kordatzis, who found a mean 0.69 mm bone loss over 5 yr in patients with overdentures. This seems to support the idea that implant-borne prostheses have a beneficial effect on the preservation of bone volume.

There did not appear to be any stratification of the results by the different treatment (2 implants on a ball vs. bar, or 4 implants). Also, magnification is not always uniform across the film; therefore, calibration by the implant does not always guarantee an accurate measurement. Also, as the authors admit, regional anatomy, such as the external oblique ridge, may limit the ability to see resorptive changes on a panoramic. Overall, the actual values obtained in this study should be seen as unreliable for practice.

**CONCLUSIONS** A relatively low rate of mandibular resorption was seen in patients wearing a mandibular implant overdenture over the long-term. [AGG]

Non-surgical treatment of peri-implant mucositis and peri-implantitis at zirconia implants: a prospective case series

**BACKGROUND** The objectives of the study were to assess the clinical efficacy of nonsurgical treatment of peri-implant mucositis and periimplantitis at zirconia dental implants.

**METHODS** 34 patients with 45 implants participated in this study. 17 patients (24 implants) were diagnosed with periimplant mucositis and received mechanical debridement+local antiseptic therapy using chlorhexidine digluconate (MD+CHX), while 17 patients (21 implants) diagnosed with periimplantitis were assigned to Er:YAG laser therapy. In both groups, postoperative maintenance care included supramucosal plaque removal and local pocket irrigation using CHX. The primary endpoint was defined as disease resolution at 6 mo (i.e. absence of BoP at mucositis sites, absence of BoP and PPD ≥6 mm at periimplantitis sites).

**RESULTS** Resolution of periimplant mucositis and periimplantitis was obtained in 9 of 17 (52.9%) (p=0.001) and 5 of 17 (29.4%) (p=0.02) of the patients, respectively.

**CONCLUSIONS** Nonsurgical treatment of either periimplant mucositis using MD+CHX or periimplantitis using ERL at zirconia implants was associated with significant short-term clinical improvements. However, a complete disease resolution was not achieved in much of the patients. [AR]
Maxillary sinus augmentation by crestal access: a retrospective study cavity size and outcome correlation

**Background** The purpose of the study was to test CBCT of crestal sinus elevations, performed using mineralized human bone allograft (Puros), to analyze and correlate results with maxillary sinus size.

**Methods** 70 sinus augmentations in 70 patients with initial bone height ≤5 mm were performed. Digital radiographs were taken at surgical implant placement up to postprosthetic loading follow-up (12–72 mo) and a CBCT was taken. Marginal bone loss (MBL) was evaluated at 6 mo and at postloading follow-up. Sinus size (BPD), implant distance from palatal and buccal wall (PID, BID), and absence of bone coverage of implant (intra-sinus bone loss, IBL) were evaluated using ANOVA and linear regression analysis.

**Results** 10 patients were excluded from the study for a final count of 60 patients. Marginal bone loss increased as a function of time and at follow-up was statistically associated with MBL at 6 mo. IBL was statistically correlated with wall distance. Wider sinuses tended to lose more IBL/mm with time, than narrow sinuses.

**Conclusions** Quantitative and SS confirmed that the crestal technique with residual height less than 5 mm is more appropriate and predictable, in terms of intra-sinus bone coverage, in narrow rather than wide sinuses. [ES]


Randomized controlled multicenter study comparing short dental implants (6 mm) versus longer dental implants (11–15 mm) in combination with sinus floor elevation procedures. Part 1: demographics and patient-reported outcomes at 1 year of loading

**Background** The study purpose was to test whether the use of short dental implants (6 mm) result in an implant survival rate similar to long implants (11–15 mm) in combination with sinus grafting.

**Methods** The design of the study was randomized controlled multicenter comparing short dental implants (6 mm) versus longer dental implants (11–15 mm) in combination with sinus floor elevation procedures. The population sample was 101 patients with a posterior maxillary bone height of 5–7 mm. Patients randomly received short implants (6 mm) (group short) or long implants (11–15 mm) with sinus grafting (group graft). 6 mo later implants were loaded with single crowns and patients re-examined at 1 yr of loading. Outcomes included treatment time, price calculations, safety, patient-reported outcome measures (OHIP-49: Oral Health Impact Profile) and implant survival. Statistical analysis was performed using a nonparametric approach.

**Results** In 101 patients, 137 implants were placed. Mean surgical time was 52.6 min (group short) and 74.6 min (group graft). Mean costs amounted to €941 (group short) and €1946 (group graft). Mean severity scores between suture removal and baseline revealed a statistically significant decrease for most OHIP dimensions in group graft only. At 1 yr, 97 patients with 132 implants were re-examined. The implant survival rate was 100%.

**Conclusions** Both treatment modalities can be considered suitable for implant therapy in the atrophied posterior maxilla. Short implants may be more favorable regarding short-term patient morbidity, treatment time, and price. [EA]


Prevalence of periodontitis in an adult population from an urban area in North Italy: findings from a cross-sectional population-based epidemiological survey

**Background** The aim of the study was to evaluate the prevalence of periodontitis and its risk indicators among adults from an urban area in North Italy.

**Methods** A cross-sectional study comprising 736 individuals aged 20–75 yr old in the city of Turin was carried out. The following clinical parameters were assessed at 6 sites per tooth: presence/absence of plaque (PI), presence/absence of BoP, PD, gingival recession (REC), and CAL for the full-mouth. Tooth mobility and furcation was also recorded. Statistical analysis was conducted using the statistical package STATA/SE 10.0.

**Results** Based on CDC/AAP case definition, the prevalence estimates of sevP and modP were 34.94% (95% CI: 31.23–38.74) and 40.78% (95% CI: 36.89–44.79). The probability of periodontitis increased in smokers (adjusted OR 2.06, 95% IC: 1.26–3.37, p=0.004) and with age but leveled off in the 50+ yr old group (p<0.001).

**Conclusions** This is the first population-based representative epidemiological study in Italy. It reported estimates of the prevalence of sevP and modP among the 20–75 yr old population in Turin, one of the biggest industrialized cities in the northern part of the country. The estimates indicated that 39.94% and
40.78% of the population was affected by the severe and moderate form of periodontitis respectively. Periodontitis was highly prevalent in the Turin population. The present data will enable development of appropriate public health programs and allocation of resources. [sh]


The effects of providing periodontal disease risk information on psychological outcomes – a randomized controlled trial

**Background** It is hypothesized that one way to encourage patients to adhere to periodontal treatment instructions is to educate them about their individual susceptibility to PD. In a two-arm randomized controlled trial, this study compared the effects of a routine periodontal assessment consultation versus a routine consultation + individualized risk assessment communication intervention on patient thoughts and emotions about PD.

**Methods** Adults (N=102) with moderate to advanced chP referred to a periodontology department of a large UK dental school underwent psychological measures before a periodontal assessment and again at the end of the visit. Intervention participants received an individualized calculation of their PD risk using PreViser Risk Calculator in addition to their routine consultation.

**Results** In routine care, patients' thoughts about PD seriousness (p<0.001) and susceptibility (p<0.03) increased after consultation. Furthermore, participants felt more positive (p<0.02) about PD. These effects were also seen in intervention participants. Additionally, the individualized risk communication intervention led to patients reporting PD treatment as more effective than they did preconsultation (p<0.001), feeling more confident in their ability to adhere to treatment as seen in increases in self-efficacy (p<0.05), and higher intentions to adhere to periodontal management (p<0.03).

**Conclusions** Individualized PD risk communication influences psychological variables that underpin adherence with periodontal instructions. [MS]


Relationship between periodontitis associated subgingival microbiota and clinical inflammation by 16S pyrosequencing

**Background** The aim of this study was to analyze the relationship between the chP associated subgingival microbiota and clinical inflammation, using pyrosequencing of the 16S rRNA gene and quantitative PCR.

