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MORE TIME TO PLAN THE PERFECT RETIREMENT
MORE FREEDOM TO TRAVEL
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Alcoholism • Chemical Dependency • Stress • Anxiety • Depression

“i need help...”

TDA Wellness Committee
(serving the entire dental profession)

We care about you as a person—an individual responsible for taking care of others. Your family, staff and patients all rely on you. If you are not at your best—physically and mentally—it’s hard to handle the stress of it all.

Our Committee is made up of concerned, caring, passionate dentists, dental hygienists and dental assistants operating under State of Tennessee law. Many members on this Committee have suffered themselves.

The Wellness program is here to help find the right professionals to deal with addiction or physiological disorders. The purpose of this program is to afford the professional every opportunity to be rehabilitated and return to a productive life and practice.

Call today, don’t wait—the Wellness Committee can be reached by calling:

615-628-3200

All calls are confidential and can be made by an individual in need of assistance or by a friend, family or staff member.
When I started practicing dentistry in 1978, there were very few government regulation intrusions into dental practices. We had to follow the State Dental Practice Act and the Rules of the Board of Dentistry. Now there are many government regulations that require that we dentists do specific functions to comply. Authorities have stated that the largest deficiency in adherence to governmental regulations in the dental office is in the area of training, policies and documentation. These are the areas of compliance that are most likely to find the practicing dentist in non-compliance and, therefore, potentially fined by a governmental agency. This editorial is to bring to the forefront these significant areas in which dentists should make sure their office has training, policies and documentation.

Regulatory compliance involves adherence to regulations and guidelines from Centers for Disease Control and Prevention (CDC), Centers for Medicare and Medicaid Services (CMS), Drug Enforcement Agency (DEA), Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA), the Office of Civil Rights (OCR) and the State’s dental board.

**Training**

**OSHA**

OSHA requires training on the Bloodborne Pathogens Standard upon hire and at least annually for dental workers who have potential exposure to bloodborne pathogens. This would include dentists, dental assistants, hygienists, lab technicians, and administrative personnel who have crossover clinical duties. Training topics must include how to maintain, replace, dispose of and replace personal protective equipment.

OSHA requires a Hazard Communication Program that includes collection of the Safety Data Sheets (SDS), training, and maintaining an annual chemical inventory. The SDS collection must be accessible and therefore if an online program is utilized, everyone must be knowledgeable of how to access it.

**CDC**

CDC recommends a written infection prevention policy and procedures appropriate for the services provided by the dental practice. These policies are to be reviewed and updated annually and include policies on elements such as:

- respiratory etiquette
- sharps safety
- safe injection practices
- sterilization and disinfection
- procedures for handling reprocessing error/failure
- environmental infection prevention and control
- dental unit water quality
HIPAA policies include privacy and security policies. The following is a sample list of required policies and elements for your program:

- Security plan. The Security Plan addresses how your office complies with the Security Rule and may include a work plan to address security issues identified in the Risk Assessment.
- Sanction policies and procedures. Dentists are required to ensure that appropriate sanctions are in place for team members who fail to comply with the practice’s HIPAA policies and procedures.
- Access policies and procedures. For example, workforce members use individual log-ins and passwords that are not shared with other individuals. User rights are limited to the assigned job position. Workstations are “logged out” prior to leaving the station such as when going to lunch or leaving the office for the day.
- Termination of employees policies and procedures
- Review of information system activity policies and procedures. For example, dentists must review audit trails regularly to detect unauthorized activity.
- Policies and procedures to address security incidents
- Contingency plan and emergency mode operations
- Hardware inventory. The hardware inventory assembles devices in use particularly those that contain ePHI.
- Retain program documentation for 6 years.

For additional information on HIPAA, please visit: https://www.hhs.gov/hipaa/for-professionals/security/laws-regulations/index.html

Documentation

OSHA

OSHA requires a sharps injury log for the recording of percutaneous injuries from contaminated sharps. If a worker experiences an exposure incident, the employer is required to properly document the exposure incident and any post-exposure evaluation.

The Employer is required to solicit direct input from non-managerial employees responsible for direct patient care who are potentially exposed to injuries from contaminated sharps. The Safer Device Evaluation and Implementation Log are completed annually.

OSHA requires a post exposure management program that ensures that the worker is evaluated by a health care professional after an exposure incident and provided with the required documentation. The employer is required to obtain a copy of the health care professional’s written opinion within 15 days of the completion of the evaluation.

OSHA requires employee medical records that maintains documentation regarding exposure incidents and vaccinations.

Labor posters may be downloaded at no cost from: https://www.tn.gov/workforce/article/required-posters (State of Tennessee) and https://www.dol.gov/general/topics/posters (Federal Department of Labor). As an alternative, you may order a space saver from the Tennessee Dental Association for the small cost of $18 for members for both posters, $25 for non-members and $10 for members for individual posters and $12 for non-members.

For additional policies and procedures relevant to OSHA compliance, please visit https://www.osha.gov/Publications/OSHA3187/osh3187.html

HIPAA

HIPAA documentation includes the required Security Risk Assessment. The purpose of the risk assessment is to identify and analyze potential risks to ePHI. Based on the assessment results, dentists must implement security measures aimed at reducing risks and vulnerabilities. If a dental office is audited, the risk assessment will be requested. The frequency varies among dental practices. Typically the risk assessment is performed at least every three years. For example, a risk assessment shall be initiated again if the following occurs:

- New technologies are incorporated
- Experienced a security incident
- Change of ownership or key personnel

If you are certifying your electronic health record (EHR), a risk assessment is required annually.

HIPAA documentation also includes obtaining an acknowledgement from patients regarding the Notice of Privacy Practices. The Notice of Privacy Practices is made available in the office and from your website.

The HITECH Act of 2009 required accountability of Business Associates for security of ePHI just as covered entities. Therefore, dentists should identify and maintain signed Business Associate Agreements having obtained assurances that the business associate will take the same precautions as the dental office.

There are now many government intrusions into the dental office. We must all know how to comply with these regulations. Training is mandated and is usually annual. Policies must be constantly updated. Documentation is critical to verify compliance. Required equipment installation must be maintained. Required posters must be displayed.

If you have questions about what you must do to comply with government regulations please call the Tennessee Dental Association at 615-628-0208. I would like to thank Olivia Wann, RDA, JD, for her technical expertise and counsel in writing this editorial.
SATURDAY, MAY 20, 2017

The meeting of the 150th Session of the TDA House of Delegates was called to order at 9:00 a.m. in Ballroom A of the Gatlinburg Convention Center in Gatlinburg, Tennessee, Dr. Chip Clayton, Speaker of the House, presiding.

Dr. Clayton called on Dr. David McNeely, past Speaker of the House of Delegates and First District Dental Society member, to deliver the invocation.

After the invocation, the Speaker led all present in the Pledge of Allegiance to the Flag and read the ADA Ethics Pledge.

At this time, Speaker Clayton called forward Dr. Jeff McMillin, President of the First District Dental Society, for welcoming remarks. Dr. McMillin said that the members of First District were honored to host the 150th TDA annual meeting and welcomed all to the House of Delegates. Dr. McMillin mentioned the beautiful convention center and gratefulness that it was not affected by the tragic fires of last year. Dr. McMillin thanked President Rick Guthrie for the great job he has done this past year as TDA President and thanked the many volunteers from First District who worked tirelessly to make the annual session a success.

Dr. Clayton then introduced those seated at the head table: Dr. Joe DiPietro, University of Tennessee President; Dr. Elizabeth Lee, Vice President, West Tennessee; Dr. Mark Freeland, Vice President, Middle Tennessee; Dr. Hope Watson, Vice President, East Tennessee; Dr. Gary Roberts, ADA President; Mr. Mike Dvorak, Executive Director; Dr. Jeannie Beauchamp, Secretary; Dr. Rick Guthrie Jr., President; Dr. Richard Dycus, President-elect; Dr. Paul Cullum, Treasurer; and Dr. James R. Hight Jr., Immediate Past President. Noted as absent was Mr. Bryan Williams, legal counsel, who was unable to attend due to illness.

Dr. Hight, Immediate Past President, asked the TDA Past Presidents in attendance to stand, and they were individually recognized.

Other special recognition was given to Dr. Bill Powell, Past ADA Trustee, Knoxville, and the Journal of the Tennessee Dental Association Editor, Dr. H. Clifton Simmons III.

Dr. Clayton noted that the House of Delegates would be digitally recorded this year and would not use the services of a court stenographer.

Dr. Clayton also thanked Mr. Mike Dvorak, Mrs. Amy Williams, and the TDA staff for the wonderful job they do for the TDA.

At this time, Dr. John Petty, Chair of the Committee on Annual Session, was called upon for his report. Dr. Bateman reported that there were 1,066 registrants at this year’s meeting, of which 340 were dentists.

Dr. Richard Bateman, General Chair of the Committee on Annual Session, was called upon for his report. Dr. Bateman reported that there were 1,066 registrants at this year’s meeting, of which 340 were dentists.

Dr. Joe DiPietro, President of the University of Tennessee, addressed the delegation.

Dr. DiPietro shared that he is a veterinarian by training and can relate to the need to have great relationships between the special schools, their professional organization and their profession in general. Dr. DiPietro spoke about the University of Tennessee with its four physical locations...
Regarding the Health Science Center in Memphis, he said that 40% of $1.6 billion slated for capital spending has gone to Memphis for various buildings and infrastructure, which he said were sorely needed. Regarding the College of Dentistry, renovations to the Dunn Dental Building are nearing completion and the bricks and mortar focus will turn toward construction of an additional building to house growing academic and clinical enterprises. The construction on the new building is already fully funded. Dr. DiPietro expressed concern about professional debt burden and said that they have asked the professional programs to tighten their belts on tuition increases. He said that this summer will be the third consecutive year that they will be under 3% for tuition increases. In closing, Dr. DiPietro said, “We need your advocacy around higher education collectively across the state.” Instead of newspaper articles about how UT is achieving its core mission – which is “Educate, Discover, Connect” – Dr. DiPietro found that the media wants controversy. So in order for people to know about the high performance level of UT, Dr. DiPietro and his marketing and communications team are rolling out a major campaign to inform the public that UT is educating more students than ever before, doing more discovery than ever before and connecting through outreach that touches millions of people every day.

Mr. Mike Dvorak, TDA Executive Director, read an address to the House from Dr. Roy Thompson, ADA Sixth District Trustee and TDA member, who was unable to attend the House of Delegates. Dr. Thompson believes one of his strengths as Tennessee’s representative on the ADA Board is that he is a fulltime solo private practice dentist encountering the same demands as most dentists. Dr. Thompson said, “As your Trustee, my pledge is to keep the health of our profession at its peak. Whether we are in private, group or corporate practice, owner or associate, whether we are clinician, researcher, educator or administrator, we all want our profession to remain respected and relevant to the public. This is what the ADA does for each of us. The ADA is committed to helping our members succeed and being the leading advocate for oral health. We do this well and the role of all ADA Trustees and Officers is to continue this legacy.” In closing he congratulated Dr. Rick Guthrie on a successful year with smooth leadership in this transitional year, and he congratulated Dr. Richard Dycus on assuming the leadership of the TDA next year.

Dr. Gary Roberts, a general practitioner from Shreveport, Louisiana, and President of the American Dental Association, addressed the House of Delegates. Dr. Roberts referred to Dr. DiPietro’s comments about student debt and said this is a real threat to our profession. Dr. Roberts said that the ADA has partnered with DRB, a company that will refinance student loans at one-half of what the federal government charges. In other areas of ADA concern, Dr. Roberts said that the ADA has partnered with DRB, a company that will refinance student loans at one-half of what the federal government charges. In other areas of ADA concern, Dr. Roberts said that the ADA has partnered with DRB, a company that will refinance student loans at one-half of what the federal government charges.

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million three-year media campaign of the ADA targets busy
moms and young millennials who have insurance but don’t see
the need for a dental exam. In closing Dr. Roberts presented Dr.
Guthrie with a plaque from the ADA commemorating his year
as President of the TDA.

Then, Dr. Guthrie presented two awards:

- Dr. James R. Hight Jr. with the Distinguished Service
  Award for serving at least six years on the Board of
  Trustees.
- The 2016 Outstanding District Award to the Nashville
  Dental Society, accepted by Dr. Rhonda Switzer-Nadasdi,
  President of NDS.

Dr. Clayton opened the floor for nominations of individuals
to serve in the elective offices of the Association for the
year 2017 - 2018. The nominations were as follows:

- President-elect – Dr. Paul Cullum
- Secretary – Dr. Jeannie Beauchamp
- Treasurer – Dr. James Avery
- Speaker of the House – Dr. George “Chip” Clayton
- Vice President, East Tennessee – Dr. Rachel Hymes
- Vice President, Middle Tennessee – Dr. Chad Edwards
- Vice President, West Tennessee – Dr. Dan Meadows
- ADA Delegate, Middle Tennessee – Dr. Rhonda
  Switzer-Nadasdi
- ADA Delegate, West Tennessee – Dr. Chris Moore
- ADA Alternate Delegate, Middle Tennessee – Dr.
  Rhett Raum
- ADA Alternate Delegate, West Tennessee – Dr. Lanora
  Bryant

As these offices were uncontested, Speaker Clayton declared
those listed above duly elected. In addition, Dr. Clayton
reported to the House that Dr. J Newman was elected by the
Chattanooga Area Dental Society as their trustee to the TDA
Board of Trustees.

Dr. Clayton called on TDA President, Dr. Rick Guthrie Jr., for
his President’s Address. (See Page 14 for Dr. Guthrie’s address
in its entirety.)

Dr. Jeannie Beauchamp, TDA Secretary, was called upon for
the Necrology Report. Dr. Beauchamp expressed great sadness
in paying tribute to those who have passed away since the last
House meeting. Dr. Beauchamp said that the TDA will send
the surviving companion or family a communication to convey
our grief over the loss and appreciation for their loved one’s
dedication to dentistry. Then the House paused for a moment of
silence in remembrance of these former colleagues.

