ISSN 2077-0871

SADTJ

The Southern African Dental Technology Journal

Nov 2014. Vol 5 Issue 2

Exclusive Interview with Mark Jackson

The Evolution of Dental Materials for Hybrid Prosthesis

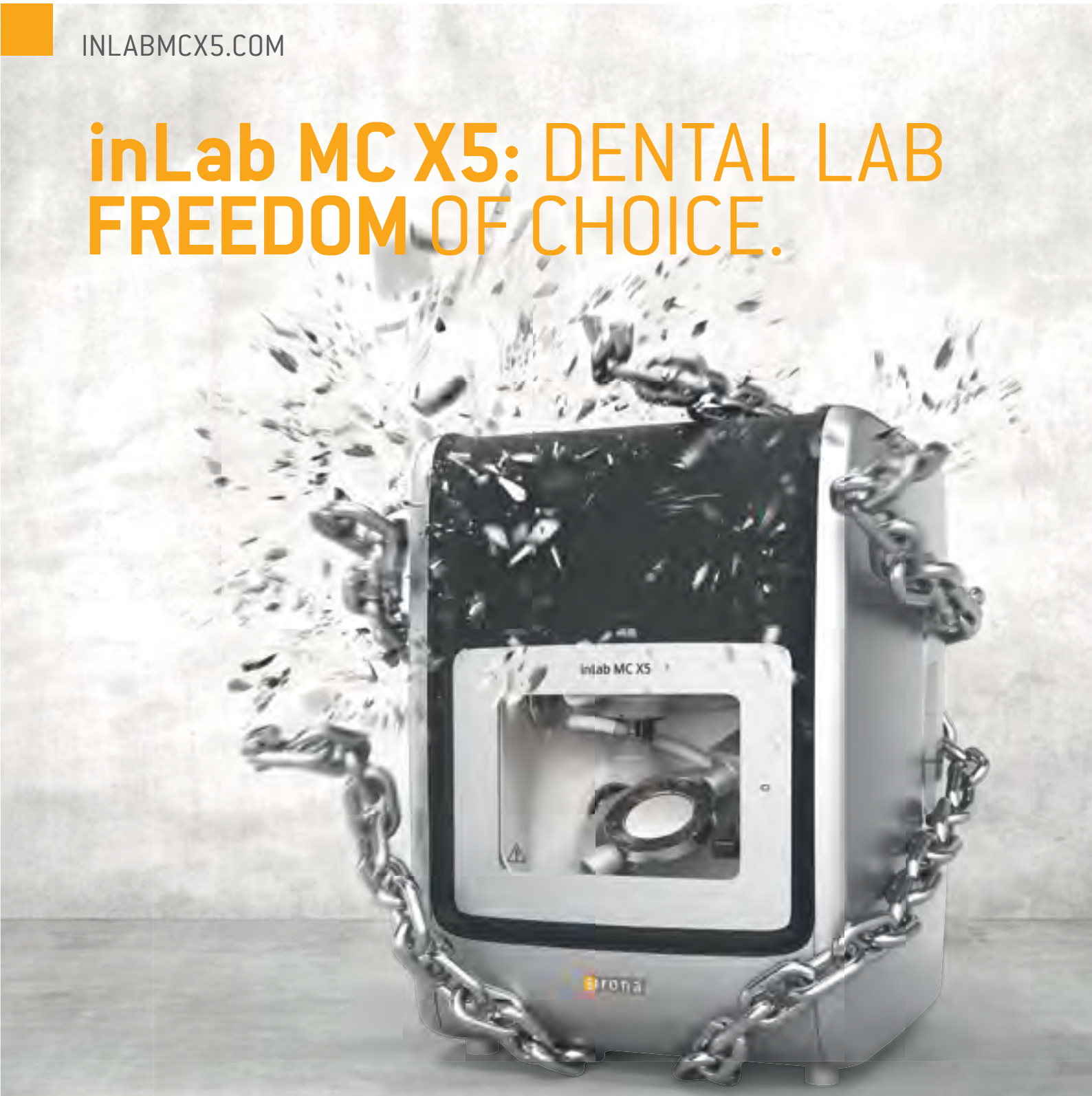
Dental Technology's own Masterchef

Case Presentation: Express dental Lab, Pta

Local industry news: Unveiling of TUT's new facility

INLABMCX5.COM

inLab MC X5: DENTAL LAB FREEDOM OF CHOICE.