**Methods** 60 subjects with generalized chP participated in this study. Patients were divided into 2 groups per their BoP scores: BoP-1 group (mean scores ≤50% in sampled sites) and BoP-2 group (mean scores >50%). Subgingival bacterial samples from periodontal patients were studied by pyrosequencing PCR products of the 16S rRNA gene and by real-time PCR.

**Results** In all the analyzed subgingival samples, 102 bacterial genera and 203 species (from 41 genera of interest) were identified. Rarefaction curves showed a greater number of bacterial species in samples from BoP-2 group compared with BoP-1 group. The BoP-2 group had significantly higher abundance percentages of Anaeroglobus (specifically, A. geminatus), Capnocytophaga (specifically C. gingivalis), TM7, and Veillonella. The BoP-2 had significantly higher abundance percentages of Desulfobulbus (especially D. propionicus), Eubacterium (especially E. saphenum), therapy.

**Methods** 80 chP patients, 40 smokers and 40 nonsmokers, were recruited to this single-arm clinical trial. Smoking status was validated by measuring serum cotinine levels. Periodontal examinations were performed at baseline (T0) and 3 mo following nonsurgical and surgical periodontal therapy (T1). At T0 and T1, subgingival plaque samples were collected from the deepest periodontal pocket in each patient and analyzed using checkerboard DNA–DNA hybridization. PD ≥5 mm with BoP was defined as the primary outcome. Unadjusted and adjusted logistic regression analyses, corrected for clustered observations within patients and teeth, were conducted comparing smokers with nonsmokers.

**Results** Clinical parameters significantly improved in both groups (p<0.001). An association was revealed between smoking and PD ≥5 mm with BoP (OR=1.90, CI: 1.14, 3.15, p=0.013), especially for plaque-positive sites (OR= 4.14, CI: 2.16, 7.96, p<0.001). A significant reduction of red complex microbiota was observed for nonsmokers only (p=0.010).

**Conclusion** Results has indicated that smokers respond less favorably to nonsurgical and surgical periodontal therapy compared to nonsmokers, particularly at plaque-positive sites. [ske]

**Site-specific treatment outcome in smokers following non-surgical and surgical periodontal therapy**

**Background** This study aimed to evaluate the effect of smoking at patient, tooth, and site level following nonsurgical and surgical periodontal therapy.
Filifactor alocis, Streptococcus constellatus, Tannerella (especially, T. forsythia), and Treponema.

**Conclusion** 16S pyrosequencing revealed that increased inflammation at sites with periodontitis is associated with a more diverse subgingival microbiota and specific changes in the bacterial composition, involving "established" perio pathogens, symbionts, and novel low-abundance pathobionts. [PM]


**Severity of periodontitis and metabolic syndrome: is there an association?**

**Background** The study aim was to estimate the association between the severity of periodontitis (exposure) and metabolic syndrome (MS) (outcome).

**Methods** A cross-sectional study was conducted with 419 patients from a diabetes and hypertensive treatment center in Brazil. The study included a questionnaire, general and oral clinical examination, and laboratory tests. Diagnosis of periodontitis and MS was performed according to various criteria. The analysis of the effect of periodontitis on MS employed logistic regression analysis with adjustment for confounders.

**Results** The prevalence of periodontitis ranged between 34.61% and 55.37% (depending on the classification criteria), about 14% classified as severe and 41% as moderate. The prevalence of MS ranged from 60% to 67% periodontitis. There was an association between sevP and MS after adjustment for gender, age, household density, alcoholic beverage consumption, smoking habit, and cardiovascular disease; MS is 2.11× more prevalent in the periodontics group than in the nonperiodontitis group (p=0.05).

**Conclusion** The results suggest that periodontitis is associated with MS, and that MS prevalence was related to sevP. [LS]


**Circulating endothelial progenitor cells in periodontitis**

**Background** Vasculogenesis occurs postnatal via endothelial progenitor cells (EPCs). EPCs are subdivided as either hemangioblastic or monocytic. Hemangioblastic are true progenitor cells because they have capability of undergoing clonal expansion into endothelial cells. Monocytic EPCs do not undergo clonal expansion, but they do augment the neovascularization process. This study aims to determine if there is a difference in levels of monocytic or hemangioblastic cells in peripheral blood drawn from patients with periodontitis.

**Methods** 56 patients with periodontitis and 56 healthy control patients were recruited for this study. The 2 groups were individually matched for (age ±5 yr) and sex. This was done because hormone levels affect the level of circulating EPCs. 2 examiners performed a comprehensive periodontal examination on each participant. Each tooth was evaluated at 6 sites and CAL and PD were recorded. Blood samples were taken from all study participants. An EPC enrichment kit and enumeration kit was used to determine EPC levels in the blood samples.

**Results** The mean level of hemangioblastic EPCs was 0.0028% in patients with periodontitis and 0.0012% in control patients. These results were statistically significant. The level of monocytic EPCs could not be determined in all participants due to the failure of peripheral blood mononuclear cells to grow in culture. The mean level of monocytic EPCs was 0.2802% in patients with periodontitis and 0.2298% in control patients. The difference was not statistically significant.

**Discussion** Hemangioblastic cell levels appeared to be positively correlated with increase gingival inflammation and moderate to deep PDs. The authors point out that the inflammatory process stimulates the process of vascular repair. Unfortunately, the monocytic EPCs were unable to be characterized due to difficulty with cell culturing. The results of this study and one performed by Li et al. demonstrated that the inflammation that occurs in periodontitis stimulates the mechanism of vascular repair. [JD]


**Periodontal findings in individuals with newly identified pre-diabetes or diabetes mellitus**

**Background** This study provides the opportunity to examine the relationship of newly identified and untreated dysglycaemia to periodontal status.

**Methods** We report on the relationship of clinical periodontal parameters to glycemic status in 1097 patients who participated in the study. A fingerstick blood sample was collected from all participants for chairside. The first 506 participants returned for collection of a fasting venous blood sample to assess the FPG concentration. The second group of 591 subjects had a venous blood sample drawn on the same day to determine the laboratory per cent HbA1C. The first cohort of 506 participants was tested for glycemic status by FPG and POC HbA1C. The second cohort of 591 subjects was tested with a laboratory HbA1C (high-performance liquid chromatography) and the POC HbA1C test.
Severe chronic periodontitis is associated with endothelial and microvascular dysfunctions: a pilot study

**Background** The study purpose was to evaluate the endothelial and microvascular changes that occur in patients with sev/chP.

**Methods** 13 patients (6 males, 7 females) with sev/chP and 10 control subjects (3 males, 7 females) without periodontitis were evaluated. Sev/chP was defined as ≥6 mm of CAL in at least 2 interproximal sites and PDs of ≥5 mm in at least 1 site interproximally. Control patients were selected based on having no CAL loss. Patients were excluded if they presented with any of the following: CVD, diabetes mellitus, smoking habit, HTN, obesity, hypercholesterolemia, or any other systemic condition that influenced their periodontal status. Pregnant, lactating, or postmenopausal patients were excluded. Subjects were also not currently taking antibiotics (3 mo prior), vasoactive, anti-inflammatory, or hypolipidemic medications. All patients underwent a thorough medical history interview, physical, and comprehensive examination. Nailfold videocapillaroscopy, video microscopy with side stream dark field imaging, and venous occlusion plethysmography were performed to study the vasculature.

**Results** Patients in the test groups had lower functional capillary density (number of capillaries per square millimeter with flowing red blood cells), red blood cell velocity at rest, and red blood cell velocity max (during hyperemic response). Test subjects time to reach red blood cell velocity max was higher. Median gingival capillary density was higher in test subjects. Peak capillary flow was lower in test subjects. Significant differences were noted in patients with periodontitis. Patients with periodontitis displayed a decrease in endothelium-dependent vascular reactivity in resistance vessels in patients with periodontitis.

**Conclusions** The present findings indicate that individuals with newly identified prediabetes or diabetes are at increased risk of PD and tooth loss. [rc]

**References**


Small sample size appears to be a limiting factor in this study. [jd]


**Predictors of tooth loss due to periodontal disease in patients following long-term periodontal maintenance**

**Background** The present research attempted to overcome some limitations of the previous research. This was a retrospective case series of 500 patients undergoing PM that aimed to assess the simultaneous impact of patient related factors (PRFs) and tooth-related factors (TRFs) on tooth loss due to periodontal maintenance (TLPD).