At this time, Dr. Clayton requested that Dr. Rachel Hymes,
Chair of the Reference Committee, present the Reference
Committee report. (Other members of the Reference Committee
were: Drs. Dave Storie, J Newman, Rhonda Switzer-Nadasdi
and Steve Nowlin.) The following resolutions presented by the
Reference Committee were adopted by the House:

---

**Resolutions**

**B&F – 17 – 1**

**Payment of Membership Dues**

**RESOLVED,** that Chapter X, Section 10 be reworded as
follows:

Each member shall pay to the Tennessee Dental
Association membership dues and assessments each
year by the published deadline. Membership dues and
assessments shall be paid to the Tennessee Dental
Association, either in full or by TDA approved installment
options for eligible membership categories. Failure to do
so shall render that membership void;

and be it further

**RESOLVED,** that Chapter X, Section 10 A. be revised to delete
“January 1” and replaced with “per TDA approved payment
options”;

and be it further

**RESOLVED,** that Chapter X, Section 10 A., 2. (b) be revised to
delete “due on January 1 of”;

and be it further

**RESOLVED,** that Chapter X, Section 10 A., 3. be revised to
delete “due January 1 of”;

and be it further

**RESOLVED,** that Chapter X, Section 10 B., 1. be revised to
delete “due January 1 of each year”;

and be it further

**RESOLVED,** that Chapter X, Section 10 E. be revised to delete
due and payable January 1”;

and be it further

**RESOLVED,** that Chapter X, Section 10 G. be revised to delete
due and payable January 1”;

and be it further

**RESOLVED,** that Chapter X, Section 10 I., 1. be revised to
delete “March 1” and replaced with “the published deadline”;

and be it further

**RESOLVED,** that the Tennessee Dental Association Bylaws be
amended accordingly.

**Bylaws Dues Amendment: Requires ¾ Majority Vote for
Adoption.**

B&F – 17 – 2
Dues Increase

RESOLVED, that the annual dues for each active member of the Association be increased from $409 to $434 beginning January 1, 2018, and
be it further
RESOLVED, that the Tennessee Dental Association Bylaws be amended accordingly.

Bylaws Dues Amendment: Requires ¾ Majority Vote for Adoption.


B&F – 17 – 3
2017 – 2018 Budget

RESOLVED, that the 2017 – 2018 Tennessee Dental Association budget of $1,723,600 as prepared by the Budget and Finance Committee, be approved.


BT3 – 17 – 1
Parliamentary Procedure Publication

RESOLVED, that Bylaws CHAPTER XVII Section 10, RULES OF ORDER: be changed by deleting the word “Sturgis”.

Bylaws change requires 2/3 majority vote for adoption.

The House adopted BT3 – 17 – 1.
Ladies and gentlemen, colleagues, distinguished guests, and friends, I would like to welcome you to this 150th annual session of the Tennessee Dental Association. That is an amazing statement, 150th annual session! We are here today because in 1867 at a dental office in Memphis, Tennessee, a small group of men gathered for the purpose of organizing a State Dental Association. On July 26, 1867, led by Dr. William Morgan (the first president), 14 dentists declared the Tennessee Dental Association duly organized and ready for business. The first meeting was held in Jackson, Tennessee. Committees reported on their progress, resolutions were adopted, scientific papers were presented, and a full slate of officers were nominated and elected. Wow, doesn’t that sound very familiar to what we are doing today!

As I have traveled to all the districts this year, my goal has been to inform you of the role your district had in these formative years, as well as, instill a sense of pride for our organization. As Dr. Madison Jones wrote in 1957 when the History of the Tennessee Dental Association was written, “One realizes how much of what he is or has depends not upon his individual accomplishments but upon the efforts and foresight of the generations that preceded him. Seeing this, he is inspired to serve the future as the past as served him.” We are truly blessed to have had individuals in the past that had the foresight to bring us to the point we are today.

I would like to tell you a story of some land I bought last year. This was 20 acres of grass and woodland that joined the property where we live. This property had not been used in over 40 years, with 75-year-old fences and overgrown woods that only the deer and turkey inhabited. It was rough ground that appeared to be uninhabitable. We started by clearing away the fences and using some rather large equipment to forge into the woods. For days, we cut and moved brush and dead trees. After several days, we had cleared off most of the undesirable brush. We were standing on top of a hill and discovered an amazing view of the local mountains that could not be seen before. It truly was spectacular. I see this process much like what those early members of the TDA did as they forged their way through organizing, operating, and maintaining our Tennessee Dental Association. In the same way that we cleared the land, they found a place where like-minded professionals can come together, be educated, share our concerns, look out for one another, and plan the best direction they want the profession of dentistry to go.

I would like to share with you just a few things that we accomplished this year. First, we welcomed a new executive director, Mike Dvorak. He started by organizing his team at the 660 Bakers Bridge Avenue headquarters building. After that he and I organized a strategic planning retreat in August with the full board at the Evans Mill Resort in Smithville, Tennessee. Here all the board members gathered and spent three days looking at what we are doing now and what we want this association to look like in 10 years. The six main areas we addressed were improving our communication and technology, growing our membership, improving our governance, diversity and inclusion, continuing our focus on political advocacy, and revitalizing our annual session. I am very proud of what this board did and is continuing to do with this ongoing process. These efforts will make our organization even stronger in 2026. In that same month, I had the distinct opportunity to address the incoming dental students at the White Coat Ceremony at Meharry Medical College School of Dentistry. October was filled with a very engaging board meeting and the American Dental Association meeting in Denver, Colorado. Our January Board meeting featured a report from Tennessee Board of Dentistry president, Dr. Nadim Jubran. I feel this meeting went a long way to strengthen our relationship with Tennessee Board of Dentistry. The Board meeting in April received addresses from both deans of Tennessee dental schools. Dr. Cherae Farmer-Dixon shared a report on Meharry School of Dentistry, and Dr. Tim Hottel reported on the state of University of Tennessee College of Dentistry. Both reports were very informative, and here again, relationships were strengthened through mutual collaboration.

I am very happy to report that our councils and committees have been working hard this year. The one I am particularly proud of is our Council on Membership, chaired by Dr. Vickie Guffey. This council is responsible for the Tennessee Dental
Association Relief Fund that is used to help fellow dentists in times of need or disaster. The flooding in Baton Rouge, Louisiana in August of last year was catastrophic and 70 dentists were affected. Our Council on Membership approved a gift of $25,000 to be given to the Louisiana Dental Association to help in this effort. We led the nation in giving from our Tennessee funds and helped these displaced dentists. To add to that, I researched our relief fund in Tennessee in 1967 had a balance of $1,950. With the generosity of our TDA members’ support, our relief fund balance is nearing $500,000! That truly shows the volunteer spirit of Tennessee dentists.

Our Governmental Affairs Committee has been hard at work this year, also. In a meeting with Dr. Joe DePietro, the University of Tennessee president last week, he made mention of the different universities he serves and them being like your children. They have different personalities and get into trouble sometimes. You love them all but some need more attention than others. Well ours might be the Governmental Affairs Committee. We had some trying times with some legislation this year. Drs. Richard Dycus and Jeannie Beauchamp’s leadership this year was valuable in the highly volatile situation we faced with proposed bills. All has worked out well, I just wish they didn’t have so much drama at times. Bottom line is that the Governmental Affairs Committee represented us well in Nashville this past legislative session and dentistry continues to have a strong advocacy position.

The usual problem child is our Budget and Finance Committee. This year our association ended the year with a deficit. We had many additional expenses as we transitioned to a new Executive Director. Under the leadership and direction of our treasurer, Dr. Paul Cullum, this year they are proposing a surplus budget for the 2017/2018 year. This is the first surplus budget I have seen in the 10 years I have been on this board. Thank you to the Budget and Finance Committee for all your hard work.

The always perfect child or committee is the Council on Scientific Programs and Continuing Education, chaired by Dr. Craig Shepherd. They did a terrific job this year in providing outstanding continuing education for this 150th meeting. One of the cornerstones of our association is to provide and maintain quality education for our membership. You have done a great job this year, and I understand they have already lined up the speakers for next year’s annual meeting in Franklin, Tennessee.

Now that I have talked about what we have done, I would like to address a few areas where I feel need some attention. The first is to increase our financial reserves. As I have researched our 150-year history, this subject has been a constant concern. At present, we are at about 25% reserve of our annual operating budget. I feel this should be at a 75% level to weather any storms that may cross our path. It just makes good sense to save for a rainy day. This goal could be achieved in 4-5 years if we start now. What a great legacy to leave for the future leadership of the TDA.

Secondly, let’s continue the relationships we have developed with the other organizations we have vested interest in: our dental colleges and universities, Board of Dentistry, Tennessee Dental Hygiene Association, Tennessee State Oral Health Initiative Committee, TennCare Board, dental insurance companies (Delta Dental, Blue Cross Blue Shield), state legislators, and others that will affect our profession. I would much rather be proactive that reactive.

Thirdly, I believe we need to take a good hard look at how we govern our Association. Dr. Dennis Gardner of Columbia, Tennessee is chairperson for a governance task force to evaluate our current system of representation for leadership of the TDA. Every district is represented on this task force. They will determine if any changes need to be made. If any are found, they will make recommendations and bring resolutions to this House of Delegates as early as next year.

As your president, it has been my great honor to represent you this year. I have visited every district on one or more occasions this year. I have traveled 12,000 miles, attended 32 different events, and been on 22 conference or Zoom calls. I have tried to do the best of my ability to represent you well and be worthy of your trust in representing our 2,450 TDA members.

A strong membership is vital to our next 150 years. Our voice is heard if we stay united and are ready for what is coming for the future of dentistry. I look at how far we have come since that meeting of those 14 gentlemen that started the Tennessee Dental Association and where we are going. Deserving of much credit is the past leadership of this organization in conjunction with the American Dental Association. Dr. Gary Roberts, American Dental Association President, is with us today to attest to all the great things we have accomplished nationally as being part of the collective voice of dentistry. As much as I love our past I can’t wait to see what the future holds. This is an exciting time to be in the profession of dentistry. We are the number 1 career in America today. US News reports dentistry to be the “Best Job” in America! Dentists serve the public well, are unified, maintain our organization, and take care of each other. I believe these are the reason for our success.

I need to thank some people for their help this past year. Mike Dvorak our Executive Director and his staff: Sharon Melvin, Amy Williams, Liz Maden, Jonsie Holloway, Brittany Hall, and Shirley Fleener work so hard for us! They have truly been a joy to work with. I have been blessed with an extraordinary Board of Trustees to serve with this year. The respect and cooperation of this group has been the reason for our success. I hope you have enjoyed this year as much as I have. My staff, many of which are here today, have been amazingly patient with me during my travels and our crazy schedules. As many of you know, I practice with my father Dr. Fred Guthrie and son Dr. Van Guthrie. Without their help this year, much of what I have been able to do would not have been possible. I must give much thanks to my driving partner, proof reader, note taker, schedule keeper, travel agent, and best friend Cindy, my wife. Thank you, sweetheart!

I want to go back to that story I was telling you about the property we purchased last year. It looks really good now. A lot of work has been done, and it doesn’t look like the same place as before. But if I do not keep it up, in 50 years or so it will be unrecognizable again. That is much like our Tennessee Dental Association. Many before us have invested so much of their time and resources to make dentistry the best job in America. It is our task and the next generation’s to take care of it now. So, I want to leave you with this: Keep the grass mowed!
Dr. H. Clifton Simmons III (right) is presented the Dr. Jack Wells Memorial Dedication to Dentistry Award by Dr. Rick Guthrie, TDA President.

2017 Fifty-Year Award Recipients

Pictured from left to right are Fifty-Year Award Recipients: Drs. John Webber, Zeb Shope, William Powell, Donald Jones, Charles Greenblatt, Ronald Kilgore, Clarence Baskette, Samuel Eddy and Riley Lunn.

Receiving the Fifty-Year Award but not pictured were Drs. David Barto, Stephen Brooks, Cordell Chaffin, James Cohen, Dwight DeBow, Robert Ducklo, Don Flanagan, Ralph Grant, Phillip Green, Enoch Hammon, Charles Hopper, David Jones, John Love, Duncan McInnis, John McSpadden, Kenneth Schenck, Jerry Taintor and Wayne Tipps.
2017 Volunteer Service in a Foreign Country Award Recipients

Dr. G. Robert Hopper  Dr. Edward Vaughan  Dr. Kristy Jo Dye  Dr. Debbie S. Wallace  Dr. Elizabeth Lee

2017 Volunteer Service in the United States Award Recipients

Dr. Nilam T. Patel  Dr. Karl L. Meyer  Dr. Kristy Jo Dye

2017 Fellowship Award Recipients

Pictured from left to right are Fellowship Award Recipients: Drs. W. Cooper Sandusky III, George S. Lee, G. Robert Hopper, Jay G. Davis, G. Matthew Brock, Robert L. Ramsey, John Alan Smith, Joshua A. Campbell and Dennis J. Wells.

Receiving the Fellowship Award but not pictured: Drs. Katherine N. Hall and Stanley R. Waddell
Introduction

Diabetes related complications are the seventh leading cause of death in the United States and is seen more prevalently in certain populations. As of June 2014, there are 29.1 million Americans (9.3% of the US population) with diabetes. Of the 29.1 million afflicted, approximately 1.25 million American children and adults have Type 1 diabetes. A staggering 8.1 million of the diabetics are unaware that they have this disease, because the early symptoms of increased thirst, appetite and urination, weight loss, and fatigue are not significant enough to make people seek treatment. In the United States, there were 86 million, age 20 and older considered pre-diabetic or diabetic when surveyed in 2014. This value is up from a previous survey in 2010, revealing 79 million who qualified as either pre-diabetic or diabetic. As we age the chance of being diagnosed with diabetes increases quite significantly, with 25.9% of seniors having this disease. Children are not as susceptible to this disease. When surveyed, only 23,500 youth had been diagnosed with diabetes; 18,436 of the 23,500 were type 1 diabetics. Ethnicity has been used as an indicator for one’s chance of being diagnosed with diabetes during their lifetime. American Indians/Alaskan natives are at the highest risk with 15.9% of their population having the disease. Non-Hispanic blacks have a 13.2% chance of being diagnosed with the disease, and non-Hispanic whites show a 7.6% chance. Men have a slightly higher prevalence rate of developing diabetes compared to women, but this statistic could easily be linked to BMI and other lifestyle factors rather than gender differences.