DEVELOPED FOR THE DEMANDS OF DENTAL LABORATORIES

inLab MC X5, the five-axis milling and grinding unit newly developed especially for the demands of dental laboratories, completes Sirona's inLab system. Dental technicians benefit from the greatest flexibility for the entire production process of aesthetically pleasing restorations and the largest selection of materials available on the market. **Enjoy every day. With Sirona.**

KEY FEATURES:

Five axis milling and grinding ▪ Wet and dry milling and grinding: no restriction in range of materials; optimum processing Disk and block processing: high productivity and versatility ▪ Open system: versatile implementation into existing lab equipment ▪ Automatic tool and block/disc changer.

JOHANNESBURG:
Tel: 010 001 2827

CAPE TOWN:
Tel: 021 555 2393

DURBAN:
Tel: 031 822 2737

The Dental Company

sirona.

SADTJ

MANAGING EDITOR Lyra Naomi Fourie
EDITOR IN CHIEF Axel Grabowski
LAYOUT AND DESIGN Lyra Naomi Fourie
COVER PAGE Model: Greg Stiemer
Photography: Lyra Fourie
ADVERTISING INQUIRIES Lyra Naomi Fourie
sadtj@dentasa.co.za
ADDRESS CHANGES Elize Morris
dentasa@absamail.co.za
ACCOUNTS Elize Morris
dentasa@absamail.co.za
Tel: 012 460 1155
PRINT COPY SUBSCRIPTIONS Fax: 0862337122
Elize Morris
dentasa@absamail.co.za
Tel: 012 460 1155
PO Box 95340, Waterkloof, 0145
International Standard Serial Numbers Electronic: ISSN 2077-2793
Print: ISSN 2077-0871

PUBLISHED BY The Dental Technology Association of South Africa

The Dental Technology Association of South Africa
Association Incorporated under Section 21
Reg No: 2005/035340/08
ADDRESS P O Box 95340, Waterkloof, 0145
105 Club Ave, Waterkloof Heights, Pretoria
PHONE 012-460 1155
FAX 0862337122
OFFICE HOURS Mon-Fri 08:00-13:00
URL www.dentasa.org.za
E MAIL dentasa@absamail.co.za

STATEMENT OF INTENT

The Southern African Dental Technology Journal is published 3 times a year. The main objective of the Journal is to provide the professional with the opportunity to earn CEU's through completing the questionnaires, or writing articles. All papers in English, on any aspect of dental laboratory science or related disciplines, will be considered on merit and subject to the review of the editorial board and the CEU accreditation committee.

EDITORIAL

We are fast approaching the end of another year. I seem to say this every yearend, but 2014 flew by before I knew it.
This has once again, and that of course is good, been a busy year with lots happening in Dental Technology.

After nearly thirty years, it would seem that the well overdue implementation of Denturism in South Africa has reached a point where there is no turning back. This, as we know this has been a thorn in the side of the majority of dental practitioners, but due to the persistence of many, especially Duffy Malherbe, the end is in sight.

Well done too, to the SADTC, for supporting this venture and for them to accept the reality of the enormous contribution we can and will make to the majority of the underprivileged population of South Africa.

I believe it is important that I represent the profession on the following task teams of the SADTC and thus give the professions input. The all-important Legislative Review Task Team (LRTT) where we have applied to the Minister of Health to re-write the very archaic Dental Technicians Act.

I am also part of the SADTC task team that is in the process of drawing up Regulations with regards to CAD/CAM and Advertising. Times are changing and so must we.

Thank you to all that made the 2014 DENTASA Summit and AGM such a huge success.

We are looking forward to the Western Cape branch hosting the 2015 Summit and AGM in the beautiful Stellenbosch. Please make every effort to attend on the 12th and 13th June.

Welcome back to Naomi Fourie to the Editorial Board of the SADTJ, and I am sure you will all agree, this edition looks and is professional. Well done Naomi.

My sincere thanks to DENTASA's ever friendly and helpful secretary, Elize.

To the Exco of DENTASA, this profession is greatly indebted to your selfless giving of your time and expertise, it is appreciated.

Thank you to each DENTASA member for your support during the year, and I would like to take this opportunity to wish you and your loved ones wonderful fest of seasons and prosperous New Year.

Editorially yours
Axel

TABLE OF CONTENT

INDUSTRY NEWS

Baby BOY FOR DENTASA PRESIDENT

The president of DENTASA, Anso Steenkamp, gave birth to a healthy baby boy on August, 6th , 2014.