**Methods** The sample of the study consisted of 500 treated periodontal patients (12,830 teeth) attending a PM program in a private periodontal practice in Valencia, Spain. The impact of PRFs on TLPD was analyzed with Poisson regression and multivariate logistic regression. The simultaneous impact of PRFs and TRFs was analyzed with multilevel logistic regression and Cox regression.

**Results** Tooth loss due to PD was 515 (mean 0.05 patient/year). The significant PRFs were sevP ($p<0.001$), agP ($p<0.001$), smoking ($p=0.018$), bruxism ($p=0.022$), and baseline number of teeth ($p=0.001$). These PRFs allowed characterizing patients losing more teeth. The whole TRFs analyzed were significant, depending on the type of tooth and the category of each factor (e.g. mobility 0, 1, 2, and 3). The significant PRFs increased the risk of TLPD by 2 to 3× while TRFs increased the risk to a higher extent. Mobility was the main TRF.

**Conclusion** The main patient-related factors associated with TLPD were sevP and agP followed by heavy smoking, bruxism, and fewer baseline teeth. Patients losing more teeth, in the models TLPD >2 and >3 teeth, were characterized by sevP, lower number of baseline teeth, and the combination of smoking with bruxism. Isolated smoking and isolated bruxism did not characterize these patients. Tooth-related factors analyzed were all significant, depending on the type of tooth and the category of each factor. The intermediate category of FI, BL, PPD, and C/R ratio duplicated the risk of TLPD, while the extreme category increased the risk by 3 to 4×. Mobility was the main factor, increasing the risk between 2 to 4× more than the remaining TRFs. [pm]

Evaluation of microRNA-146a and its targets in gingival tissues of patients with chronic periodontitis

Background microRNA is involved in regulation of gene expression by targeting mRNA, leading to mRNA degradation or translation inhibition. miR-146a is involved with innate immune response and inflammation acting as a negative regulator of inflammation. The purpose of this study was to look at the miR-1 expression levels and downstream targets TNF-α, IL-1β, IL-6 in patients with chP. Other parameters were correlated are PD and CAL.

Methods 10 healthy patients and 20 patients with chP were selected. Everyone received periodontal exams and clinical parameters were recorded using a periodontal probe. Tissues were collected from healthy patients who needed crown lengthening procedures and from chP group during flap surgery after completion of initial therapy. Total RNA was isolated first, complementary or CDNA synthesis was performed to isolate miR-146a. Polymerase chain reaction was used to quantify levels of cytokine expression TNF-α, IL-1β, and IL-6. Statistical analysis was performed.

Results The results showed 32.6-fold increase in miR-146a expression in patients with chP and was positively correlated with PD and AL increase with miR-146 expression. miR-146a elevation was accompanied with marked reduction in expression of TNF-α and IL-6. [dv1]


Effectiveness of an in-office arginine-calcium carbonate paste on dentine hypersensitivity in periodontitis patients: a double blind randomized controlled trial

Background The aim of the study was to evaluate the effectiveness of an in-office desensitizing paste containing 8% arginine and calcium carbonate in providing relief on dentine hypersensitivity immediately after SRP and its sustained relief over a 6 wk period.

Methods In a single-center, 2-cell, double-blind, randomized, controlled clinical study, 50 periodontitis subjects presenting hypersensitivity were subjected to SRP and in-office application of either 8% arginine and calcium carbonate desensitizing paste (25 subjects, test group) or fluoride-free prophylaxis paste (25 subjects, control group). Air-blast hypersensitivity was assessed using Schiff and Visual Analogue Scale (VAS) at baseline, postscaling, postapplication, 2, 4, and 6 wk.

Results At all evaluation times, the test group presented significant percentage reduction in hypersensitivity relative to postscaling (t-test: p<0.05) (Schiff Test: 57, 58.6, 60.2, 68; Control: 28.6, 22.2, 23, 23) (VAS Test: 60, 55.6, 60.1, 68.4; Control: 25.9, 18.2, 20.6, 22.7) and significant percentage hypersensitivity difference relative to control (ANCOVA, p<0.05) (Schiff: 38.9, 45.9, 47.4, 57.7; VAS: 49.1, 48.9, 52.6, 61).

Conclusion The single in-office application of the 8% arginine–calcium carbonate desensitizing paste after SRP provided significant immediate reduction in dentine hypersensitivity, which sustained over a 6 wk period. [EA]

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Comparison of glycated hemoglobin levels in individuals without diabetes and with and without periodontitis before and after non-surgical periodontal therapy

Background By 2025 it is estimated that 300 million people will have DM, and more than one in three people aged >30 y will have periodontitis. Periodontitis mediators are tumor necrosis factor (TNF)-α, IL-6, IL-1β, and interferon (IFN)-g, and increased levels of acute-phase proteins, such as C-reactive protein (CRP), which all have an important impact on glucose metabolism, such as antagonism of insulin (TNF-α, IL-6, IL-8). Elevated levels of CRP lead to insulin resistance. IFN-g induces apoptosis of pancreatic β cells. The aim of the study was to compare A1C levels in healthy patients without PD to healthy patients with PD before and after initial therapy.

Methods Both groups of healthy patients without DM, one group (group A without PD) and another group (group B) with CAL of >3 mm on at least 5 teeth, thus patients with mod/chP. There were 60 patients, 30 per group. Comprehensive periodontal evaluation was done. Blood samples, collected to evaluate A1C levels. Initial periodontal therapy was done. Reevaluation of A1C was done after 3 mo.

Results Group B (healthy patients with CAL) at baseline showed higher HbA1C levels than group A and the difference was statistically significant. Post initial therapy at 3 mo after SRP, group B showed a statistically significant reduction in OHI-S, PD, CAL, and A1C. Overall CAL in group B have decreased to about 4.54 mm at 3 mo after therapy, yet complete elimination of pockets was not achieved. The HbA1C level of group A 3 mo after SRP was 5.31%–0.33%, whereas that of group B was 5.67%–0.33%. This difference was statistically significant. Though the values in group B have decreased post initial therapy,
those values have not dropped to the values of non-periodontitis patients.

CONCLUSIONS Based on the results obtained from this comparative clinical study, it can be concluded that the HbA1C level of individuals without DM and with periodontitis was significantly reduced at the end of a short-term recall period of 3 mo after nonsurgical periodontal therapy, although the values were never lowered to the levels of those of the individuals without DM or periodontitis. [14]


Melatonin as a candidate therapeutic drug for protecting bone cells from chlorhexidine-induced damage

BACKGROUND This in vitro study was performed to assess the short-term effects of melatonin on osteoblasts while simultaneously incubating them with different concentrations of chlorhexidine.

METHODS MC3T3 osteoblasts were cultured. Chlorhexidine digluconate was applied at different concentrations (0.0001, 0.001, and 0.01) with 50 µg of melatonin in the test group and the control group received no melatonin. After 24 h the chlorhexidine was removed and cells were immediately analyzed or they were cultured for another 48 h. Total ROS and superoxide levels were determined along with a cell death assay used to determine apoptotic events. A metabolic activity assay was performed to evaluate cytotoxicity.

RESULTS As dose of chlorhexidine was increased, the osteoblast cell growth was decreased and cell shape was altered. Even 0.0001% CHX slightly decreased osteoblast growth when compared to control where no CHX was introduced. When 0.001% CHX was introduced the cell growth was also decreased and cell shape changed to dentritic. Clusters of cells were also observed which were spherical with a light microscopic halo after 24 h. The 0.01% CHX group was even more affected in terms of cell growth, and cell shape was planar/rectangular after 24 and 72 h. In the 0.001% CHX group, the levels of ROS and superoxide were similar whether melatonin was present or not. In the 0.0001% CHX group, the levels of superoxide and ROS were similar in both melatonin and nonmelatonin groups. When 0.01% CHX was used the melatonin addition resulted in a significant decrease in ROS and superoxide. As concentration of CHX increased, the level of late-stage apoptotic and necrotic osteoblasts increased. When melatonin is added to the culture, it appears to effectively delay osteoblast death. Melatonin also proved to downregulate metabolic activity following application of 0.001% CHX.