The Centers for Disease Control (CDC) released statistics revealing the counties in the US with the highest percentage of people with Type-2 diabetes. This region of the Mid-South has been referred to as “The Diabetes Belt” due to higher prevalence of diabetes mellitus when compared to other regions. Counties were placed in the diabetes belt if at least 11% of the residents had type-2 diabetes. The state of Tennessee is nearly entirely within this belt. Factors related to increased incidence of diabetes mellitus within the region are associated with a larger proportion of African-American ancestry in the population, poor nutrition, sedentary lifestyle, and increasing numbers of obese children and adults.

Despite extensive research, the disease process associated with diabetes mellitus is not fully understood. Diabetes can be subdivided with regard to different pathogenic factors, however, the focus of this paper is on diabetes mellitus (DM) type 1 and type 2. Diabetes mellitus is a metabolic disease characterized by the lack of, or the inability for the body to use insulin effectively, leading to fat, protein, and carbohydrate metabolism disruption. There are two main types of diabetes mellitus: Type 1 (insulin-dependent) and Type 2 (non-insulin dependent). Type 1 DM (IDDM) presents itself when the body has an autoantibody response to islets of Langerhans cell within the pancreas causing destruction to the insulin secreting beta cells. This type accounts for about 10% of all DM cases. Type 2 DM (NIDDM) is more commonly associated with adulthood, and is caused by a resistance to insulin at the target tissue. The target cells fail to respond to the presence of the insulin leading to cell starvation. It is postulated that affected cells either have a decreased number of insulin receptors, or the receptors simply fail to recognize insulin, resulting in a breakdown in metabolic function. This primarily affects the utilization of glucose, with an increased catabolism of fats and proteins, which in serious cases can result in ketoacidosis.

Type 1 DM is usually diagnosed early in life, from approximately age five to early teens, but can be diagnosed in all age groups. This form of DM has a strong association with other endocrine autoimmunity, such as Addison’s or Grave’s disease, and has a large genetic component. The genetic link associated with type 1 DM is believed to be strongly related to the father’s genetic makeup when passing on factors that can lead to type 1 DM. There is a 10% chance of acquiring DM type 1 if a first-degree relative has diabetes, and if an identical twin is diagnosed with type 1 DM, the other identical twin has a 33% chance.

Other significant risk factors are an enteric viral infection early in life, having an older biological mother, or a mother diagnosed with pre-eclampsia.

Abstract

Diabetes mellitus (DM) and its related complications have increasingly climbed the list of cause of death in the United States over the course of several decades. A large percentage of afflicted individuals with Diabetes mellitus are often completely unaware and undiagnosed. Medical, along with perioperative management of these individuals, continues to be paramount in achieving safe and effective care for the diabetic patient. Dental practitioners share this responsibility, to provide and seek proper consultation in treating this seemingly ever-growing population.
Diabetes Mellitus: A Short Review for Practitioners

Diabetes Mellitus

Type 1 DM

The development of type 1 DM is thought to have both genetic and environmental factors contributing. The development of type 2 DM has a clear association with a family history of diabetes. The known genetic factors have shown polymorphisms on insulin receptors and insulin receptor substrate. Polymorphisms are also seen on thrifty genes such as the beta-3 adrenergic receptor gene and the uncoupling protein gene, which are associated with visceral obesity and promote insulin resistance. Glucolipotoxicity and chronic low-grade inflammatory factors can contribute to the impairment of insulin secretion and signaling dysfunction. Most commonly, the patients suffering from type 2 DM are obese with extra central visceral adipose tissue. It is thought that the actual adipose tissue also plays a role in the development of this disease. The accepted hypothesis states: the elevated non-esterified fatty acid concentration plays a critical role in the development of the disease. 

Research shows that diabetes can have a significant impact on the body, however, dental implications are something that can easily be overlooked by the general population. Several studies have indicated significant dental implications and some suggest modification of proposed treatment plans when a patient has been diagnosed with type 2 diabetes or is poorly-controlled. The study by Dubey et al., discusses the effect of diabetes on impact treatment success. This study concluded that failure rates in DM patients were slightly higher when compared to subjects not afflicted with DM. This group noticed that the rate of mineral apposition in newly formed bone and the bone density around implants were significantly less in uncontrolled DM patients, but the apposition and density in well-controlled DM patients showed a similar pattern compared to health. Bone volume and density are important to the success of the implant, but even more crucial than that, the bone-implant interface was found to be significantly less in DM patients. 

This study also discussed the manner in which hyperglycemia can lead to inhibition of osteoblastic activity, altering the response of Parathyroid hormone. This in turn can affect osteoblastic activity further by decreasing the collagen formation during callus formation, inducing apoptosis (programmed cell death) of the bone-lining cells, and increases osteoclastic activity due to increased inflammatory response. The implant success rate ranged from 85.5% – 100% in the control and DM patients, however, in general the study observed slightly higher early (within one year of placement) failure rates in DM patients compared to late failure rates. The overall lower success of implants in patients with DM may be due to higher chance of micro-vascular complications which consequently lead to delay of healing around the implants and hence a higher chance of early failure. 

A study by Zhou et al., about the relationship between periodontitis and DM patients shows the impact of DM on bone levels from periodontitis, and the synergistic affect DM and periodontitis may have on each other. It was found that plaque index, gingival index, and bleeding on probing were all significantly higher in DM patients compared to healthy controls. A two-year follow up study showed a 4.23 fold increased risk of severe alveolar bone loss in type 2 diabetics compared to their healthy counterparts. It was determined that advanced glycosylation end products accumulate in a diabetic’s blood, and when these bind to their target receptors they cause activation of monocytes and endothelia cells resulting in release of pro-inflammatory cytokines. The increased inflammatory response is what results in gingival tissue and tooth supporting bone destruction. 

New treatments for approaches for managing and diagnosing DM are on the rise. One study explained how in the near future dentists would be able to screen for diabetes with nothing other than sufficient blood from bleeding on probing. Diagnosing diabetes from a simple periodontal exam would help reduce the ever-growing number of undiagnosed diabetics in this country. Another area related to diabetes that is being researched is the anti-cancer effect of metformin specifically in the head and neck region. A study has shown a 30% reduction in cancer incidence in type 2 diabetics on Metformin compared to type 2 diabetics on non-Metformin treatment. 

The diabetic patient can have many perioperative treatment precautions taken along with preventative tests run to ensure the safety of the patient. Diabetics are known to have cardiac enlargement and pulmonary vascular congestion. Cardiac rhythm problems can also manifest in these patients. The evidence seen on an EKG show incidence of ST-segment and T-wave abnormalities, and cases of myocardial ischemia can also manifest itself on an EKG despite a negative history that could be caused from myocardial neuropathy. Kidney function is an important part of patient health that must be monitored within the diabetic patient. A common sign of
kidney dysfunction is proteinuria, which can be elucidated often by elevated serum creatinine.

Certain tests may be run to show the long-term levels or control of hyperglycemia. HbA1c levels increase in the presence of hyperglycemia, and labs are able to determine the amount of sugar attached to the patient’s hemoglobin. When hemoglobin proteins are glycosylated, it results in the formation of HbA1c. A1C levels correlate with the levels of glucose within blood over the past 2 to 3 months. Healthy patients should show an A1C value of ≤6%, and in well-controlled diabetics the value should stay below 7%. Uncontrolled diabetics can present with A1C values as high as 20% glycosylated. With these simple laboratory tests a diabetic patient’s hemoglobin A1C levels can and should be checked before any major surgery. Complications can arise in a patient with elevated HbA1c values, so for patients not currently monitoring their A1C state it is of great importance to know this value prior to surgical treatment. One longitudinal study suggests that A1C values play a vital role in predicting postoperative complications. The study shows that diabetics with A1C values below 7% had 42% fewer systemic complications and 57% less mortality compared with poorly controlled patients.

There are a wide array of potential complications when performing any operation for a diabetic patient. The use of aspirin or other NSAIDs in patients taking any sulfonylureas has the potential to worsen the hypoglycemia. Local anesthetics are generally not an issue if the diabetic is well controlled, however, if the patient has hypertension, or any history of cardiac problems, specifically arrhythmias or infarction, the dosage of epinephrine should be limited to two carpsules (0.034mg) containing 1:100,000 epinephrine. A confirmation of cardiovascular status is imperative, especially when the patient is taking beta blocker drugs due to the hypoglycemic potential from an interaction with sulfonylureas. Patients are advised to take the usual dosage of insulin and eat normal meals the day of the appointment. Providers must be aware of the patient’s signs and symptoms of a hypoglycemic event (shakiness, dizziness, sweating, headache, pale skin color, blurred vision, increased heart rate, and hunger), and be prepared with a glucose source (orange juice, soda, cake icing) to treat the hypoglycemic patient. Other treatment options for severe hypoglycemia are administration of intramuscular or sublingual glucagon. A consultation should be made to the patient’s physician concerning the postoperative diet prior to any extensive dental surgery. If the diabetes is not well-controlled the day of the appointment, the surgeon should provide emergency care only.

Establishing a good glycemic control pre-surgery is key in preventing possible complications. For the type-2 diabetic, controlled by diet only, the provider must measure the blood glucose prior to surgery, after the procedure, and during the procedure if prolonged. For type-2 diabetics controlled by oral medications, Metformin should be withheld 48 hours prior to the surgery, and if they are unable to cease taking the medication, plan to monitor for lactic acidosis. Patients should discontinue the shorter acting sulfonylurea agents the night before. In the event of marked hyperglycemia, insulin may be supplemented. Early morning appointments or operating room procedures are most adventitious for diabetic patients. Type-1 diabetic patient treated with insulin needs to discontinue the long acting insulin (Ulteralute®, Lantus®) 1-2 days prior to surgery and begin more intermediate acting insulin.

Patient evaluation and risk management are an integral part to keeping postoperative complications to a minimum. Determining if the patient has diabetes mellitus is the first step within this process. Patients that are obese, older than 45 years of age, patients with close relatives with a history of DM, or women who have given birth to large birth weight babies (greater than 9 pounds) or who have had multiple spontaneous abortions or stillbirths should be screened. The risk of postoperative infection in diabetics is directly related to their blood glucose levels, the presence of infecting organisms, and invasiveness of dental procedures. There is no increased risk of infection if the blood glucose level is 206 mg/100mL or below, but if the fasting blood glucose reaches between 207 and 229 mg/100mL, then the risk increases by 20% during surgery. If the fasting blood glucose level rises above 230 mg/100mL, there is an 80% increased risk for postoperative infection. If glycemic control is poor or the patient shows signs or symptoms of an undiagnosed problem, then a medical consultation is indicated prior to surgery. A well-controlled fasting glucose (between 70 mg/dL and 200 mg/dL) with no sign of complications, blood pressure <180/110 mm Hg, and a functional capacity > 4 metabolic equivalents (patient able to perform moderate activity i.e. jogging) are all satisfactory signs and all dental procedures can be performed without special precautions.

The surgical management of a type-1 or type-2 diabetes patient can be difficult; however, if the provider is conscious of precautionary measures, along with monitoring before, during and after the surgery, the chances of complications are drastically reduced. Stress-induced glucose intolerance from cortisol, catecholamines, and glucagon production occurs in diabetics and in many healthy patients as well. The diet should contain at least 250 to 300 g of carbohydrates on each of the 3 days before testing. Patients whose blood glucose level is going to be assessed should not participate in excessive physical activity, as exercise tends to lower blood glucose levels. Preoperative emotional stress, intraoperative anesthesia stress, postoperative wound, physiologic, and emotional stress all increase the insulin requirement perioperatively for Type-I DM patients. Elevated blood sugar not only impairs wound healing but also depresses leukocyte and pancreatic β-cell function. Long-standing diabetics are also at risk for Coronary Artery Disease and do not tolerate post-operative infections. Platelet adhesion is affected in type-1 patients by having a higher chance of surgical flaps healing poorly.

**Hospital-Based Management of the Diabetic Patient**

The preoperative phase has many variables to consider on the day of the appointment. As mentioned, the surgery should be short and scheduled early in the morning. Try to delay the morning insulin dose until after the surgery and...
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If the patient misses breakfast and lunch then administer 1/3 – 1/2 of the morning NPH dose and 1/3 of the regular. Patients with insulin pumps may simply continue at the basal rate. For late procedures the provider should administer 1/3 to 1/2 of the usual intermediate insulin and D5W 100 cc/hour, and if a pump is active then continue the basal rate. A short-acting sliding scale is also useful for late in the day procedures. If a procedure is perceived to be a long operation then insulin should be infused with glucose and administered. Educating the patient regarding hypo/hyperglycemic episodes is indicated prior to any surgery.

Intraoperative management of the diabetes patient has a goal of keeping the glycemic index between 120 – 200 mg/dL. One unit of regular insulin typically lowers blood glucose 25 – 30 mg/dL in a 70 kg patient. Each mL dose of D50 raises the blood glucose approximately 2 mg/dL. There are three options for intraoperative management as follows: Subcutaneous sliding scale, GIK regimen, or separate insulin and glucose intravenous solutions. The subcutaneous sliding scale is recommended for minor surgery and is based on a 2-4 hour peak effect. The sliding scale works by administering frequent but small doses of short-acting insulin. Starting at serum glucose level of 150-200 mg/dL, a subcutaneous dose of 2 units would be administered, and for every 50 mg/dL serum glucose level increase an additional 2 units should be administered. The glucose insulin potassium infusion (GIK) technique uses a GIK drip in a single solution infusion that includes 500mL of 10% dextrose with 10 mmol of potassium chloride, and 15 units of short-acting insulin. This mixture is infused at 100 mL/hour. The levels are measured every two hours, and they may be strengthened or weakened by 5 units of insulin. The potassium levels should be checked every 6 hours to prevent hypokalemia, due to the increased potassium uptake into cells in response to the insulin. The blood glucose should be monitored at least every two hours. The GIK method is considered a safe method because the insulin and glucose are given together, but still may require frequent changes of intravenous solution. The problem with this approach is that if glucose levels run low, based upon the target levels, and the infusion is stopped, then patients with type-1 diabetes can quickly become ketogenic. The final technique to control the blood glucose of the diabetic patient is the use of separate insulin and glucose IVs. In this technique the dextrose is administered at approximately 5-10gm of glucose/hour. Insulin infusion is given separately using short-acting insulin. The typical type-1 diabetic patient will require an infusion at a rate of 1 to 2 units/hour, while the more insulin resistant type 2 diabetic can require higher insulin rates. Dividing the blood glucose level (in mg/dL) by 100 and then rounding the result in U/hr calculation can give you the correct initial dosage for these patients.