Eben Steenkamp was born at 8h47 am, at the Pretoria East Hospital. At birth he weighed 3,52 kg and was 48cm tall. Both mom and baby are doing well.

Ansu will be returning to the bench at Boshtech Dental Laboratory where she works as an employee on December 1st, 2014.

THE GRADUATE ACHIEVER AWARD 2014

The competition was set to encourage students to strive for excellence in their work and motivate them to showcase their skills at creativity, problem-solving, aesthetics, technological skill, communication, etc. The idea was to provide an opportunity for students to interact with the wider dental profession in exchanging ideas, theories and best practices. The organizers wanted to help students develop pride in their profession and to develop leadership skills and ethical values.

The winner was awarded with an all-expense paid academic trip to Europe to attend specific short courses offered by selected manufacturers and visit a number of top-end dental laboratories. The winning package included return air tickets, accommodation, transport and an entrance ticket to IDS 2015 in Cologne – Germany. Companies that sponsored courses for the winner in Europe is: Ivodent, Nova Dental Supplies, Dentaurum SA, Dentalab Supplies, Zenith and Organic SA.
The four runner-up contestants will each receive an iPad 5 sponsored by Ivodent, Betta Dental Supplies and Metal-Free Dental Supplies, together with a certificate of merit.

Entrants had to enter a case study that could cover any topic from a complex orthodontic, hybrid denture, or combination case, to a complex case involving implants, or complex maxillofacial case. They had to do an oral presentation of the case study to five judges at the DENTASA Summit. Students had to present a poster of the case study and the actual completed technical work of the cases for display.

The standard of work presented by the students was exceptional, and the competition fierce. In the end, Corné Sardyn walked away with the much coveted first prize. Runners up were, Juan Cronje, Gideon van Zyl, Kyle De Villiers, Bianca Haasbroek and Albertus Rust.

Changes in the Act

Dental Technicians Regulations Open for Comments

Gazette 37987/711
9 Sept 2014

Open for comments until
9 Dec 2014

Scope of Practice for Dental Technicians and Technologists

Supervision of Registered Dental Laboratories

Health minister Aaron Motsoaledi has published regulations on dental technicians and technologists as well as on dental laboratories in the Government Gazette for comment.

The notice in Gazette 37987 / 711 of 9 September 2014 relates to the scope of the dental technicians and dental technologists professions and the notice in Gazette 37986 / 710 of 9 September 2014 to the supervision of registered dental laboratories.

Interested persons are invited to comment on the proposed directives within three months of their publication.

The regulations are recommended by the Dental Technicians Council.

View the documents:

http://www.gov.za/sites/www.gov.za/files/37987_rg10264_gon711.pdf

http://www.gov.za/sites/www.gov.za/files/37986_rg10263_gon710.pdf

TUT UNVEILS MOST MODERN DENTAL TECHNOLOGY LABORATORIES ON THE CONTINENT

Top large photo:
New CAD/CAM laboratory

Above:
Porcelain room

The Tshwane University of Technology (TUT) unveiled what could be considered the most advanced dental technology training laboratories on the African continent.

Made possible by the Infrastructure and Efficiency Funding (IEF) for scarce skills received from the Department of Higher Education and Training, upgrades and refurbishment amounting to R20 million was undertaken by the dental technology division, enabling TUT to deliver world-class graduates as well as addressing the shortage of skilled professionals.

The renovations included equipping the new laboratories with the most modern equipment available as well as the refurbishment of the dental laboratories, plaster rooms, machine and casting rooms, student workstations and diagnostic facilities. The new equipment enables TUT students to enhance their practical skills on the most innovative technical equipment currently available.

The new computer-aided design (CAD) and computer-aided manufacturing (CAM) system includes 17 linked workstations that will greatly enhance the training aspect in relation to the design and creation of dental restorations, more specifically dental prostheses, including crowns, crown lays, veneers, inlays, fixed bridges, dental implant restorations, dentures, and orthodontic appliances. Other new equipment includes state of the art Phaser welders that, based on pulsed micro arc technology, are optimized for easy, fast and reliable welding of all types of dental welding jobs. Furthermore new furnaces, milling stations, electro polishers and induction casting machines are just some of the equipment that can be seen in the new laboratories that now consists of over 110 brand new lab benches and individual student training stations.