DISCUSSION This study showed that melatonin supports osteoblastic morphogenesis and growth. It also reduces levels of superoxide and ROS, delays apoptosis, and downregulates metabolism in osteoblasts when CHX is introduced in culture. The authors suggest that subgingival irrigation should be avoided in periodontal therapy. The results of this study provide statistically significant evidence that melatonin may be an excellent addition to the armamentarium when treating PD. [10]


Relationship between serologic markers of periodontal bacteria and metabolic syndrome and its components

BACKGROUND The goal of this study was to investigate the extent to which the bacterial clusters (as described in the National Health and Nutritional Examination Survey [NHANES]) are related to metabolic syndrome (MetS) and the components of hypertension (HTN), hypertriglyceridemia, low high-density lipoprotein (HDL) cholesterol, central adiposity, and elevated plasma glucose. It is hypothesized that subsets of serum immunoglobulin (Ig)G antibodies against periodontal bacteria were linked to periodontal health or disease and could be associated with metabolic control.

METHODS The study population included participants of the NHANES III study who were >40 yr old with complete data for serum IgG antibody titers against 19 oral bacteria (N=8153). After excluding those on insulin and with gestational diabetes, this left 7848 participants for the final analysis. This was a noninstitutionalized population. The outcomes of 5 components included (1) elevated central obesity (waist circumference [WC] >90 cm for males, >85 cm females); (2) hypertriglyceridemia (>150 mg/dL); (3) low HDL cholesterol (low if HDL <40 mg/dL males, <50 mg/dL females); (4) high blood pressure (>130 mmHg systolic or >85 mmHg diastolic, or on antihypertensive meds); and (5) high elevated fasting glucose (>100g/dL). The participants were analyzed for IgG antibodies against 19 oral bacteria. The sera were analyzed using the checkerboard immunoassay technique as described in the NHANES III documentation.

RESULTS Only orange-red scores were higher in individuals with MetS and those with elevated plasma glucose levels. Increased orange-blue scores were observed in individuals who had no hypertension and normal plasma blood glucose. After adjustment of potential confounders, there was no association observed in 4 cluster scores with MetS and any of the individual components except elevated plasma glucose.
DISCUSSION This study showed that elevated plasma glucose was more common in individuals with higher serum IgG antibody titer scores against organisms belonging to the orange-red cluster (indicating PD) and lower in titer scores against organisms from the orange-blue cluster after adjustment for several sociodemographic, anthropometric, and behavioral factors. No association was found between antibody clusters and MetS or individual components of MetS (hypertension, dyslipidemia, or central obesity). The literature has shown that periodontal microbiota has been associated with hyperglycemia, hypertension, elevated low-density lipoprotein (LDL), triglycerides, and atherosclerosis. Furthermore, Porphyromonas gingivalis has been shown to be linked to key roles in systemic inflammation mechanisms.

CONCLUSIONS Antibodies against periodontal microorganisms in the orange-red and orange-blue clusters were moderately associated with plasma glucose but not with MetS or its other components. The information from this research with other studies provides further evidence that gut microbiota is correlated with MetS traits. Further studies should include longitudinal research with clinical, microbiologic, and immunologic data to understand the relation among microorganisms in the mouth, gut, and metabolic state. [RL]

Expression of protease activated receptor-1 in chronic periodontitis

BACKGROUND Protease activated receptor-1 (PAR1) is a protease activated receptor-1 that is a predominant mediator of thrombin signaling in many cell types, such as platelets, endothelial cells, gingival fibroblasts, gingival epithelial cells, PDL cells, osteoblasts, and monocytes. MMP-1 and 13 are known to activate PAR1. Selective cleavage of PAR1 up-regulates expression of the proinflammatory cytokines, such as IL-1α and β, IL-6, and TNF-α. PAR1 might be associated with repair and homeostasis of periodontal tissues in nonsurgical treatment. The purpose of the study was to evaluate if decreased inflammation followed by periodontal treatment is associated with PAR1 expression.

METHODS 38 moderate PD patients and 37 periodontally healthy patients were selected. Evaluations were done at baseline and at 6 wk. After SRPs, active treatment patients received weekly prophylaxis and OHI. GCF was sampled after therapy and gene expression of PAR1 and PAR2 in the GCF was evaluated by qPCR. Flow cytometry was used to detect PAR1 expression in the surface of leukocytes and epithelial cells.

RESULTS At baseline, PAR1 expression in PD patients was significantly lower compared with control group. After periodontal therapy, PAR1 expression was significantly increased compared to baseline and significantly higher than control group. PAR2 expression at baseline in patients with PD was significantly higher compared with controls and significantly decreased in PD patients after treatment. There was no difference between control and PD group after treatment. The GCF levels of IL-6, IL-8, TNF-α, IFN-g, MMP-2, and MMP-8 were significantly reduced in patients with chP after treatment compared with baseline values. It was demonstrated that PAR1 is down-regulated in epithelial cells and leukocytes from diseased periodontal pockets compared with clinically healthy human gingival sulci. This result is in accordance with the study by Wong et al. showing that PAR1 is not associated with periodontal tissue breakdown. Major finding was that PAR1 expression in PD patients after treatment was more than two-fold increase compared with its baseline expression. PAR1 expression was inversely correlated to PAR2 expression and with GCF levels of IL-6, IL-8, TNF-α, IFN-g, and MMP-2.

CONCLUSION The present results reveal a possible protective role for PAR1 during periodontal repair after nonsurgical periodontal treatment in patients with chP.

The impact of structured plaque control for patients with gingival manifestations of oral lichen planus: a randomized controlled study

BACKGROUND Rarely, patient-based outcome measures have been used to evaluate interventions for oro-mucosal diseases, including oral lichen planus (OLP), and those that do, generally use it as a secondary outcome measure. This study aimed to evaluate the impact of a structured plaque control intervention on clinical- and patient-centered outcomes for patients with gingival manifestations of OLP.

METHODS 82 patients were included in a 20 wk randomized controlled trial. The intervention was structured plaque control comprising powered tooth brushing and interdental cleaning advice. Control subjects continued normal dental plaque control regimen. The primary outcome measure was the oral health impact profile (OHIP) with secondary outcomes of pain, plaque index, mucosal disease score, and cost effectiveness.

RESULTS Overall, intervention patients showed statistically significant improvements in OHIP sum ordinal and OHIP dichotomous scores compared with
control. There were improvements in the functional limitation, psychological discomfort, and physical disability domains at 4 and 20 wk, as well as in the psychological disability domain at 20 wk. The intervention succeeded in reducing plaque compared with control (p<0.001). Improvements were observed using the mucosal disease indices at the 4 and 20 wk follow-ups (p<0.001).

**Conclusions** A structured plaque control intervention was effective in improving the oral health-related quality of life and clinically observed gingival lesions. This study provides evidence of benefits in including intensive plaque control within patients’ initial and on-going management.

**References**


**Association between overweight/obesity and increased risk of periodontitis**

**Background** The purpose of the study was to investigate periodontitis as a co-morbidity of overweight/obesity in an age-matched sample of periodontitis cases or periodontally healthy controls.

**Methods** Participants underwent a periodontal examination using full mouth clinical periodontal measures. Body mass index (kg/m²), overweight (BMI 25–29.99 kg/m²), or obese BMI ≥30 kg/m²) were used as explanatory variables to calculate the odds ratio for diagnosis of periodontitis using a multivariable conditional logistic regression analysis. A receiver operating characteristic (ROC) curve was generated of all possible BMI (kg/m²) cut-off points discriminating individuals for diagnosis of periodontitis.