On the day of surgery the patients have two protocols that could be followed. The first option has the patient withholding from any short-acting insulin, but should be given between 1/2 to 2/3 of intermediate or long-acting insulin to provide basal insulin and prevent ketosis during the procedure. Option two has the patient taking between one-third to one-half of the total morning dose (both intermediate and short-acting insulin) as intermediate acting insulin only. Patients on continuous insulin infusion may continue with their usual basal infusion rate. Start dextrose containing intravenous solution (either dextrose with water or one-half isotonic saline) at a rate of 75 to 125 cc/hour to provide 3.75 to 6.25 grams of glucose/hour to avoid the metabolic changes of starvation.

Postoperative management can be one of the most important steps to keeping the patient out of harms way. If large volumes of lactate-containing IV fluids were used intraoperatively, blood sugar will continue to rise for 24-48 hours following surgery. The patient can have gastroparesis leading to persistent nausea and vomiting precipitating another hospital visit. After the patient begins eating well again, the preoperative diabetes treatment regimen may be reinstated. If the patient does not resume eating well postoperatively, then insulin infusions should be continued. Once it seems likely that solid food will be tolerated, the patient can be switched to subcutaneous insulin with a D5 supplement. If the patient has a history of renal insufficiency, significant hepatic impairment, or any type of congestive heart failure, then Metformin should not be restarted. Sulfonylureas stimulate insulin secretion and may cause hypoglycemia; they should be started only after eating has been well established. A step-up approach can be used for patients on high doses of sulfonylureas, which is simply starting them at low doses and adjusting them until the usual dose is reached. Thiazolidinediones should not be used if patients develop congestive heart failure or problematic fluid retention, or if there are any liver function abnormalities. The ADA recommended caloric intake after surgery is between 1800 and 2000 daily. The patient needs to continue their Accu-Chek® every 2-4 hours, and once their levels are controlled can advance to checking twice daily.

Office-Based Management of the Diabetic Patient

Protocol for intravenous sedation should involve post-midnight fasting the morning of the appointment. Tell the patient to only use half of their usual dose of insulin, and the other half will be supplemented with intravenous glucose during the procedure. The diabetic patient that is controlled but is known to be a brittle diabetic, meaning that the disease is not easily managed or is typically on high doses of insulin, is at an increased infection risk. Prophylactic antibiotic treatment is typically not needed, but if an infection arises, the antibiotic treatment should be given. Patients with brittle diabetes or receiving high doses of insulin with an acute infection present should have a culture taken of the area for further antibiotic sensitivity testing. In a well-controlled diabetic with an episode of acute dental infection, the practitioner should use standard methods of treatment: incision and drainage if needed, warm intraoral rinses, pulpectomy, pulpotomy or extractions.

In general, antibiotic use prior to routine dental procedure (restorations, cleaning, impressions in well-controlled diabetics are not necessary. The practitioner must utilize sound
clinical judgment in conjunction with preoperative blood glucose readings to assess need for antibiotics in the pre/intra/post-operative phase. Individuals with blood glucose reading less than 200mg/dL are considered safe for all dental procedures, with upper limits of 250-300mg/dL for emergency treatment (extractions, endodontic treatments for symptomatic patients). The authors recommend antibiotic treatment being initiated for poorly-controlled diabetic patients after all blood-letting procedures (extractions, endodontic therapy, deep scaling and root planning), and certainly for any patient with signs, or symptoms of acute/chronic infection (frank pus, periapical pathology, fever, tachycardia). Diabetic patients with acute odontogenic infections which have progressed beyond the alveolar bone (fascial space infections) are indicated for referral to a specialist for further treatment. Patient education regarding their increased risk for infection secondary to diabetes mellitus, and specifically hyperglycemia, needs to be addressed with the patient to emphasize the need for excellent glycemic control to optimize results and minimize the rate of complications after their dental procedures.

Lastly, although dental practitioners have undertaken an increased role in managing the overall health of our patients, one must consider the medical and legal ramifications when treating diabetic individuals. Complications related to hypoglycemic and hyperglycemic events can be significant and often dangerous. Proper consultation to the patient’s Primary Care Provider or Endocrinologist is in the best interest of the patient and practitioner alike within the medically compromised population. A sound line of communication between all individuals providing care for the patient will allow for the best quality treatment.

Disclosure: The authors did not report any disclosures.
1. As of June 2014, what percentage of the U.S. population were listed as having diabetes?
   a. 1.3%
   b. 9.3%
   c. 30%
   d. 50%

2. Eighty-six million of those surveyed in 2014, age 20 and older were considered diabetic or pre-diabetic?
   a. True
   b. False

3. Which ethnic group has the greater chance of developing DM?
   a. non-Hispanic white
   b. Scandinavian
   c. non-Hispanic black
   d. American Indians/Alaskan Natives

4. What region in the United States is referred to as “The Diabetes Belt”?
   a. Southwest
   b. Northwest
   c. Northeast
   d. Mid-south

5. The number one risk factor in type-2 DM is
   a. obesity
   b. lack of sleep
   c. consumption of red meat
   d. water consumption

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Conservative Repair of a Fractured Porcelain-Metal Prosthesis: A Case Report


Introduction

Single and multiple unit fixed dental prostheses (FDPs) incorporating porcelain-fused-to-metal (PFM) components have traditionally been the most frequently employed permanent restorations for replacement of missing anterior and posterior teeth. The fabrication of PFM restorations utilizing feldspathic porcelains have been considered the standard of care for over fifty years and continue to be widely accepted primarily as a result of the inherent esthetic qualities of these materials. Contemporary dental porcelain formulations combine the high-strength, durability, and visual attributes necessary for successful restorative treatment outcomes. However, studies describing survival and failure rates comparing different sub-structure and supra-structure materials have shown rather conflicting results. Newer materials employed for FDPs construction have included the introduction of glass and particle reinforced ceramic supra-structures and zirconia (zirconium-oxide) framework sub-structures. Irrespective of the advanced physical and biomimetic characteristics exhibited by modern dental material components, clinical failures nevertheless occur and can be acutely problematic and expensive to resolve.

Many of the challenges associated with this treatment dilemma have involved technical or laboratory processing (errors), material physical properties, iatrogenic or laboratory technician problems, and patient imposed inadequacies. Material imitations and/or incorrectly applied component principles associated with the physical or mechanical properties are factors, which can precipitate fatigue and eventual failure of the restoration. Environmental and/or patient induced factors, such as unexpected trauma or post-treatment occlusion disharmonies, can also result in subsequent material failure.

Dentists are often challenged with difficult diagnostic and treatment decisions following the unanticipated injury to a tooth or dental restoration, specifically in the anterior esthetic zone of a dentition. Unforeseen damage from trauma and/or long-term affront can produce significant impairment functionally, phonetically, and esthetically. These deficiencies can also be temporarily detrimental, both psychologically and emotionally, hence, prompt repair or restoration of the affected area is often the principal concern of the patient. Systematic review articles in the dental literature have described contributory limiting factors associated with the delivery of dental restoratives. Studies describing the etiology or cause of material failure and subsequent failure rates for all-ceramic FDPs, ceramic-based PFM FDPs, and zirconia-based FDPs, whether they are tooth-supported or implant-supported, have resulted. Chairside and indirect repair procedures, as well as combination techniques of the two methods, have likewise been reported. Also, laboratory studies have been conducted testing different procedures and restoratives for repair of veneering porcelains using direct surface preparation and material application techniques. Long-term study results have shown that failure rates are higher for all-ceramic FDPs compared to PFM FDPs; however, with contrast to single units (crowns) utilizing the same materials, no significant differences were encountered. Substructure or framework fractures have been a principal reason for loss of veneering porcelain materials, while for zirconia-based prostheses, which includes higher strength constituents, fracture of the overlying porcelain is often the main reason for failure. Chipping rates for FDPs with zirconia veneers using direct surface procedures and restoratives for repair of veneering porcelains using combination techniques, and failure and subsequent failure rates are higher for all-ceramic FDPs compared to PFM FDPs; however, with contrast to single units (crowns) utilizing the same materials, no significant differences were encountered. Substructure or framework fractures have been a principal reason for loss of veneering porcelain materials, while for zirconia-based prostheses, which includes higher strength constituents, fracture of the overlying porcelain is often the main reason for failure. Chipping rates for FDPs with zirconia frameworks, using a porcelain-based veneer, range from 0 to 54 percent following three years of observation,
While fracture rates for FDPs using PFM are approximately 3% after five years of observation. According to one study, the frequency of success from repair by finishing and polishing the existing fractured porcelain alone was significantly higher than from fractures incurred whereby addition of veneering materials were required.

Clinical techniques for repair of damaged porcelain surfaces associated with a PFM single crown or FDP can involve successful interim corrective measures prior to eventual removal of the existing defective restoration and replacement with a newly designed prosthesis. Prior to active initiation of a finalized treatment plan, an evidence-based approach to patient care should be formulated using the most current, standard of care procedures, best judgment of the clinician, and patient involvement in decision-making. Accordingly, the patient must be informed regarding the options for provisional as well as permanent comprehensive treatment that could impact future physical, financial, and psychological concerns. Assimilation of all pertinent information, including the patient’s medical and dental histories, clinical evaluation, and radiographic interpretation, for the final differential diagnosis and treatment plan, must be performed prior to active therapy.

Case Report

A 75-year-old female presented to the Department of General Practice Dentistry, University of Tennessee (UTHSC), College of Dentistry, for a complete dental examination. A review of the patient’s medical status included a history of high blood pressure and mental depression, for which specific medications were prescribed. Clinical evaluation of the maxillary arch (Figure 1) revealed a removable partial dental prosthesis (RDP) and a maxillary FDP, spanning the permanent right to left canines. The right lateral incisor and canine serving as false or pontic teeth, right/left central incisors performing as abutment teeth, with complete crown PFMs having previously restored the left lateral incisor, canine, and first premolar—all splinted. The maxillary FDP/complete crowns consisted of porcelain veneer facings overlying metal frameworks.

Also, an un-restored right first premolar implant prosthesis was noted. One of the maxillary FDP pontic teeth exhibited fractured porcelain on the facial surface (Figure 2). Observation of the mandibular arch noted existing single complete crown restorations and a RDP. Subsequent diagnoses included generalized periodontitis, with 4.0 millimeters of horizontal bone loss and gingival recession on the remaining teeth. Carious lesions on the labial surfaces of the mandibular central and lateral incisors, with non-serviceable FDP abutment crowns with recurrent caries, and ill-fitting extant RDPs. Furthermore, all maxillary and mandibular restorations and prostheses had been in service for a minimum of twenty years.

Treatment planning recommendations included: extraction of the maxillary anterior and posterior teeth/implant prosthesis with comprehensive rehabilitation consisting of an immediate removable complete dental prosthesis (ICDP) and replacement of existing mandibular complete crowns with re-surveyed crowns, followed by re-design and fabrication of a new RDP. The patient accepted the documented information presented; however, the chief complaint of the chipping of the veneering porcelain, of an anterior FDP in the existing space of the permanent maxillary right lateral incisor (pontic tooth), seemed the most immediate concern. The porcelain had fractured from the restoration the previous week and the patient stated she was “very self-conscious about missing the top portion of my tooth.” Upon consultation with the attending faculty members, Department of Dental General Practice, options for the maxillary right lateral incisor (pontic tooth) included different scenarios of treatment based upon the patient’s present treatment plan, esthetic, functional, emotional, and financial requirements. These options included: 1) repair/replacement of the existing veneering porcelain of the pontic tooth, using composite resin as a provisional restorative; or 2) immediate commencement of the comprehensive treatment plan. The decision was made by the patient, in consultation with the student and attending doctor, that the maxillary right lateral incisor, pontic...
tooth, would be provisionally repaired using composite resin. The patient understood the risks, benefits, and potential complications of provisional restoration and signed the consent for treatment.

The intraoral shade was acquired for the maxillary FDP teeth (pontic and abutment teeth) using an Esthet-X™ (Dentsply-Caulk, USA) composite resin guide shade of C4. A dental dam was positioned around the maxillary anterior dentition (FDPs). A diamond tapered finishing bur was used to place a 1.0 mm bevel on the facial-incisal surface that incorporated the fractured area of the porcelain. This was followed by the addition of mechanical retention placed into the palatal surface of the metal substructure using a #35 inverted cone bur. Bisco Porcelain Etchant™ (Bisco Inc., USA) 9.5% buffered hydrofluoric acid gel (Figure 3) was applied to the beveled area of the porcelain for 60 seconds. The acid was carefully rinsed from the porcelain surface followed by application of Optibond Solo Plus™ (Kerr, USA) adhesive system and polymerized for 10 seconds using a light emitting diode (LED) light source. Esthet-X™ composite resin, shade C4, was applied to the area, carefully blending the material to match the contour of the existing porcelain, and again, light polymerized for 40 seconds. Tapered, carbide finishing burs were employed to smooth and contour the repaired surface followed by further polishing using medium and fine aluminum oxide finishing discs. Lastly, Embrace Wetbond Seal-and-Shine™ (PulpDent, USA) low-viscosity surface sealant was applied to fill any remaining surface microporosities and to further enhance the esthetic qualities of the repaired restoration. The patient was immediately pleased with the appearance of the newly refurbished tooth and was once again informed that this repair was a provisionally corrected measure only, until further permanent treatment ensued (Figures 4a-4c).