New Smart-classroom capabilities will enable lecturers to not only do practical demonstrations that students follow on high definition big screens, but also share them with fellow students and lecturers in adjacent or distant laboratories. This innovative approach truly makes the new facilities an interactive experience simulating the current dental workplace. All demonstrations, lectures and practical work can also be recorded in high definition and uploaded to a server making it possible for students to review work again or

catch up on classes they might have missed. According to the Faculty of Science Associate Dean, Prof Prince Ngobeni, the modernization of the laboratories places TUT at the forefront in Africa in terms of training and research capabilities. This was an enormous undertaking and we have to thank the dental industry who helped us greatly with the establishment of the refurbished laboratories and equipment. I would also like to commend the total commitment and guidance from the Dental Technology staff who were 100% dedicated to the task at hand.

The new facility allows the University to deliver students trained on the most modern equipment anywhere on the African continent. This is indeed a massive step forward in establishing the Dental Technology division at TUT as the most advanced in its class in Africa. "

The TUT Dental Technology division is more than 40 years old having started in 1972 at the former Pretoria College for Advanced Technical Education, and is one of only three institutions in South Africa offering the Dental Technology degree.

Above: Modern Laboratories

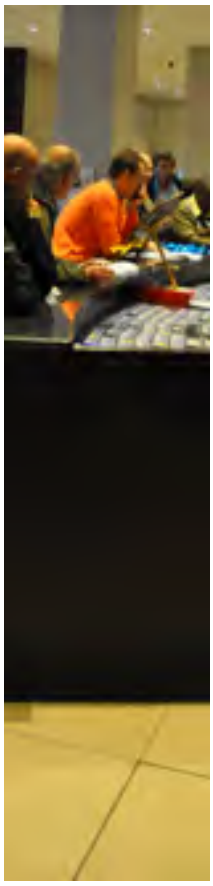
Above Left to right: Mr Dries Boshoff (TUT), Mr Louis Steyn (Vice-President of the Council of the South African Dental Technicians Council), Mrs Catherine Mokgatle-Makwakwa (President of the Council of the South African Dental Technicians Council), Prof Prince Ngobeni (TUT), Dr Ingrid Mokgobu (TUT), Charl Hartman (TUT) and Willie Smit (TUT) at a site inspection by the Council of the South African Dental Technicians Council.

Far left: Rows of model trimmers

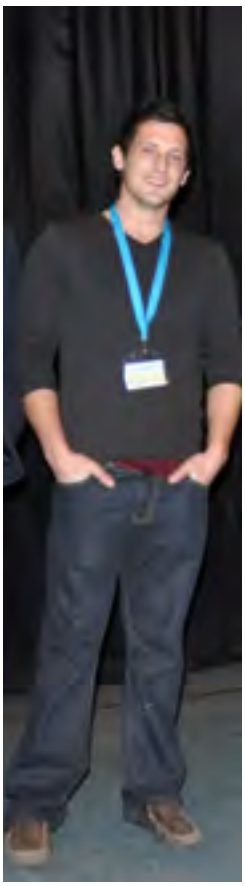
Left: TUT Alumni and now Chief Operating Officer of The Dental Technology Association of South Africa, Axel Grabowski, unwrapping new equipment for the laboratories just as he did in 1972.

Equipment that goes on for miles and miles.....just like the smiles of the students and lecturers at TUT's Dental Tech Dept.

DENTASA SUMMIT AND AGM 2014





The DENTASA Summit and AGM was held on 1 and 2 August 2014 at the Birchwood Hotel and OR Tambo Conference Centre.

Like every other year, dental techncians from all over the country gathered for this event. Lectures were attended to earn much needed CPD points, but over lunch and tea, it was time to catch up with old friends and long lost collueges.