**Results** The study comprised 286 participants. BMI showed a dose–response association with increased odds (1.12 per increase of 1 kg/m², 95% CI 1.05–1.20, p=0.001) of being a case compared to a control independent of gender, ethnicity, smoking status, and dental plaque level. Similarly, overweight/obese were independently associated with increased odds of diagnosis of periodontitis for overweight (OR=2.56, 95% CI 1.210–5.400, p=0.014) and for obese (OR=3.11, 95% CI 1.052–6.481, p=0.015) compared to normal weight individuals. The ROC curve analysis confirmed diagnosis of periodontitis was 1.6× more likely in an individual with the BMI ≥24.32 kg/m².

**Conclusions** In this case-control study, overweight/obese individuals had a higher chance to suffer from periodontitis compared with normal weight individuals.

**References**


**Impact of periodontal maintenance on tooth survival in patients with removable partial dentures**

**Background** The study objective was to examine the impact of regular periodontal maintenance visits on survival of removable partial dentures (RPD) abutment teeth.

**Methods** The design of the study is a practice-based cohort involving 192 patients who had been previously provided with 304 new clasp-retained RPDs at Osaka University Dental Hospital, Japan. Using the Kaplan–Meier method and log-rank test, 1094 abutments were analyzed to illustrate survival curves and to compare each curve. Per the frequency of periodontal maintenance, study samples were divided into 3 groups; every 3–6 mo (3–6M group); 1 yr (1Y group); and no maintenance (NM group).

**Results** 7 yr cumulative survival rates were 83.7% (3–6M group), 75.5% (1Y group), and 71.9% (NM group), respectively. Survival of abutment teeth in the 3–6M group was significantly better than both 1Y group (p=0.005) and NM group (p<0.001).

**Conclusion** These longitudinal clinical data indicate that periodontal maintenance at least once in 6 mo had the most favorable outcome. Frequent periodontal maintenance after RPD provision could be effective in preventing further tooth loss.

**Clinical and microbiological effects of probiotic lozenges in the treatment of chronic periodontitis: a 1-year follow-up study**

**Background** Several studies have evaluated the effects of probiotics in the treatment of different types of PDs in humans, but the results have been controversial. The objective of this study was to evaluate the effects of lozenges containing *Lactobacillus reuteri* as an adjuvant treatment to initial periodontal therapy for chP patients and to detect the level of *L. reuteri* colonization in the periodontal pockets of treated patients.

**Methods** 40 patients were randomly divided into 2 groups. Each patient had at least 2 teeth with 1 approximal site each with a PD of 5–7 mm and GI of ≥2 in each quadrant. Group I received SRP plus *L. reuteri*-containing lozenges, and group II received SRP plus placebo. The PI, GI, BoP, PD, and relative attachment level were measured. Microbiological sampling was performed at baseline, as well as on days 21, 90, 180, and 360 and was analyzed by culturing. The Bonferroni-corrected paired sample t-test, Bonferroni-corrected Wilcoxon signed rank test, and paired sample t-test were used to evaluate intragroup
differences. The Bonferroni-corrected Student’s t-test and the Mann–Whitney U-tests were used to evaluate intergroup differences.

Results After treatment the PI, GI, BoP, and PD were significantly ($p<0.05$) lower in group I compared with group II at all time points. Similar observations were made for the total viable cell counts and the proportions of obligate anaerobes except for day 360. In group I, significantly fewer patients required surgery on ≥3.

Conclusions L. reuteri-containing lozenges have potential as a useful adjunct for slowing re-colonization and improving clinical outcomes of chP. Further studies are needed to clarify the optimal dose of the lozenges. [ms]


- CLINICAL / Surgical

Relative composition of fibrous connective and fatty/glandular tissue in connective tissue grafts depends on the harvesting technique but not the donor site of the hard palate

Background It is known that harvesting of the CTG should be limited to the area with thicker tissue and away from the neuro-vascular bundle, mesial to the first molar, as well as between 7–17 mm away from the CEJ of the 1st molar. If it is decided a CT is to be taken from area distal to 1st molar, use of FGG protocol with de-epithelization can be done. Previous studies showed that CTG from anterior palate is less dense with connective tissue compared with de-epithelialized graft from posterior palate. Other positive aspects of a DE graft are less shrinkage and better tissue thickness at 1 yr. Present study wanted to evaluate histologically if the tissue harvested from posterior epithelialized grafts contains more CT vs. grafts harvested from anterior palate.

Methods 10 fresh cadaver heads were used in the study. Full thickness tissue was harvested from area of the 2nd premolar to 2nd molar, 2 mm from gingival margin, making blocks of about 8x8 mm. Tissues were stored and prepared for histologic analysis in 2 μm slices. 3 regions of interest were identified: ROI A, including the entire section, i.e., from the epithelium to periosteum; ROI B, including the tissues located directly below the epithelium and extending 1.5 mm toward the periosteum, representing tissues contained in a DE-harvested CTG; and ROI C, including the tissues located 1.5 to 3.0 mm below the epithelium toward the periosteum, representing tissues contained in an SF-harvested CTG, assuming a primary flap 1.5 mm thick. In cases where ROI A was <3 mm in height, a primary flap 1 mm thick was assumed ($n=9$). Using histologic staining they differentiated fatty glandular tissue from fibrous connective tissue.

Results 35 of 40 samples could be analyzed. Overall biopsy showed superficial layer of 0.3 mm thick orthokeratinized epithelium, followed by lamina propria, with mainly CT and submucosa consisting mainly of FGT. Results showed great variability among patients. Proportion of FGT ranged from 0.04% to 73.8%; CT ranged from 23.2% to 93.3%. Lamina propria thickness (the extent of subepithelial portion of the biopsy, containing <25% or <50% FGT ranged from 0.2 to 2.8, to 0.3 to 3.3, respectively. Thicker palate correlated with higher FGT content, thinner lamina propria. Men showed lower FGT and more fibrous CT in anterior mucosa compared with women. Lamina propria of anterior palate was twice as thick in men compared with women. Significantly higher amount of lamina propria was harvested with de-epithelialized vs. split thickness with lower amount of GFT.

Conclusions Overall there were no statistically significant differences in terms of relative tissue composition (fibrous CT and FGT) among the various regions (anterior vs. posterior, marginal or apical). But the harvesting technique greatly influenced the amount of CT that is present in the graft. DE harvested CTG contains much larger amount of dense fibrous CT vs. split thickness design. Previous studies comparing the root coverage or width of KG outcomes showed no remarkable differences. [dvi]

periodontal pockets at posterior natural teeth after initial therapy were enrolled. Periodontal pockets were associated with infrabony defects ≤3 mm. 15 patients were randomly assigned to FibReORS test group and 15 to ORS control group. Measurements were performed by a blinded and calibrated examiner. Soft-tissue rebound after flap suture was monitored by changes in gingival recession at 1, 3, 6, and 12 mo follow-up. A multilevel analysis considering patient, site, and time levels was performed.

**Results** Greater osseous resection during surgery and higher postsurgical gingival recession were observed in the ORS control group. The mean amount of soft-tissue rebound following surgery was 2.5 mm for ORS treated sites and 2.2 mm for FibReORS treated sites. Approximately 90% of the coronal re-growth was detectable after 6 mo for both procedures. The association between ORS and time of observation showed a higher soft-tissue rebound after 12 mo (p=0.0233) for ORS-treated sites.

**Conclusions** Both procedures showed similar coronal soft-tissue re-growth, with a significantly higher recession reduction for ORS-treated sites. Significant clinical stability of the gingival margin was obtained 6 mo after surgery for both procedures. [ms]

**Prognostic factors for the loss of molars – an 18-years retrospective cohort study**

**Background** This study aimed to identify long-term prognostic factors for the loss of molars with different degrees of furcation involvement (FI) during supportive periodontal therapy (SPT).

**Methods** 379 compliant subjects with 2373 molars at baseline were retrospectively assessed. After nonsurgical (n=76) or surgical (n=303) nonregenerative active periodontal therapy (APT: T0–T1), patients remained under SPT (T1–T2) for 18.3±5.5 (9–30.8) yr. Association between tooth- and subject-related factors with tooth loss was assessed using multilevel Cox regression-analysis.