Discussion

Re-establishment of a patient’s smile to natural esthetics and function is a very satisfying moment for the dentist. Trauma to a tooth/teeth or dental prosthesis can be a frustrating event to the patient’s emotional and psychological well-being, especially if pertaining to the esthetic zone.13, 14 Fractured or chipped external surfaces of teeth usually require restoration to varying degrees, provisionally or permanently. Eventually, complete rehabilitation of the involved tooth/prosthesis necessitates a comprehensive intraoral examination and treatment planning for successful long-term rehabilitation of the chief complaint. Of primary importance is that the patient takes an active role in the decision-making and treatment planning processes based upon all aspects of future care.25

Replacement of an impaired prosthesis with a new restoration (FDP/PFM) is often an eventual rationale; however, immediate surface repair of the veneering porcelain can be performed achieving satisfactory, short-term functional and esthetic results for the patient. The etiology of fracture or chipping of PFM prostheses can be multifactorial in origin, with associated sequela.26 Damage to a PFM porcelain superstructure can be a result of several factors: 1) the inherent physical properties: modulus of elasticity, coefficient of thermal expansion, thermal conductivity, and phase transitions compared to enamel tooth structure. These can potentially create adverse effects, which result from residual stresses from thermo-mechanical parameters, autocatalytic transformation during firing, and phase transitions in the oral cavity due to temperature and moisture. Induced processes or treatments from inexact procedures performed by the laboratory technician or from incorrect or inappropriate material applications can contribute to the failure, along with techniques employed by the dentist. Long-term stresses caused, primarily, through shearing forces following the application of rigid opposing substances; usually through the actions of mastication, can precipitate micro-cracks and finally material failure. Substructure framework torque can cause fracture
and subsequent failure of the veneering porcelain. Trauma from blunt force can also cause fracture of the porcelain as well as the metal framework. Other patient and/or environmental etiologies include diet, oral hygiene maintenance, smoking, and oral habits. Upon delivery of a new prosthesis or repair of existing restorations, the clinician must also provide adequate attention to the occlusion of the opposing arches prior to dismissal of the patient. Verification of potentially detrimental centric and lateral excursive contacts are always necessary. Careful adjustments should be performed in order to minimize destructive shearing contacts and, in turn, any clinical sequelae associated with the prosthesis delivery and/or repair materials.

Ceramic (porcelain) materials have been utilized for dental application for over two centuries. The ability of these materials to simulate natural enamel and dentin qualities as well as producing comparable biocompatibility characteristics and physical properties, unique to the human tooth structure, are certainly noteworthy. Significant improvements in ceramics science and processing techniques have expanded the spectrum for dental application of these materials by allowing successful attachment to sub-structure (metal) frameworks, enhanced function and esthetics, and repairability. These improvements associated with developments in impression materials, rotary handpiece capabilities, and advancements in furnace design and technology, have also permitted for improved physical attributes (increased strength, mechanical retention, stress parameters, decreased phase transformations in water and lower shrinkage characteristics) and subsequently, superior functional and aesthetic qualities. Metal-ceramic (PFM) materials have traditionally been used in 70% to 80% of the cases for production of FDPs, with three distinct classes of dental porcelains available for prosthodontic restoration, including: 1) glassy; 2) particle-filled; and 3) polycrystalline.

Glassy or feldspathic (alumino-silicate) porcelains exhibit high firing ranges and improved esthetic and biocompatibility qualities. Particle-filled porcelains include the addition of filler particles (leucite) for enhanced mechanical and aesthetic (opalescence, color, and opacity) qualities. Polycrystalline porcelains contain no glass components, thus are extremely strong and fracture resistant. These materials (polycrystalline) have been primarily used for computer assisted, 3-D fabrication processes. Due to the inherent opaqueness of the composition, polycrystalline components have also been utilized as substructure copings for application of veneering feldspathic porcelains. Lastly, the development of dental zirconia (zirconium oxide) used, predominantly, as sub-structure coping materials have shown good short-term results due to increased fracture resistance and adequate esthetic qualities; however, possible disadvantages of the material could include instability in the presence of water and the somewhat opaqueness, which calls for overlying veneering using dissimilar types (feldspathic) of porcelain.

Numerous studies have been published in the dental literature regarding repair versus replacement, for fractured prosthesis supra-structure veneering materials. Since dental ceramic materials, specifically porcelains, have been extensively utilized as esthetic facing appendages, bonded to precious metal sub-structures (PFM FDPs) for the restoration of anterior and posterior segments of the oral cavity, considerable information has been forthcoming in the past four decades describing porcelain fracture—repair procedures. Clinical success of repaired fractured restorations can depend upon several factors:

1. The dentist’s acumen or experience with pertinent techniques and restorative materials (technique sensitivity).
2. Case selectiveness—is the patient’s oral hygiene status and/or any intraoral habits, requiring previously documented medical and dental histories, conducive for this procedure?
3. The patient’s acceptance based upon all evidence-based treatment modalities presented by the dentist and not acquired from perceived, anecdotal remedies, perhaps obtained from self-exploration of the internet.
4. Clinical technique utilized—specifically, the quality and durability of the bond created between the ceramic (porcelain) and the veneering repair material-usually composite resin.

Traditionally, two direct clinical techniques have been utilized for the intraoral repair of fractured porcelain veneer facings of a PFM FDP: 1) re-bonding of the fractured segment of material using various surface conditioning techniques, adhesive components, and repair material (composite resin); 2) using composite resin as the resurfacing material alone, employing the above-mentioned techniques. Advantages of these methods include immediate enhanced esthetic results and relatively inexpensive chair-side procedures. Disadvantages can include post-treatment discoloration of the repair material (usually composite resin), increased wear, and decreased bond strengths due to the adhesive characteristics of disparate materials.

Different preparation techniques of the material surface, prior to repair, have also been reported. Surface conditioning using sand-blasting or air-abrasion procedures using portable micro-etching equipment (alumina-silicate particles), acid-etching gels (hydrofluoric, phosphoric concentrations), retention bevel placement methods using diamond coated burs, surface treatment with silane coupling agents, and laser assisted adhesion have been employed, often revealing contradictory and inconsistent results. Knowledge of the individual etiology of the damaged prosthesis, accurate diagnosis, and a judiciously applied treatment plan, followed by appropriate post-treatment instructions, can hopefully provide an extended service period. For silicate-based ceramics (feldspathic porcelains), use of appropriate acid-etching (hydrofluoric acid concentrations) and mechanical (air abrasion) surface preparation techniques together with the application of silane agents, have yielded superior results. However, for oxide-based ceramics (zirconia), a combination of air abrasion and silanization agent have shown superior outcomes. The use of acid etching procedures of oxide-based materials have not proven to be effective techniques for the production of
surface micro-retention features, while the use of phosphoric acid concentrations for micro-etching of silicate-based, porcelain surfaces has revealed significantly inferior results compared to the use of hydrofluoric acids.8

A recent in vitro study conducted by Yoo et al.,1 tested two intraoral porcelain repair systems: 1) Intraoral Repair Kit™ (Bisco, Inc., Schaumburg, IL, USA) consisting of a 4% hydrofluoric acid, accompanying silane agents-acetone and ethanol, opaquer catalyst-bisphenol A glycidyl methacrylate (Bis-GMA), benzoyl peroxide cleaning solution, and opaquer base-Bis-GMA, urethane dimethacrylate (UDMA) components and 2) CoJet Sand System™ (3M-ESPE, Seefeld, Germany) including 30 µm aluminum (UDMA) components and 2) CoJet Bis-GMA, urethane dimethacrylate (Bis-GMA), benzoyl peroxide cleaning solution, and opaquer base-Bis-GMA, urethane dimethacrylate (UDMA) components and 2) CoJet Sand System™ (3M-ESPE, Seefeld, Germany) including 30 µm aluminum oxide modified silica particles and 3-methacryloyloxypropylmethoxysilane (MPS) with ethyl alcohol components. The results of the study1 showed that for repair of the porcelain surface only, the Intraoral Repair Kit™ was recommended and if repair of a metal substructure was necessary, the CoJet Sand System™ was preferred. More recent generation adhesive systems, including ScotchBond Multi-Purpose Plus™ adhesive system (3M ESPE, St. Paul, MN, USA), Clearfil repair system™ (Kuraray America Inc., New York, NY, USA), Ceramic repair system™ (Ivoclar Vivadent Inc., Amherst, NY, USA), ProBond™ all-purpose bonding agent (Dentsply-Caulk, USA), Bistite II DC™ (Tokuyama Dental Corp., Tokyo, Japan), and the Rocatec™ silica-coating system (3M-ESPE, St. Paul, MN, USA) include the use of air abrasion techniques; hydrofluorosilicic acid and phosphoric acids, and silane coupling agents as surface preparation components followed by application of individual system primer and adhesive constituents, have also been utilized for porcelain repairs, with varying degrees of success.10, 15, 17 Yet another in vitro study1 revealed that the utilization of Er:YAG irradiation evaluating shear bond strengths of composite resin adhesion/cohesion parameters to feldspatic porcelain. The result of the study1 revealed that the utilization of Er:YAG produced energy as a surface preparation procedure prior to bonding of the two dissimilar materials, showed significantly lower bond strengths compared to the use of hydrofluoric acid prepared material surfaces.

This case report described a conservative, intraoral technique for repair of a fractured or chipped porcelain surface of a PFM FDP pontic tooth. A combination of material surface conditioning procedures consisting of placement of macro-mechanical retention through the use of tapered, diamond coated and inverted cone carbide burs together with micro-mechanical preparation (etching) of the preexisting porcelain surface using 9.5% hydrofluoric acid proved adequate for subsequent bonding of the composite resin repair restorative. Although a silane coupling agent could have been applied following surface preparation, the clinicians decided the technique utilizing surface acid conditioning in conjunction with additional mechanical retention using burs was appropriate considering the anticipated short period of service prior to permanent replacement of all existing restorations. The process of silanization of the fractured surface utilizing silane coupling agents (dual functioning monomers containing silanol groups for adhesion to the porcelain and methacrylate groups that react with composite resin) allows for the formation of covalent, chemical bonds between the inorganic material (porcelain) and the organic restorative (composite resin) while concurrently promoting the wettability of the porcelain surface for supposedly improved bond strengths between the different materials.2,27,28 Conflicting information in the dental literature7, 17 exists regarding the usage of silane coupling agents in conjunction with intraoral porcelain repair procedures. Several studies8 have advocated the usage of this step while other reports8 have shown that these agents are unnecessary and that techniques advocating the usage of micromechanical methods together with micromechanical bonds created by acids, promote satisfactory surfaces prior to bonding procedures.

According to one report2, restoration success is defined as the “demonstrated ability of a restoration (including prosthesis) to perform as expected”, with restoration failure defined as “any condition that leads to replacement of a prosthesis.” Although these definitions appear to be somewhat simplistic in their content, they are accurate. A treatment plan including and demonstrating an eventual success rate of 100% during a long-term observance period for any restorative process is idealistic and can be misleading if forwarded to the patient’s prognosis and mental projection.

The dental literature has furnished numerous, possibly contradictory studies,2, 4, 8, 29 regarding survival and failure rates of FDPs. Several systematic reviews2, 19-22 providing survival rates of FDPs have proposed specific terminologies relative to the performance of a restoration or prosthesis. Survival has been defined as “the percentage of FDPs that remain in situ with or without modifications.” Biological complications include: caries, loss of pulp vitality, abutment tooth fracture, and progression of periodontal disease. Technical complications consist of: framework fracture, fracture or chipping of the veneering ceramic, marginal gap/ discoloration, and loss of retention. As evidenced, one contemporary report22 revealed a five-year survival rate of 94% for metal-ceramic FDPs and 89% for all-ceramic FDPs. Another study19 found a five-year survival rate for all-ceramic crowns of 93% compared to 96% for PFMs. Studies conducted by Heintze and Rousson,21 and Saier et al.,22 revealed contradictory results regarding chipping fractures of PFM PDFs. After analyzing clinical studies of the frequency of veneering porcelain fractures, Heintze and Rousson21 found that chipping fractures occurred in 34% of PFM FDPs compared to 54% of zirconia-supported FDPs. The same report21 found that upon consideration of treatment procedures (recontouring/ polishing, repair, and replacement) for veneer chipping fractures, 97% of PFM FDPs and 90% of zirconia FDPs survived at least three years. However, a longitudinal report by Saier et al.,26 revealed a 2.9% mean chipping rate for PFM FDPs after a five-year review period.

Problems can occur with any form of dental treatment, especially regarding permanent restorations and/or prostheses. There appears to be minimal documented objective,
standardized evaluation systems for the comprehensive determination of etiologies involved with clinical failure of dental restorations. Distinct criteria for repair versus replacement of dental restorations are also not well-documented; however, a report by Anusavice advocating descriptive guidelines and comprehensive clinical reporting (forms) for the classification and treatment of fractures of all-ceramic and PFM FDPs has been proposed, based upon interpretation of information concluded from other referenced studies. 12-24

Upon the pronouncement of the chief complaint by a dental patient, an objective knowledge base regarding the specific etiology opposed to subjective descriptions should be included. Current decision-making processes for treatment planning procedures have traditionally been based upon the clinical judgement of the dentist with/without the inclusion of evidence-based strategies — incorporating the most current, standard of treatment procedures (dental literature) and associated patient involvement. The development and application of systematic reporting practices based upon evidence-based methodologies, including quantitative criteria for the location and type of fracture, with concurrent use of objective criteria for dissemination of appropriate case etiological factors, could encourage the prevention of FDP fracture occurrences and also promote improved corrective actions.