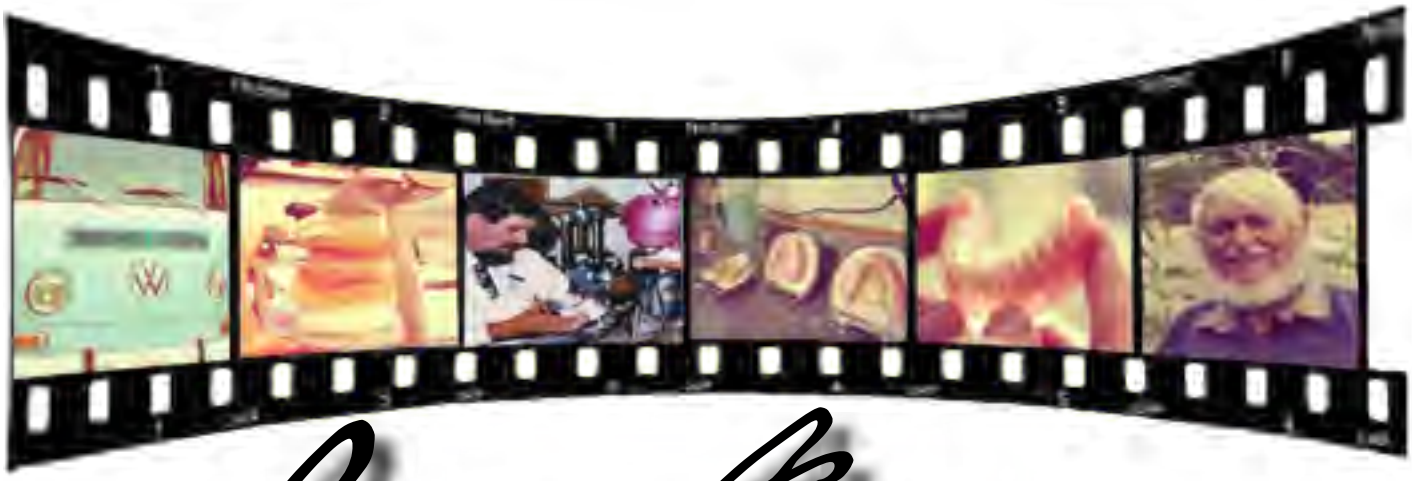
The exhibition hall was filled with booths from traders exhibiting everything from consumables, to the staples like micromotors and articluators, through to the latest equipment on the market.

This year delegates at the Summit and AGM were treated to some special lectures, of which the highlight was the keynote speaker, Mark Jackson. Often described as the dental techncian's, dental techncian, just a few minutes into one of Mark's lecutres and one immediately understands the popularity of this unassuming American. The tone for the Summit and AGM this year was very positive and the energy and vision that Mark shared thoughtsout was there cherry on top!

This year the Student Achiever Award has been revived by DENTASA, bringing lots of excitement to the dental techncology student community as the prize was an amazing overseas trip for the winner and iPads for the runners up. The quality of work produced by the students was of a very high standard and judges had difficulty appointing the winner. Well done to CPUT and Corne Sardyn for winning the Student Achiever Award 2014. We are looking forward to hearing a lot more from all the talented youngsters who wowed us with their projects!

Overall, the DENTASA Summit and AGM 2014 will go down in the history books as a very successful and uplifting meeting. Judging on the smiles on the faces of people leaving the venue on Saturday afternoon, and overwelming positive responce on the DENTASA facebook group, this event was a massive succes!

Thank you to Mariaan, Elize and Axel for the hard work that you have put in to make such an amazing event possible. We appreciate the many hours that you have put in and the degree of effort you have gone trough!



Oom Bo

KEN IS NIE KAN NIE, KAN IS HERHAAL

Most of us who studied Dental Technology at the Pretoria Technikon, later known as Tshwane University of Technology, have in some form been shaped by a great man named, Edvin Bovill, better known as Oom Bo. On July 16, 2014 Oom Bo 'went home'. His funeral was held on July 26, 2014 and was attended by several old students and colleagues.

He will always be remembered with fondness by whoever knew him. With his large stature, big beard and even bigger voice, he taught us more than just first year prosthetics. Oom Bo transformed rookie students into dental technicians, not an easy task by any means.

If there is one thing that Dental Technology has no shortage of, it is colorful characters, and Oom Bo definitely rated highly in that category. The sayings and unusual habits of this exceptional man have been recalled and shared by various people who knew him on social media and in private conversation.

Probably his most well-known habit was the fact that Oom Bo would fall asleep every lunch time at his desk within seconds, to wake up about 15 minutes later, as fresh as a daisy! A colleague of his remembered how he used to take Aspirin with a Coke whenever plagued by a migraine. After years of working in prosthetics, he lost his feeling in his fingertips due to the constant exposure to monomer.