**Results** During APT 159 and during SPT 438 molars were extracted in 256 subjects, respectively, yielding an overall survival of 74.8% (T2). Survival probabilities after 15 yr of SPT were 92.4% for molars with FI-0, compared to FI-1 = 85.6%, FI-2 = 74.9%, and FI-3 = 62.3%. The risk of molar loss was significantly increased for teeth with FI-3 (hazard ratio: 2.39 [95% CI: 1.54–3.70]), bone loss >50% (2.16 [1.36–3.42]), mobile teeth (2.07 [1.51–2.84]), maxillary molars (1.44 [1.12–1.85]), and endodontically treated teeth (1.89 [1.58–2.26]). For each mm of mean residual PPD, the hazard of tooth loss increased 1.89-fold (1.58–2.26). On a subject level, for each year of age HR was 1.03 (1.01–1.05).

**Conclusions** Furcation involvement, bone loss, tooth mobility, mean pocket depth and age were among the factors that could strongly predict tooth loss during SPT. Periodontally compromised molars could be maintained for long-term via conservative nonregenerative active and supportive therapy. [sk]

**An explorative study to develop a predictive model based on avascular exposed root surface area for root coverage after a laterally positioned flap**

**Background** The goal of this study was to examine the avascular exposed root surface area (AERSA) as a primary prognostic criterion for gingival recession (GR) defects.

**Methods** 91 patients with 91 isolated single GRs (32 Miller class I, 29 Miller class II, and 30 Miller class III defects) located at upper and lower incisors and canines were treated with a laterally positioned flap. Clinical parameters were recorded and correlated with the outcome of complete root coverage (CRC) after 6 mo. Parameters included GR depth, GR width, PD, CAL, and apico-coronal KTW. The primary endpoint of the study was the percentage of root coverage at 6 mo. The AERSA-A was calculated as GRD × GRW before (AERSA-B) and 6 mo after surgery (AERSA-6). Once anesthetized, the roots were debrided and planed. Root surfaces were conditioned with 24% EDTA for 2 min to remove the smear layer and rinsed with saline for 60 s. The procedure used is the Chambrone modification of the original laterally positioned flap (LPF) procedure.

**Results** From all parameters tested, AERSA showed the highest sensitivity and specificity for predicting CRC. Analyses showed 3 acceptable cutoff points based on baseline AERAA for achieving CRC with higher sensitivity and specificity values compared to GR depth, width, and gingival thickness. The GRD = 15.0 mm², GRW = 17 mm², and GT 19 mm². The baseline cutoff value for having CRC was 3.5 mm for GRW, 5.5 mm for GRD, and 0.85 mm for GT.
Univariate and multiple linear regression analyses reported that the models could explain the 86% of the mean root coverage with AERSA. The model can predict the level of MRC-MD by a minimum of −7.7 and a maximum of 7.0 error.

**Discussion** Miller’s classification is the most widely used system for facilitating the diagnosis and treatment of GR. Even so, the literature shows CRC in class I and II recessions to range from 9% to 90% after the free gingival graft and 9% to 80% with a coronally advanced flap (CAF), and 40% to 80% after a CAF+connective tissue graft. Therefore, the Miller classification may not be accurate in predicting the outcomes of RC. The regression analysis showed that with each increment in baseline AERSA of 1 mm², RC percentage was reduced by ~1.2%. Based on the results of this study, a formula was developed to predict final MCR. The size of the AERSA may explain why some Miller class I and II defects do not achieve full coverage when smaller Miller class III may achieve favorable root coverage. Future studies should direct the use of coronally positioned flaps with this model.

**Conclusions** This study indicated that AERSA may be used to classify GR defects and may be used to predict final root coverage outcomes. A prognostic formula model (\(MRC=114.9 + [-1.2 \times AERSA] + [-1.0 \times GT]\)) was developed to predict CRC as the outcome of GRs treated with LPF, with AERSA and GT being the most important prognostic criteria. [rt].

**A computer-guided bone block harvesting procedure: a proof-of-principle case report and technical notes**

**Background** During autogenous mandibular bone harvesting, there is a risk of damage to anatomical structures, as the surgeon has no 3D control of the osteotomy planes. The aim of this proof-of-principle case report was to describe a procedure for harvesting a mandibular bone block that applies a computer-guided surgery concept. The purpose of this report was to demonstrate the feasibility of performing a bone block mandibular harvesting procedure by applying the technology of computer-guided surgery.

**Methods** A partially dentate patient who presented with 2 vertical defects (1 in the maxilla and 1 in the mandible) was selected for an autogenous mandibular bone block graft. The bone block was planned using a computer-aided design process, with ideal bone osteotomy planes defined beforehand to prevent damage to anatomical structures (nerves, dental roots, etc.) and to generate a surgical guide, which defined the working directions in 3D for the bone-cutting instrument. Bone block dimensions were planned so that both defects could be repaired. The projected bone block was 37.5 mm in length, 10 mm in height, and 5.7 mm in thickness, and it was grafted in 2 vertical bone augmentations: an 8×21 mm mandibular defect and a 6.5×18 mm defect in the maxilla. Supra imposition of the preoperative and postoperative computed tomographic images revealed a procedure accuracy of 0.25 mm. This computer guided bone harvesting technique enables clinicians to obtain sufficient autogenous bone to manage multiple defects safely. Today there are no instruments or methods used for cutting the mandible that is able to fully avoid damage to anatomical structures because the free hand 3D working direction cannot be controlled.

In a recent report, it has been suggested to use a dehydrated homologous bone block formed using CAD/CAM system to avoid the need to harvest autogenous grafts. Another suggestion is to use a premade bone cutting guide based on the CBCT scan.

**Methods** Mandibular defect measured from left 2nd premolar and 1st and 2nd molar areas measuring 8 mm high × 21 mm in length and maxillary defect was 6.5 mm high×18 mm long. Software was used to define all cutting planes, after which their projection outside the bone body/surface defined the internal faces of the surgical guide. Guide was then created using CAD/CAM in medical polyamide material. Surgical guide was inserted and secured to the bone with 1.3 mm screw. Piezoelectric surgery was used to create cuts. Computer planning of osteotomy line allowed the instruments to be inserted into the bone deeper than just the cortical plate thickness, thus reducing the inner bone surface that had to be fractured to a minimum. The software calculated the discrepancy between the preop and postop images as 0.25 mm difference.

**Conclusion** This case report demonstrated the feasibility of performing mandibular bone harvesting with a computer-guided approach, allowing for better bone quantity and safety. [dvi]

**References**

Comparison of two differently processed acellular dermal matrix products for root coverage procedures: a prospective, randomized multicenter study

**BACKGROUND** The study aim was to evaluate whether clinical parameters were improved by SDADM when compared to FDADM for the treatment of Miller class I or II GR defects in a multicenter controlled, randomized clinical trial.

**METHODS** Patients 18 or older with Miller class I or II defects of >2 mm on incisors, canines, or premolars were selected from 4 locations across the US. Exclusion criteria were previous surgery in the area within 12 mo, antibiotic usage >2 wk in the past 3 mo, allergy to study materials, unstable systemic diseases or compromised immune functions, active infections, and tobacco use in the past year. Participants were assigned randomly to CAF with SDADM or CAF with FDADM. 42 FD and 38 SD were included in the study. SDADM was hydrated for 5 to 30 min in endotoxin-free, room-temperature 0.9% sterile saline. FDADM was hydrated in 2 separate saline baths, 10 min each for a total of 20 min. Full thickness flaps were raised past the MGJ with 2 vertical releasing incisions, adjacent papilla was de-epithelialized, root planing with curetts was completed, and periosteal release was done to allow coronal advancement. Flaps were advanced 1–2 mm above CEJ so the ADM was covered. ADM was sutured using single slings and the flap with a sling-tag suture. Sutures were removed at 14 d. Measurements were taken at 90, 180, and 365 d visits.