Conclusion

This report presented a case whereby a patient unintentionally fractured a small amount of the porcelain veneer facing material from a PFM FDP. Following a comprehensive oral and radiographic evaluation, a plan of action consisting of repair of the existing, fractured FDP pontic tooth was formalized. The patient was provided with adequate evidence-based information regarding the diagnosis, treatment plan, and prognosis of the refurnished prosthesis prior to and following the intraoral repair procedure, as to contribute to, and participate in, an assented informed consent. The patient was pleased with the newly repaired restoration and acknowledged that the procedure was a provisional measure only, prior to comprehensive rehabilitation of the anterior and posterior dentitions.

This case series (examination, diagnosis, treatment plan, active treatment, and prognosis) was performed at an educational institution (UTHSC, College of Dentistry) by a third-year student doctor in the Department of General Practice Dentistry under the supervision of attending general dentists encompassing many years of clinical experience. Although the treatment provided to the patient did not reveal any novel restorative procedures, the knowledge obtained by the student doctor and the mentoring relationship provided by the attending doctors formulated on evidence-based dentistry was paramount.

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References


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1. Which of the following materials have been employed for the fabrication of single and multiple unit fixed partial dental prostheses (FDPs):
   a. Zirconia.
   b. Porcelain-fused-to-metal (PFM).
   c. Other glass and particle reinforced ceramics.
   d. All the above

2. In the case report associated with this article, which of the following treatment procedures were performed as a provisional remedy for the patient’s chief complaint (fracture of an anterior FDP):
   a. Replacement of the fractured or chipped porcelain “facing” suprastructure using composite resin as the restorative material.
   b. Removal of the existing prosthesis, with complete fabrication of a new FDP restoration following a comprehensive examination, diagnosis, and treatment plan.
   c. Observation of the existing prosthesis with no treatment scheduled.
   d. Replacement of the fractured or chipped porcelain “facing” suprastructure using acrylic as the restorative material.

3. Damage to a PFM porcelain supra-structure surface can be a result of all of the following reasons, EXCEPT:
   a. Inherent material physical properties (inadequacies).
   b. Iatrogenically induced processes.
   c. a and c
   d. Long-term stresses from the forces of occlusion.
   e. a, b, and d

4. Clinical success or failure of a provisionally repaired FDP depends upon which of the following factors:
   a. Dentist’s acumen or experience.
   b. Appropriate case selection.
   c. Patient’s compliance.
   d. Technique/materials utilized.
   e. All of the choices are correct.

5. Regarding survival and failure rates of FDPs, potential biological complications accompanying these prostheses can include which of the following choices:
   a. Framework or sub-structure material fracture.
   b. Chipping of the supra-structure surface material.
   c. Inadequate marginal adaptation with loss of retention.
   d. Abutment tooth fracture.
   e. All the above

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Introduction

Chondrosarcomas are uncommon malignant tumors (occurrence rate of 5.76%) of the head and neck region, occurring most commonly in the maxilla, nasal cavity, nasal septum and the mandible. Malignant tumors of the facial, palatal and/or nasal bone are slow growing and locally invasive and may necessitate extensive surgical excision to eradicate the disease, thereby creating a prominent midfacial defect. Acquired or surgical defects may lead to an orbital-antral communication, communication between the oropharynx and the nasopharynx resulting in compromised facial esthetics, difficulty in mastication, deglutition, speech, and poor quality of life.

Acquired defects may be rehabilitated surgically or prosthetically depending on their site, size, etiology, severity, age, and the patient’s preferences. Certain factors such as patient’s age, general medical condition, radiation exposure, complexity of the defect, recurrence potential, and associated surgical morbidity, may favor prosthetic rehabilitation of the defect. Prosthetic rehabilitation is planned, based on the quality of adjacent tissues, the residual palatal base, and the remaining dentition. Thorough diagnosis, pre- and postsurgical reconstructive and prosthetic treatment planning, aids in ensuring optimal rehabilitation of the patient.

A definitive obturator is a maxillofacial prosthesis that artificially replaces part or all of the maxilla and associated teeth lost due to surgery or trauma. The obturator may be designed to engage the remaining natural teeth and/or tissue bearing areas to optimize its retention and stability. An obturator can be extended into the anterior nasal aperture to aid in its retention. The obturator prosthesis offers several advantages including: restoration of the dentition and patient esthetics, seals the communication between the oral cavity and antrum, oropharynx and nasopharynx, aids in the mechanism of deglutition and permits easy evaluation and access to the defect.

The weight of obturator can adversely affect its retention and stability. Many reports and studies have been published describing the technique and the importance for fabricating hollow-bulb-obturator to overcome the problem of weight. A hollow obturator may be designed to be open or closed depending on the preferences of the dental practitioner and the requirement of the patient. Open hollow obturators are light in weight, easy to clean, and aid in improvement of speech. Closed hollow obturators prevent food and fluid accumulation, decrease air space, and permit maximal extensions. The routine procedure for fabricating a closed hollow-bulb-obturator includes evenly and accurately grinding out the interior of the bulb after processing and then fastening the lid to the superior border through various techniques. Most of these techniques involve complex and multiple laboratory steps, which are cumbersome and time consuming.

The shape and form of the nose is determined by its osteocartilaginous framework. A small or moderate soft tissue defect in the nose can be easily reconstructed by a simple local flap. When the underling osteocartilaginous framework of the nose is missing/lost, it presents a challenging reconstructive problem for the surgeon and the prosthodontist. The utilization of endosseous implants in conjunction with free-tissue transfer for the prosthetic rehabilitation of oral, orbital and/or nasal defects has been very beneficial, when compared with conventional procedures/techniques, because retention can be obtained regardless of the defect anatomy or size, provided adequate bone is available to place the implants. Inadequate osseous support for implant placement precludes their usage. It is critical that each patient be treatment-planned specific to their needs and the procedures/techniques be modified / developed based on their individual situation. This clinical report describes the prosthetic management of

ABSTRACT

Management of neoplastic disease of the facial region may involve extensive surgical ablation to achieve tumor-free margins of the residual tissue, thereby creating a prominent midfacial defect. Surgical defects may not only cause functional impairments but also esthetic disfigurement and significant reduction in quality of life. Acquired defects may be rehabilitated surgically or prosthetically, depending on their site, size, etiology, severity, age, and the patient’s preferences. This clinical report describes the prosthetic management of a patient with rare, large maxillofacial defect with a combined hollow-bulb-obturator nasal prosthesis (processed with the lid in a single step), and a removable cast partial dental prostheses.

Keywords
maxillofacial, hollow-bulb-obturator nasal prostheses, chondrosarcoma
a patient with a rare, large maxillofacial defect (extending to the nasal osteocartilaginous framework), with a combined hollow-bulb-obturator nasal prosthesis and a removable-cast-partial dental prosthesis.

**Case Report**

A 45-year-old Indian male patient was referred to the department of prosthodontics at ACPM Dental College and Hospital, Dhule, (Figure 1) for assessment and rehabilitation. The patient presented with a history of chondrosarcoma which was surgically treated three years prior. The chondrosarcoma was surgically removed along with wide excision of premaxilla, anterior nasal framework, anterior alveolar ridge, and anterior palate, to eradicate the disease (Figure 2). One year later, reconstructive surgery (nose release with posterior nasal inlay and split-thickness skin graft and release of fibrotic bands) was performed for the patient.

An extraoral examination of the patient revealed a collapse of the midfacial region. Intraoral examination revealed a large anterior, midline defect involving the premaxilla, almost all of the hard palate and the nasal cavity (Figure 3). Most of the alveolar ridge and the teeth except teeth #2, #3, #13, #14, #15, #16 were removed. Based on its location, the defect was classified as a class VI Aramany maxillary defect (bilateral defect lying anterior to abutment teeth) and as a class VI Brown vertical defect (naso-maxillary defect). A definitive hollow-bulb-obturator nasal prosthesis was planned for this patient (Figure 4). The procedure for its fabrication is described below.

**Procedure**

A diagnostic impression of the defect with a resin modified stock tray was

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**Figure 1:** Pre-treatment frontal view of patient demonstrating midfacial defect.

**Figure 2:** Radiographic image delineating extent of defect.

**Figure 3:** Intraoral view of surgical defect.

**Figure 4:** Line diagram representing design of obturator prosthesis.

**Figure 5:** Diagnostic impression of defect and the dentition.
made with putty silicone impression material (Zetaplus, Zhermack, Badia Polesine (RO), Italy). After recording the defect, the excess impression material was trimmed, a suitable adhesive was applied along the periphery of the impression and the tray was loaded with light-viscosity silicone impression material (Zetaplus, Zhermack, Badia Polesine (RO), Italy) to record the remaining arch. The impression (Figure 5) was boxed and poured with type III dental stone (Vinayak Gypsum and Interiors Pvt Ltd., Maharashtra, India) to obtain a diagnostic cast.

Surveying of the diagnostic maxillary cast indicated that the path of insertion/removal of the obturator and that of the cast partial removable dental prosthesis would be different. Accordingly, the patient was treatment-planned to receive an internal obturator (for the palatal and nasal defect) and removable cast partial dental prosthesis (for restoring the missing teeth and oral tissues) as separate components.

Fabrication of the obturator along with the nasal prosthesis

An auto-polymerizing acrylic resin custom tray was fabricated over the defect portion of the diagnostic cast to make a definitive impression of the defect. Reviewing pre-surgical patient photographs aids in developing the desired nasal and facial support with the impression material prior to making the definitive impression. Putty consistency silicone impression material (Zetaplus, Zhermack, Badia Polesine (RO), Italy) was utilized to make the impression; ensuring adequate nasal and facial support were developed. A wash impression was made over the putty impression material with a light body silicone material (Zetaplus, Zhermack, Badia Polesine (RO), Italy) (Figure 6). Airway patency holes were marked in the impression using an indelible marker and then it was boxed and poured in type III dental stone to obtain a definitive cast of the defect.

Two layers of base plate wax were adapted and contoured in the defect area of the definitive cast to form the walls of the defect. Airway hole perforations were made through the wax in pre-marked nasal area and posterior-superior area of the defect. Laboratory putty (Zetalabor, Zhermack, Badia Polesine (RO), Italy) was appropriately mixed as per the manufacturers’ recommendations and was utilized to shape and fill the bulb portion of the obturator and the airway holes, to maintain their patency. Next, two layers of baseplate wax were adapted on the superior surface of the laboratory putty material (for lid fabrication) and the assembly was invested in a denture flask (Figure 7). Following wax elimination, heat polymerized resin (Lucitone 199®, Dentsply, USA) was mixed as per the manufacturer’s recommendations and rolled into a sheet of approximately 2mm thickness and half of it was adapted over the walls of the defect. Putty material filling the bulb portion was carefully replaced in its original position. Asymmetric configuration of the defect permitted accurate orientation and replacement of the putty index. Another half of the resin material was placed over the putty material for lid fabrication. The flask was trial packed and the prosthesis was processed with a long polymerization cycle to fabricate a uniform thickness hollow-bulb-obturator with a lid in a single step, (Figure 8). After finishing and polishing the obturator, airway holes were relieved by trimming the putty index material completely with rotary cutting instruments and by scraping with sharp instruments.

Prosthesis Delivery

The obturator and the oral cavity were moistened adequately and the palatal obturator–nasal prosthesis was inserted in the mouth using a rotational path, the anterior portion was positioned, first over the space originally occupied by the nasal osteocartilaginous framework, and the posterior extension was then rotated upward over the remaining hard palate (Figure 9). It was evaluated for fit and comfort, adjusted, finished, and polished, as necessary.
Fabrication of the removable cast partial dental prosthesis

After the placement of the obturator intraorally, all the steps for fabrication of removable cast partial dental prosthesis were carried out using current best prosthodontic procedures. A removable cast-partial dental prosthesis was designed to be placed over the obturator; its fit, extensions, and occlusion were evaluated and adjusted as necessary. Oral hygiene instructions and demonstrations for correct positioning, insertion, removal, and cleaning of the obturator and the removable cast partial dental prosthesis were given to the patient. This combined prosthesis restored deglutition, speech, articulation, esthetic, psychological well-being and airway patency. The patient was satisfied with his prosthesis (Figure 10). The patient was placed on quarterly recall schedules to ensure patient comfort with the prostheses and monitor for recurrence of disease.

Discussion

This article describes a case in which a patient with a maxillary and nasal osteocartilaginous framework defect was rehabilitated with a maxillary hollow-bulb-obturator nasal prosthesis and a removable cast-partial dental prosthesis. The obturator nasal prosthesis was fabricated in a single-stage utilizing a simple, quick and easy technique. Fabricating the removable cast-partial dental prosthesis and the obturator as separate components permitted the removal of the cast-partial dental prosthesis without having to remove the obturator. Heavy obturators have compromised retention, stability and dislodge very easily, hence it is critical to design hollow-bulb-obturators.15-18 Many articles describe the technique for fabrication of hollow-bulb-obturators but most of them describe complicated multi-stage fabrication procedures which are time consuming and may not result in uniform thickness of the obturator bulb.15, 17, 18, 20-22 In addition, every patient is different, techniques have to be constantly developed/modified to optimally rehabilitate these patients with their specific requirements.

The technique described in this article involved waxing the walls of the defect and filling the bulb portion with laboratory putty material and waxing the lid portion over the putty material. Filling the bulb portion with laboratory putty material permitted the fabrication of uniform thickness hollow-bulb-obturator in a single stage. The airway holes permitted complete removal of laboratory putty material without having to remove the lid portion of the obturator. This technique eliminated the need for separating the lid and re-luting of the lid to the obturator. In addition, extension of the hollow-bulb-obturator in the nasal cavity aided in optimizing its retention and stability. This combined prosthesis restored deglutition, speech, articulation, esthetic, and psychological well-being of the patient.

It must be noted that routine insertion and removal of the prosthesis requires considerable psychomotor skills. Proper patient training is indicated to improve the prosthetic prognosis.

Summary

The maxillary hollow-bulb-obturator nasal prosthesis ensured optimal patient rehabilitation, improving oral function, speech, esthetics, and overall quality of the patient’s life.

Disclosure: The authors did not report any disclosures.
REFERENCES


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Gregory Paprocki, D.D.S., M.S., Assistant Professor, Department of Prosthodontics, University of Tennessee Health Science Center, College of Dentistry, Memphis, Tennessee.
### Exam Questions

1. Chondrosarcomas are common malignant tumors of the head and neck region.
   a. True
   b. False

2. Acquired or surgical defects may lead to:
   a. Oro-antral communication
   b. Esophageal reflux
   c. Barrett’s esophagus
   d. None of the above

3. How is a communication between the palate and the nasal area treated?
   a. An obturator
   b. A night guard
   c. A sliding-flap
   d. None of the above

4. When a definitive maxillo-facial prosthesis is constructed to replace part, or all, of the maxilla and associated teeth, the obturator may be designed to:
   a. Engage the remaining teeth.
   b. Prevent food and fluid accumulation
   c. It can be extended into the anterior nasal aperture, if necessary
   d. All of the above

5. A hollow-bulb-obturator will:
   a. Overcome weight concerns.
   b. Prevent food and fluid accumulation
   c. Assist speech
   d. Deglutition
   e. All of the above

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- Full
- Partial
- No

Your comprehension of material

- Excellent
- Fair
- Poor

Appropriateness of the material

- Excellent
- Fair
- Poor

Was the material adequately in-depth?

- Yes
- No

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Introduction

In 2010, the U.S. Government issued 14 Grand Challenges for biomedical research in the 21st century including the “Detection of dozens of diseases in a sample of saliva.” The National Institute of Health’s 2011 Government Performance Report Act (GPRA) mandated that by 2013, the efficacy of using salivary diagnostics to monitor health would be accessed, and that a minimum of one systemic disease would be diagnosed. In addition, in 2002, the National Institute of Dental & Craniofacial Research (NIDCR) made a significant investment toward developing the science and clinical utilities of saliva. Saliva has since become an emerging biofluid poised for translational and clinical applications. The NIH initiatives have resulted in a number of important outcomes that have significantly substantiated the scientific foundation of saliva. Five diagnostic alphabets are now known to be present in saliva. They include the proteome, the transcriptome, micro-RNA, the metabolome, and the microbiome.

The most important point to be considered, however, is the clinical relevance of salivary diagnostics, its translation into clinical practice of dentistry and medicine, along with the potential to enable screening, early detection and/or possible prevention of various human diseases. The list of conditions encompass both oral diseases (i.e. periodontal diseases, dental caries, orthodontically induced inflammatory root resorption) as well as systemic diseases such as cancers, autoimmune, infectious (viral, bacterial, or fungal), cardiovascular, endocrinological, psychiatric, cardiac, nephrological, metabolic, neurological, etc. (Table 1). Thus, as a “mirror of the body” saliva can reflect the health condition of human body and can successfully be used as a clinical early-detection biofluid. The use of saliva offers a cost-effective approach for large-scale screening. Sample collection is simple, non-invasive, and causes less anxiety for patients. Contrary to other biofluids (i.e. blood), saliva does not require sophisticated processing, storage and transport conditions.

Systemic Disease Detection

The salivary biomarkers possess discriminatory power for the non-invasive detection of a systemic cancer. Thus, a simple salivary test could be useful for clinical screening and detection of a cancer.

Lung cancer

The combination of four messenger RNA biomarkers (KRAS, MBD3L2, ACRV1, and DPM1) could differentiate resectable pancreatic cancer patients from non-cancer subjects (chronic pancreatitis and healthy controls), yielding a receiver operating characteristic (ROC) plot, area under the curve (AUC) value of 0.971 with 90.0% sensitivity and 95.0% specificity. In addition, the combination of two bacterial salivary biomarkers (Neisseria elongata and Streptococcus mitis) yielded an AUC value of 0.90 (with 96.4% sensitivity and 82.1% specificity) in distinguishing patients with pancreatic cancer from healthy subjects.

Pancreatic Cancer

The combination of four messenger RNA biomarkers (KRAS, MBD3L2, ACRV1, and DPM1) could differentiate resectable pancreatic cancer patients from non-cancer subjects (chronic pancreatitis and healthy controls), yielding a receiver operating characteristic (ROC) plot, area under the curve (AUC) value of 0.971 with 90.0% sensitivity and 95.0% specificity. In addition, the combination of two bacterial salivary biomarkers (Neisseria elongata and Streptococcus mitis) yielded an AUC value of 0.90 (with 96.4% sensitivity and 82.1% specificity) in distinguishing patients with pancreatic cancer from healthy subjects.
**Table 1. The list of salivary biomarkers used for detection of various human oral and systemic diseases.**

### ORAL DISEASE DETECTION

<table>
<thead>
<tr>
<th>DISEASE</th>
<th>TYPE OF SALIVARY BIOMARKERS</th>
<th>BIOMARKERS</th>
<th>AUTHORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodontal disease</td>
<td>Proteins</td>
<td>Elastase, lactate dehydrogenase, interleukin-1β (IL-1β), IL-6, tumor necrosis factor alpha (TNFα)</td>
<td>Gursoy et al., 2009(^8)</td>
</tr>
<tr>
<td></td>
<td>Microbes</td>
<td>Aggregatibacter actinomycetemcomitans, Porphyromonas gingivalis, Prevotella intermedia, Tannerella forsythia, Treponema denticola</td>
<td>Gursoy et al., 2009(^8)</td>
</tr>
<tr>
<td>Dysplastic oral leukoplakia</td>
<td>Proteins</td>
<td>IL-6</td>
<td>Sharma et al., 2011(^19)</td>
</tr>
<tr>
<td></td>
<td>Proteins</td>
<td>M2BP, MRP14, profilin, CD59, catalase</td>
<td>Hu et al., 2008(^10)</td>
</tr>
<tr>
<td></td>
<td>RNAs</td>
<td>IL8, IL-1β, DUSP1, HA3, OAZ1, S100P, SAT</td>
<td>Li et al., 2004(^1)</td>
</tr>
<tr>
<td></td>
<td>Metabolic biomarkers</td>
<td>valine, lactic acid, phenylalanine</td>
<td>Wei et al., 2011(^11)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>choline, betaine, pipecolinic acid, L-carnitine</td>
<td>Wang et al., 2014(^12)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>propionylcholine, N-acetyl-L-phenylalanine, sphinganine, phytosphingosine, S-carboxymethyl-L-cysteine</td>
<td>Wang et al., 2014(^13)</td>
</tr>
</tbody>
</table>

### SYSTEMIC DISEASE DETECTION

<table>
<thead>
<tr>
<th>DISEASE</th>
<th>TYPE OF SALIVARY BIOMARKERS</th>
<th>BIOMARKERS</th>
<th>AUTHORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pancreatic cancer</td>
<td>Messenger RNAs (mRNAs)</td>
<td>KRAS, MBD3L2, ACRV1, DPM1</td>
<td>Zhang et al., 2010(^14)</td>
</tr>
<tr>
<td></td>
<td>Microbes</td>
<td>Neisseria elongate, <em>Streptococcus mitis</em></td>
<td>Farrell et al., 2012(^11)</td>
</tr>
<tr>
<td>Lung cancer</td>
<td>Proteins</td>
<td>HP, AZGP1, human calprotectin</td>
<td>Xiao et al., 2012(^15)</td>
</tr>
<tr>
<td></td>
<td>mRNAs</td>
<td>BRAF, CCNI, EGRF, FGF19, FRS2, GREB1, LZTS1</td>
<td>Zhang et al., 2012(^16)</td>
</tr>
<tr>
<td>Breast cancer</td>
<td>mRNAs</td>
<td>CSTA, TPT1, IGF2BP1, GRM1, GRIK1, H6PD, MDM4, S100A8</td>
<td>Zhang et al., 2010(^17)</td>
</tr>
<tr>
<td></td>
<td>Protein</td>
<td>CA6</td>
<td>Zhang et al., 2010(^17)</td>
</tr>
<tr>
<td>Ovarian cancer</td>
<td>mRNAs</td>
<td>AGPAT1, B2M, BASP2, IER3, IL1B</td>
<td>Lee et al., 2012(^18)</td>
</tr>
<tr>
<td>Gastric cancer</td>
<td>Proteins</td>
<td>cystatin B (CSTB), triosephosphate isomerase (TP1), deleted in malignant brain tumors 1 protein (DMBT1)</td>
<td>Xiao et al., 2016(^19)</td>
</tr>
</tbody>
</table>
**Breast cancer**

Eight mRNA biomarkers (CSTA, TPT1, IGF2BP1, GRM1, GRK1, H6PD, MDM4, S100A8) and one protein biomarker (CA6) for breast cancer yielded an accuracy of 92% (83% sensitivity, 97% specificity).

**Ovarian cancer**

Five validated mRNA biomarkers (AGPAT1, B2M, BASP2, IER3, and IL1B) could serve as biomarkers for detection of ovarian cancer with high 85.7% sensitivity and 91.4% specificity, yielding an AUC value of 0.909.

**Gastric cancer**

The combination of three protein biomarkers, cystatin B (CSTB), triosephosphate isomerase (TPI1), and deleted in malignant brain tumors 1 protein (DMBT1), could reach 85% sensitivity and 80% specificity for the detection of gastric cancer with accuracy of 0.93.

Those studies provide the proof of concept that validated salivary biomarkers can be used for the non-invasive detection of various cancers and after applicable clinical testing could enter the everyday doctoral practice.

**The Significance of Clinical Utility of Salivary Diagnostics for Medical and Dental Applications**

Many oral and systemic diseases do not give specific symptoms, thus making their accurate diagnosis much more difficult. Often, dentists are the first people to see the affected patients that come for the regular check-up or to seek dental treatment, however, unaware of a more serious medical condition. That is why, it is so important to improve the current methods of clinical evaluation. Presently, the gold standard for early detection and diagnosis for most of those diseases includes mainly visual inspection performed during the dental examination. However, the absence of early symptoms for many of them makes patients and dentists unaware of the existing pathology. Thus, the demographic data reveals that the vast majority of the affected cases are diagnosed too late or even left untreated.

Many systemic diseases, including cancers, cardiovascular diseases, and autoimmune diseases, are challenging to diagnose without supplementing clinical evaluation. However, even with laboratory tools, the final diagnosis of many of those diseases is often negative, thus imposing unnecessary burdens on hospitals and increased waiting times for patients. Salivary diagnostics can provide a non-invasive way of testing and have the potential to decrease the number of invasive, costly, time-consuming and inaccessible diagnostic workups as in the case of cancers (i.e. endoscopic ultrasound, X-Rays, computed tomography, magnetic resonance imaging, positron emission tomography, biopsy, endoscopy, etc.) in patients with suspicious symptoms. Late diagnoses and their poor accuracy make salivary diagnostics even more tempting and a valuable tool in clinical diagnostics.

Salivary biomarkers for disease detection, translational, and clinical applications have received increasing scientific credibility in recent years. Biomarkers, produced by normal healthy individuals or by individuals affected by specific diseases are telltale molecules that could be used to monitor the health status, disease onset, treatment responsiveness, and outcome. Biomarkers that are specific and indicative of health or disease are needed to serve as surrogates for clearly defined endpoints such as cancer.
In order to successfully translate biomarkers into clinical practice, their development should follow the principles of prospective-specimen-collection and retrospective-blinded-evaluation (ProBE).30 In addition, the use of biomarker for clinical decision-making requires stringent testing of the biomarker’s performance including the validation of discovered biomarkers set as the crucial step2 (Figure 1). Three important premises of successful translation of diagnostic tests into clinical utility comprise:31

2. Easy and inexpensive sampling methods with minimal discomfort for the subject.
3. An accurate and quantitative diagnostic platform.

Saliva as a biofluid fulfills all the above-mentioned prerequisites.

Public Health Service (PHS) grant 5R09DE023057-03 from the National Institute of Health/National Institute of Dental and Craniofacial Research (NIH/NIDCR) in United States (K.E.K-U).

**Disclosure:** David Wong is co-founder of RNAmeTRIX Inc., a molecular diagnostic company. He holds equity in RNAmeTRIX, and serves as a company Director and Scientific Advisor. The University of California also holds equity in RNAmeTRIX. Intellectual property that David Wong invented and which was patented by the University of California has been licensed to RNAmeTRIX.

**Disclosure:** Dr. Kaczor-Urbanowicz, Dr Wang and Dr. Garcia-Godoy did not report any disclosures.

**References:**


**Current saliva-based technologies**

The advent of emerging saliva-based technologies such as point-of-care diagnostics, RNA Sequencing, liquid biopsy, and micro/nanofluidic-based biosensors will enable the chairside detection of many serious dental and medical conditions including lethal diseases.

**Point-of-Care Diagnostics**

In all the recent publications, dental clinicians highlight an urgent unmet need for development of a diagnostic test that can be used as a self-administered screening tool to identify people at risk or an with an reversible stage of various human diseases (i.e. salivary biomarker-based home test).

**Summary**

As new evidence emerges, it may be possible to utilize newly emerging saliva-based technologies in order to develop a routine diagnostic tool such as an electrochemical multiplex biosensor or lateral flow test strip. Point-of-care diagnostics will potentially enable to manufacture easy to use, specific and sensitive saliva-based devices for early detection of human oral and systemic diseases in clinical practices.