**RESULTS** Mean age was 47 for FDADM and 43 for SDADM. Majority defects were Miller class I on canines. Only 1 patient in each group had exposure of the graft with infections. One patient in SDADM reported paresthesia after the surgery with resolution after follow-up. After 1 yr, both had significant RD reduction and root coverage when compared to baseline. There were no significant differences between groups for CAL, GT, PD, RD, RW, and width of keratinized tissue. SDADM scored higher in handling, 97.4% compared with FDADM at 73.8%.

**DISCUSSION** Results from this study show no differences in outcomes of either ADM. Slightly lower results in this study could be due to surgical technique, open approach causing lack of blood supply. Both procedures improved CAL, increased tissue thickness 1–3 mm apical to free gingival margins and KT width. Both types of ADM are thought to have similar results due to having a collagen matrix structure allowing easy penetration of vascular channels. Woodyard et al. showed that with ADM the zone of KT with results very similar in this study.

**CONCLUSION** Both SDADM and FDADM can be used successfully to treat Miller class I and II gingival defects with equal outcomes.

**LABORATORY STUDIES**

**LABORATORY/Implants**

**Influence of reinforcement on strains within maxillary implant overdentures**

**BACKGROUND** Long-term studies have shown several common complications with implant overdentures, such as fracture at the midline and over the implant female attachments. A recent review concluded that the absence of a metal framework increased the incidence of mechanical and technical complications. Deformation of the denture may also negatively affect the underlying residual ridge and implants through transmission of forces. This study aimed to evaluate the effect of reinforcement on the strains placed on implant overdentures.

**METHODS** 2 implants were placed in the canine positions of a model of an edentulous maxilla with its surface covered in silicone rubber to simulate a mucosal lining. 2 cast-metal, dome-shaped copings were cemented to the implants. The copings were 6 mm above the "mucosa" with a 6° taper. Acrylic resin experimental dentures were fabricated with 5 different designs for reinforcement: (1) no reinforcement; (2) reinforcement over the residual ridge and the tops of the copings; (3) residual ridge, tops of copings, and across the palate; (4) reinforcement over the residual ridge and the sides of the copings; and (5) residual ridge, sides of copings, and across the palate. Strain gauges were attached to the experimental dentures at the canine positions and at the midline in the labial, middle, and posterior aspects of the denture. A vertical load of 49N was applied in the 1st premolar and 1st molar, and strain was measured.
According to this study, the 3D periodontal positioning (chin up, chin down, and normal). Linear head positions to simulate changes in the patient’s head were performed using a CS 9000 linear tomographic unit (Carestream Health) with 3 voxel sizes (0.200 and 0.300 mm). Panoramic imaging of the skull was performed using a CS 9500 machine (Carestream Health) with two voxel sizes (0.200 and 0.300 mm). Panoramic images of the skull were performed using a 3D Accuitomo 170 machine (Carestream Health) with 3 regions were evaluated in this study. Each maxilla and mandible was scanned using a 3D Accuitomo 170 machine (Carestream Health) with 3 areas were used to take vertical linear measurements. The authors propose that this effect should be generalized to attachments other than the dome copings used in the study.

Conclusions Metal reinforcement of implant overdentures seems to reduce the strain on the denture and implant copings. Reinforcement over the top of the coping seems to reduce strain the most. [AGG]


Accuracy of linear measurements using cone beam computed tomography and panoramic radiography in dental implant treatment planning

Background The study purpose was to investigate the accuracy of linear measurements from cone beam computed tomography (CBCT) images and digital panoramic radiographs at various implant sites.

Methods 6 dry human skulls with partially or completely edentulous regions were used for the study. Edentulous areas were used to take vertical linear measurements. Incisor, canine, premolar, and molar areas were evaluated in this study. Each maxilla and mandible was scanned using a 3D Accuitomo 170 machine with 3 different voxel sizes (0.125, 0.160, 0.250 mm) and a CS 9500 machine (Carestream Health) with two voxel sizes (0.200 and 0.300 mm). Panoramic imaging of the skull was performed using a CS 9000 linear tomographic unit (Carestream Health) with 3 head positions to simulate changes in the patient’s head positioning (chin up, chin down, and normal). Linear measurements were made from radiographs according to the gutta-percha guides that were placed in the skulls. Direct bone measurements were recorded at the evaluated region using a digital caliper.

Results 48 regions were investigated completely out of the 50 regions. Results of the different measurements are shown in a table. The difference in maxillary CBCT was −1.06 to −1.23 mm, mandibular CBCT image was −0.24 to −0.55 mm, maxillary pan was −1.80 to −2.45 mm, and mandibular pan was −0.34 to −1.35 mm. All mean differences were less than 2 mm except for the chin down position of the maxilla (−2.45 mm) in the PAN.

Discussion In the current study the mean difference from every protocol was negative, indicating that the radiographs slightly underestimated the real distance compared with the physical measurements. Difference in voxel size did not affect the accuracy of the linear measurements in line with the previous studies.

Conclusions According to this study the 3D Accuitomo 170 and CS 9500 CBCT machines have sufficient accuracy for linear measurement of alveolar bone height. The voxel size in both machines does not affect the accuracy of linear measurements. The measurements by PACS PAN radiographs were also comparable with actual physical measurements. [AGG]


Antibiotic susceptibility of periodontal Streptococcus constellatus and Streptococcus intermedius clinical isolates

Background The aim of this study was to determine in vitro susceptibility of Streptococcus constellatus and Streptococcus intermedius clinical isolates from human periodontitis lesions to 6 antibiotics.

Methods Fresh clinical isolates were recovered, including 33 S. constellatus and 17 S. intermedius. The species were isolated from pooled subgingival plaque biofilm; specimens were removed and transported in anaerobically prepared medium. The samples came from 50 systemically healthy adults with untreated chP, having 3 to 5 deep periodontal pockets. S. constellatus is gram-positive, lactose-4-methylumbelliferyl-B-D-glucuronide (MUG) test negative, nonmotile, facultative cocci. S. intermedius is gram-positive, lactose MUG test positive, nonmotile, facultative cocci. Pure culture cell suspensions and clinical isolates were adjusted and streaked across 150 Mueller-Hinton agar
plates with 5% sheep's blood. After drying, predefined antibiotic gradient strips containing amoxicillin, azithromycin, clindamycin, ciprofloxacin, or doxycycline were applied to the inoculated media surface. After 24 hr of incubation, the antibiotic gradient strips were read to determine the in vitro inhibitory concentration (MIC) value. A separate agar dilution assay was used for in vitro assessment of metronidazole susceptibility. MIC values for each antibiotic were determined.

**Results** The antibiotic gradient strip MIC values for *Streptococcus pneumoniae* quality control strain for the antibiotics and metronidazole resistance testing did not provide results within the expected ranges and outcomes. Having the lowest MIC90 values, clindamycin was the most active antibiotic against *S. constellatus*, whereas amoxicillin was most active against *S. intermedius* (MIC90 0.125 mg/mL). Both antibiotics were 32× more active against the test species than doxycycline. A table shows the distribution of MIC antibiotic values against *S. constellatus* and *S. intermedius* isolates. Resistance was most frequently observed in vitro to doxycycline, with 30% of all test strains yielding MIC values above the doxycycline resistance breaking point concentration. No *S. constellatus* and *S. intermedius* were resistant in vitro to amoxicillin and only a low frequency of resistance was detected to azithromycin, clindamycin, and ciprofloxacin.

**Discussion** This study demonstrates that the antibiotic susceptibility of subgingival *S. constellatus* and *S. intermedius* are similar to those of strains of the species recovered at other body sites. Another relevant finding was that 30% of subgingival isolates were resistant to doxycycline. Resistance to doxycycline and other tetracycline antibiotics, may compromise treatment outcomes. Previous studies, including this data, suggest the need for caution in using doxycycline or other tetracycline antibiotics in periodontal therapy on patients with high number of *S. constellatus* and *S. intermedius*. Also, nearly all subgingival *S. constellatus* and *S. intermedius* isolates were resistant to metronidazole at a 16 mg/L concentration. There may be limitation of single antibiotic drug regimens involving metronidazole alone in patients with periodontitis.