**Acknowledgements**

This work was supported by the
1. Saliva is an emerging biofluid and has how many diagnostic alphabets?
   a. One
   b. Three
   c. Five
   d. Seven

2. Saliva can reflect the health of the human body.
   a. True
   b. False

3. Sample collection of saliva
   a. Offers a cost-effective approach for large screenings
   b. Saliva requires no sophisticated processing
   c. Sample collection is simple and non-invasive
   d. All of the above

4. Pancreatic cancer can be distinguished from healthy subject with 96.4% sensitivity and 82.1% specificity.
   a. False
   b. True

5. Important premises of successful translation of diagnostic tests into clinical utility comprise:
   a. Development of definitive disease-associated biomarkers
   b. Inexpensive sampling with minimal patient discomfort
   c. An accurate and quantitative diagnostic platform
   d. Rendering the biofluid non-infective
   e. a, b, c., only
   f. All of the above
Answer Form for TDA CE Credit Exam #89: 
Priorities of Salivary Diagnostics in Clinical Practice

Circle the correct letter answer for each CE Exam question:

1. a b c d
2. a b
3. a b c d
4. a b
5. a b c d e f

Date exam taken: ____________________________

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<th>Partial</th>
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<td>Was the material adequately in-depth?</td>
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Introduction

Independent of the type of restoration, esthetics in the anterior maxilla continue to be a challenge. Traditional metal–ceramic crowns exhibit a lack of translucency with the surrounding soft tissues due to the reflection of the subjacent metal frameworks and its opaque layers. As a result, esthetics is often compromised.¹ To mask the opacity of metal cores, several different materials are commonly used²⁻⁴ and an exceptionally skilled technician is required. Ceramics have unique properties that include biocompatibility, stability, durability, and optical qualities.⁵ Ceramic crowns must be both translucent and resistant to fracture. The increased use of ceramic restorations and the desire for improved physical properties have fueled the development and introduction of new ceramic restorative materials.⁶ Ceramic core options include: feldspathic porcelain, alumina-ceramic, lithium-disilicate-based ceramic, glass infiltrated magnesia aluminate spinel, glass-infiltrated alumina, glass-infiltrated zirconia, and mica-based glass-ceramics.⁷ The improved strength of the new all-ceramic crown systems has generated great interest in recent years. Among these systems, one especially attractive feature material is glass-ceramic, due to its excellent optical and aesthetic qualities, translucency, and vitality. Unlike metal-ceramic and aluminous-ceramic systems, glass-ceramic material features visually improved light transmission properties.⁸ It can be used in single-unit crowns, veneers, onlays, and inlays.⁹,¹⁰ The survival rate of this material when used for crowns in the esthetic zone is approximately 99%.⁹ Its use in fixed prosthodontics has proved to be effective and reliable in the short- and medium-term.¹¹ Its flexural strength and fracture toughness have been described to be 400MPa and 3.3MPa x 0.5m, respectively.¹²,¹³ The translucency and light refraction properties of this material can overcome the opacity problems that may be intrinsic to porcelain fused-to-metal restorations, due to the presence of the subjacent metal. The superior light transmission in the cervical third of the crown allows a more harmonious blend of the restoration with the surrounding gingival tissue, while avoiding the potential for shadowing so commonly seen in metal-ceramic crowns.⁸

COLOR MATCHING can be a challenge when working over different types of darkened substrates. This article describes the rehabilitation of the esthetic zone with veneers, crowns, and implant screw-retained restorations, using only one material, lithium disilicate.

Clinical Report

A 45-year-old Caucasian woman with no relevant dental history other than absence of the maxillary left lateral incisor and deficient restorations in the maxillary anterior area presented for treatment at the Center of Continuing Education and Research in Implant Dentistry at the Federal University of Santa Catarina (CCERID-FUSC). Her chief complaint was that the maxillary anterior quadrant revealed significant functional and esthetic concerns (Figure 1). Radiographic exam revealed an implant for #10. At the first appointment, the patient was wearing an interim removable prosthesis replacing the missing tooth.

The treatment options for this patient consisted of veneers and crown and implant restoration. The patient consented and signed the treatment plan. The prosthodontist needed treatment options that would allow for successful rehabilitation while taking into consideration the different substructures. When faced with this dilemma, lithium disilicate individual restorations, covered with feldspathic porcelain, enabled the replacement of deficient restorations and crowns with a functional and aesthetic prosthesis. The treatment plan included: four veneers, one crown, and one implant-supported restoration. A disadvantage of this treatment option was the potential difficulty to achieve the same color shade for all six restorations. The lithium disilicate restorations were designed with more thickness with the goal of covering the implant metal abutment and...
the metal post. Another method used to complement the implant restoration and the crown was to use the metal/ceramic or zirconia restorations. While this technique would provide the same esthetic result, it has disadvantages in terms of matching the same color shade for all the restorations. If the finished porcelain veneers’ shade does not match the other crowns, then the porcelain restorations must be removed and replaced, or all the restorations would have to be remade. Repairing prostheses with porcelain veneers would thus require more time with the provisional restorations and fabrication of a new set of prostheses, and this would be costly. Fabrication of the prostheses began with an open custom tray impression (Figure 2) made with polyvinylsiloxane (Imprint™; 3M ESPE, St. Paul, Minnesota, USA). Prior to impression, the settlement of the implant impression coping was verified radiographically. The opposing arch impression was made with irreversible hydrocolloid material (ALGInoplast®; Heraeus Kulzer, Hanau, Germany). A definitive cast (Figure 3) was fabricated from die stone (Tuff Rock; Talladium, Inc., Valencia, California, USA). Maxillomandibular relationship and facebow records were obtained using wax (Aluwax™ Bite, Aluwax Dental Products Co, Allendale, Michigan, USA) and transferred to a semi-adjustable articulator (Model 2240, Whip Mix Corp., Fort Collins, Colorado, USA). Using the existing provisional restorations as reference, a diagnostic wax-up was completed to serve as a guide for fabrication of lithium disilicate copings. The implant restoration coping was developed from acrylic resin (GC Pattern Resin, CG Corporation, Tokyo, Japan), and the crown and veneer copings from wax (GEO Classic Avantgarde, Renfert do Brasil, Ribeirão Preto, SP, Brasil). Copings were fabricated with the assistance of a silicon matrix obtained from the initial wax-up, firstly to provide support for the porcelain veneer, secondly, to avoid opacity reflection through the coping. Lithium disilicate copings were obtained using the traditional lost-wax casting in combination with the press technique (Figure 4). The planned copings were pressed from lithium disilicate ingots (IPS e.max®, Ivoclar Vivadent; Schaan Liechtenstein). Implant and crown copings were pressed with an opaque lithium disilicate ingot rather than the veneer copings. The final color shade was selected and approved by the patient. Porcelain veneers were added to the lithium disilicate copings to complete the crowns. Note the harmonious tapered translucency of the incisal thirds of the final crowns (Figure 5) from the gingival to the incisal third of the incisors (Figure 6).

The crowns were fabricated with an access hole for the abutment screw. The crown and veneers’ interproximal contact areas were checked and then cemented with resin cement (Variolink®, Ivoclar Vivadent, Schaan, Liechtenstein). The implant restoration consisted of cementing the crown onto the implant abutment with resin cement (RelyX™ U-100, 3M ESPE, St. Paul, Minnesota) extra-orally. Next, the crowns were screwed to the implant and torqued to 20 Ncm using a torque wrench. Screw access holes were covered with teflon tape and then with composite resin (Tetric® N-Ceram, Ivoclar Vivadent; Schaan, Liechtenstein). Cement excess was removed and a canine protected occlusion was provided to the patient. Postoperative instructions were given to the patient for care and maintenance, verbally and in writing. Color shade
was properly evaluated and there was no visible mismatching (Figure 7a, b). The patient was instructed in the use of dental floss and other hygiene aids. The patient was placed on a six-month recall for longitudinal maintenance of the prosthesis and routine evaluation of her oral health.

**SUMMARY**

A technique for restoring teeth and implants in the esthetic zone with the same restoring material is presented. Restorations consisted of individual lithium disilicate copings veneered with porcelain on vital teeth and implant. The outcome of the described treatment met the patient’s esthetic and functional expectations without any additional repairs related to color shade. Although there was a possibility of reaching an esthetic outcome with different restorative materials, the restorative dentist must be cautious when selecting the restorative material. The treatment presented here provides the option of one material when facing different types of substrates in the esthetic zone.

**ACKNOWLEDGEMENTS**

Dr. Prado & Dr. Cardoso: Performed restorative procedures.

Dr. Ivich: Performed dental laboratory work.

Dr. Ferreira: Performed initial case selection, treatment plan, drafted and critically revised article.

**Disclosures:** The authors did not report any disclosures.

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**References**

1. Traditional metal-ceramic crowns exhibit a lack of translucency with the surrounding soft tissues often resulting in:
   a. Compromised esthetics
   b. Marginal chipping
   c. Gingival tattooing
   d. None of the above

2. Ceramics have unique properties that include:
   a. Biocompatibility
   b. Stability
   c. Durability
   d. Optical qualities
   e. All of the above

3. Ceramic core options include:
   a. Feldspathic porcelain
   b. Aluminous porcelain
   c. Lithium-disilicate-based ceramics
   d. Glass-infiltrated alumina
   e. All of the above

4. Glass-ceramic material can be used in the construction of:
   a. Single-unit crowns
   b. Veneers
   c. Onlays and inlays
   d. None of the above
   e. All of the above

5. The survival rate of glass-ceramic material in the esthetic zone is approximately:
   a. 99%
   b. 50%
   c. 25%
   d. 3.14%
   e. 75%
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Retrieval of a Dental Implant Healing Abutment with a Stripped Driver Recess: A Clinical Technique

Cimara Fortes Ferreira, D.D.S., M.Sc., Ph.D., M.D.S.; Russell A. Wicks, D.D.S., M.S.

Introduction

Prosthetic complications involving fastened connections are known to occur in implant dentistry. Several methods for retrieval related to screw breakage have been reported. Mechanical alteration of the retained screw surface by grooves, slots or other configurations have been suggested to permit the access and purchase of a removal instrument. Enhanced techniques to help remove fastened components employing cryo-mechanics and ultrasonic instrumentation have also been reported.

Healing or transitional abutments are commonly joined to dental implants after osseointegration has occurred. These abutments are manufactured to various heights and widths to develop the most desirable peri-implant mucosal tissue configuration prior to restoration. These abutments are most frequently produced as one-piece components without an anti-rotational feature or separate fixation screw. The manufacturer’s screw carrying system (SCS) is used for direct attachment of the abutment to an exposed implant interface. This clinical report describes such an attached abutment which had been recycled multiple times and had a worn SCS screwdriver recess. In the present case, the SCS screwdriver could not engage the recess securely enough to apply any torque in a counter-clockwise direction for removal.

Clinical Technique

A patient presented to the University of Tennessee Health Sciences College of Dentistry undergraduate implant clinic for initiation of stage III of implant rehabilitation. Patient presented with an RC (024.0001S) healing abutment (Straumann® USA, LLC, Andover, Massachusetts, USA) in #14i (Figure 1). In order to make an implant-level impression, various attempts were made to remove the present healing abutment. It became apparent there was no frictional purchase on the abutment upon application and turning the SCS screwdriver (Straumann® USA, LLC, Andover, Massachusetts, USA) in the recess.

The size of the screwdriver (Straumann® USA, LLC, Andover, Massachusetts, USA) (Figures 2a) was measured using a periodontal probe and compared to a larger-sized, Locator® screwdriver (Figures 2b). Note that the side of the hexagon of the SCS screwdriver has an approximate measurement of 0.5 mm, resulting in a surface area of 0.65mm². Alternatively, the side of the Locator® screwdriver is an isosceles triangle with an approximate measurement of 2 mm, resulting in a surface area of 1.732 mm². The surface area of the Locator® screwdriver is approximately 2.6 times larger than the surface area of the SCS screwdriver. This pattern for the Locator® screwdriver was recreated within the occlusal confines of the healing abutment using a taper fissure carbide bur #700 (Brasseler USA® Dental, Savannah, Georgia, USA) in a high-speed handpiece (Figures 3 and 4) under profuse irrigation.

The Locator® driver was attached to a torque wrench (Straumann® USA, LLC, Andover, Massachusetts, USA) set to a reverse (counter-clockwise) rotational direction and placed into the newly formed recess. Finger pressure was exerted to maintain the driver in place and the torque wrench turned to release friction on the screw threads. Once loosened, the abutment was completely unscrewed manually from the implant using the Locater® screwdriver (Figure 5). Impression procedures proceeded as planned, and a new RC healing abutment was reattached using a SCS screwdriver.

Conclusion

Overcoming mechanical complications through diligence and common sense is necessary in implant dentistry. The article presents a practical and efficient solution to one such problem.

Disclosures: The authors did not report any disclosures

REFERENCES

Retrieval of a Dental Implant Healing Abutment with a Stripped Driver Recess: A Clinical Technique

Figure 1: Occlusal view of the stripped Straumann RC healing abutment for #12i.

Figure 2: A) A Straumann® SCS screwdriver (046.400). Note that the side of the hexagon was measured using a periodontal probe and shows an approximate measurement of 0.5 mm. B) Locator® screwdriver (046.416) (Straumann® USA, LLC, Andover, Massachusetts, USA). Note that the side of the triangle was measured using a periodontal probe and shows an approximate measurement of 2 mm.

Figure 3: Taper fissure carbide bur #700 (Brasseler USA® Dental, Savannah, Georgia, USA) attached to a high-speed handpiece.

Figure 4: Occlusal view of the modified RC healing abutment before complete removal using the Locator® screwdriver.

Figure 5: Locator® screwdriver and bur modified Straumann RC healing abutment after retrieval from the patient’s oral cavity.

References:


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Russell A. Wicks, D.D.S., M.S., Professor and Chairman, Department of Prosthodontics, University of Tennessee College of Dentistry, Memphis, Tennessee.
1. The manufacturer’s screw carrying system is used for:
   a. The direct attachment of the abutment to an exposed implant interface.
   b. Connecting the final restoration to the implant.
   c. Use as an abutment.
   d. None of the above.

2. What can result from using recycled implant abutment screws?
   a. Wearing of the screw recess.
   b. Inability to gain frictional purchase so it can be removed.
   c. Inability to remove the healing abutment.
   d. All of the above.

3. The surface area of the Locator® screwdriver is approximately 2.6 times larger than the surface area of the SCS screwdriver.
   a. True
   b. False

4. In this case study the pattern for the Locator® Screwdriver was recreated within the occlusal confines of the healing abutment using:
   a. A round diamond bur
   b. A 33 1/2 carbide bur
   c. A safe-end 557 diamond bur
   d. A taper fissure carbide bur

5. In this article, what provided the pressure to maintain the driver in place?
   a. A periodontal probe
   b. A bayonette forceps
   c. A mosquito hemostatic forceps
   d. Finger pressure

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Appropriateness of the material
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