**Conclusions** Subgingival isolates were nearly all susceptible to amoxicillin, clindamycin, and azithromycin, intermediate in susceptibility to ciprofloxacin, frequently resistant to doxycycline, and nearly all resistant to metronidazole. [RL]

| LABORATORY / Surgical |

**Platelet-rich plasma derived from bone marrow aspirate promotes new cementum formation**

**Background** The aim of this study was to evaluate the influence of platelet-rich plasma from bone marrow aspirate (PRP-BMA) on healing of periodontal fenestration defects in rats.

**Methods** 40 male Wistar rats were used in the study. A single fenestration defect was created in each animal, and they were assigned to wither the control of PRP-BMA grout using a simple random sample. The groups were then subdivided into groups euthanized at 10 or 30 d postsurgery. Before surgery, bone marrow was collected from the right and left iliac crests to amount to 1 mL volume of total marrow. The marrow was centrifuged to separate the plasma containing the platelets and nucleated bone marrow cells (NBMCs) from the rest cells. Plasma was drawn off the top and centrifuged again to separate the platelets and NBMCs from the platelet-poor plasma (PPP). The PPP was drawn off, leaving the PRP-BMA and buffy coat.

For the surgical procedure, an incision was made and a FTF reflected over the body of the mandible coronal to the inferior border of the right side of the mandible. Fenestrations measuring 3 mm width by 2 mm in length and 1 mm depth were created by removing superficial bone with a round bur. Using a chisel, the distal root of the first mandibular molar was denuded of its PDL, cementum, and superficial dentin. The incision was then closed. In the control group, the defect was filled by a blood clot only. In the test group, 25 µL PRP-BMA was activated with 1.25 µL 10% calcium chloride. The rats were euthanized at 10 or 30 d and the area of the defect was resected en bloc, fixed, and prepared for microscopy. Also, immunohistochemical reactions were completed. The total defect area, new bone area (NBA), and area of bone trabeculae (ABT) were measured.

**Results** After 10 d control and PRP-BMA groups showed similar amounts of NBA and ABT; NC formation was not observed. By 30 d both groups showed similar amounts of NBA and ABT. The PRP-BMA group presented with NC formation with collagen fibers inserted obliquely or perpendicular to the root surface. This was not observed in any control group specimen. Also, the PRP-BMA specimens presented higher numbers of PCNA-positive and TRAP-positive cells than control at 10 and 30 d. Additionally, at 10 and 30 d postoperatively there was no significant difference in the numbers of OCN-positive or TRAP-positive cells between the groups.

**Discussion** NC is defined as the tissue attached
to the root surface with fiber bundles arranged in a palisade-like fashion. This is critical for regeneration. It is known that cementum has limited self-healing capacity and the results support this as all specimens from the control group showed a total absence of cementum formation. In contrast, the test group 30 d specimens presented significant NC formation with thick collagen fibers inserted to the root surface. This is in alignment with Simsek et al. who observed significant NC when class II furcation defects were treated with MSCs/PRP.

The MSCs contribute to regeneration of bone, cementum, and periodontal ligament. The results may be possible due to a significant increase in MSCs and GFs at the surgical site. It is possible that the GFs in PRP may activate several cell types involved in wound healing and thus induce soft tissue healing and bone regeneration.

**Conclusion** This study shows that PRP-BMA promoted NC formation with a functional periodontal ligament when applied at experimental periodontal fenestration defects. [RL]


**Demineralized dentin as a semi-rigid barrier for guiding periodontal tissue regeneration**

**Background** The current materials being used for GTR in periodontal defects leave room for improvement. Barrier membranes alone cannot adequately support the soft tissue and create the space necessary for regeneration, and other biomaterials often lack adequate rigidity and osteoconductivity. Consequently, dentin has been explored as a semi-rigid, osteoconductive, extremely biocompatible material for use in GTR. Dentin is approximately 70% mineral, 20% organic, and 10% water, similar to the composition of bone. This study evaluates the physiochemical properties of dentin after different protocols of demineralization and its GTR performance in a canine model.

**Methods** Caries-free teeth were extracted from human subjects for orthodontic reasons and 30 dentin “beams” were created. 5 groups were created, receiving 0, 6, 12, 24, or 48 hr of exposure to 0.6M hydrochloric acid for demineralization. Other samples were subjected to micro-CT analysis for surface mineralization density, testing for surface wettability, flexural strength, flexural modulus, and modulus of toughness. Canine bone marrow stem cells were also seeded onto the surface to study attachment and morphology of these cells. For the canine trial, the investigators created periodontal defects in 6 healthy beagles by surgically removing facial bone and implanting impression material in the periodontal apparatus for 1 mo. The defects were re-exposed, and given no treatment (group A), GTR with a collagen membrane (group B), or 6 hr demineralized dentin fixated with a titanium screw (group C). Animals were sacrificed after 3 mo and periodontal regeneration was assessed microscopically.

**Results** Mineralization density after 6 hr of treatment most closely resembled that of bone. There was a sharp decline after 6 hr in mineralization and flexural testing, so group C was chosen for cell attachment tests and in vivo applications. More bone marrow stem cells resided on treated and untreated dentin when compared with HA, and the cells showed elongated morphology, indicating good biocompatibility. At 2 mo, the in-vivo trial showed significantly more bone formation (8.07% vs. 0.5% vs. 0%) and new cementum length (44.12% vs. 20.93% vs. 3.33%) for group C compared to group B and group A. At 4 mo, group C’s percentages of new bone and cementum increased to 43% and 65%.

**Discussion** This study has confirmed that the hardness and density of dentin decreases per the time of acid treatment. More bone marrow stem cells attach to and spread across a 6 hr treated dentin sample than untreated dentin or HA. Finally, the use of a 6 hr treated dentin sample as a barrier for GTR resulted in more periodontal tissue formation than a collagen membrane (Bio-Gide). The authors explain this result with the concept that the semi-rigid dentin better supports the overlying soft tissue, maintains adequate space due to slow degradation, and allows for better osteoconduction than a collagen membrane. Additional growth factors were not used, making these results even more impressive.

**Conclusion** Demineralized dentin appears to perform well as a barrier for periodontal GTR (in canines). [AGG]

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ADDENDUM Inadvertently, the corresponding address was omitted for Dr. Farokh Khatiblou, author of “Nonsurgical Management of Retrograde Peri-Implantitis”; that appeared in Periodontal Abstracts, vol. 64, no. 2, 2016. He can be reached at 60 Satary Ave., Africa Blvd., Tehran 19689, Iran; tel/fax: 98-21-88784409; email dr.khatiblou@yahoo.com. Periodontal Abstracts regrets the omission.
WSP Meeting Schedule

Saturday, January 28, 2017
ASP/WSP - SCOTTSDALE TEAM SESSION
Scottsdale, Arizona

Saturday, February 4, 2017
OSP/WSP - PORTLAND TEAM SESSION
Portland, Oregon

Friday, February 24, 2017
WSP - SPOKANE TEAM SESSION
Spokane, Washington

March 31 - April 2, 2017
WSP - 2017 ANNUAL SESSION
Seattle, Washington

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Meetings of Interest

Friday–Saturday :: February 10–11, 2017
USC PERIODONTAL SYMPOSIUM
Los Angeles, California

Friday–Monday :: February 3–6, 2017
LSU BOARD REVIEW COURSE
New Orleans, Louisiana

Thursday–Saturday :: February 23–25, 2017
CHICAGO MID-WINTER MEETING
Chicago, Illinois

Saturday :: March 11, 2017
USC RUTH RAGLAND HYGIENE SYMPOSIUM
Los Angeles, California

Wednesday–Saturday :: March 15–18, 2017
ACADEMY OF OSSEOINTEGRATION MEETING
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Friday–Sunday :: May 19–21, 2017
CALIFORNIA SOCIETY OF PERIODONTISTS ANNUAL MEETING
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