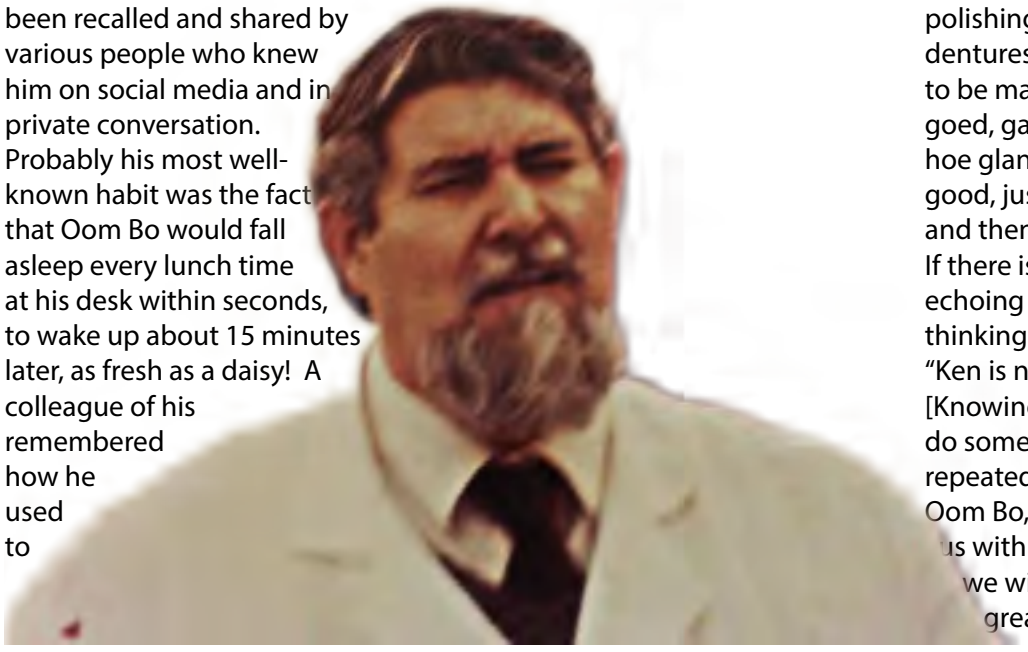
When anyone complained about meat being tough, Oom Bo would say that tough meat is a bargain, it takes longer to eat and therefore the taste lingered longer. An old student who specialized in prosthetics after he qualified recalled that he learned from Oom Bo, that prosthetics technicians should have a big 'boep' to rest the articulator on, and a beard to keep acrylic out of your face. You listened well Nelis!

With his upbeat personality he would evaluate students' set-ups and after a few seconds of silent review announce: "Baie mooi, skuif nou net die middel-lyn so 2mm na regs, dan's ons by die huis!" [Very good, just move the midline about 2mm to the right and then we are home!]

How many of us have spent hours polishing and high shining our dentures before taking it to Oom Bo to be marked, just to be told. "Dit lyk goed, gaan gee hom nou net so bietjie hoe glans dan is hy reg". [That looks good, just do your high gloss finish and then it's ready]

If there is one saying that keeps echoing through our minds when thinking about Oom Bo, it must be: "Ken is nie kan nie, kan is herhaal!" [Knowing doesn't mean being able to do something, knowing comes from repeated practice.]

Oom Bo, we salute you! You taught us with a firm, but gentle hand and we will always remember you with great respect and fondness.



SADTJ: ***Where does your love for cooking come from?***
Abigail: My love for cooking comes from my upbringing. The kitchen was a place where my whole family shared great moments, so when my mom passed on my siblings and I would always catch up with each other over food we cooked ourselves and we would mostly be replicating the dishes my mom used to prepare for us. But for me, I would always bring in a modern twist to her dishes of which it became apparent to my siblings that I was doing something out of the ordinary and that was pleasantly appreciated. So I grew to love this new hobby and found it therapeutic.

SADTJ: ***I know that you have lost your brother to diabetes and that it inspired you to change the eating habits of the black middle class. Tell us more about this.***
Abigail: My eldest brother was my swimming instructor, so I spent quite a lot of time with him. He fell ill during one of our sessions but at the time we weren't aware that he was diabetic. We were informed about his diabetic condition when he had actually passed on due to his glucose having shot up, sending him into a comma. During that week I went through a lot of introspection. I read up, trying to find the cause of this diabetes and it all pointed to his diet.

SADTJ: ***Tell us about your healthier options menu at your brother's sports café in Khayelisha.***
My brother came up with the idea to cook healthy meals for them after he and friends found that they enjoyed going back to the township for the vibe and socializing but that options for food were limited. One would have to go to a Tshisanyama or fast foods takeaways to get a meal.
So I did a pilot project from September till November 2013 where I cooked and sold well balanced meals at my brother's sports café. The meals would consist of a starch, protein and vegetables. I cooked old favorites but with a modern twist.

SADTJ: ***Understandably, you are focused on healthier culinary options. Bland steamed fish and veggies however could not have gotten you a place as a Master chef SA finalist. What is your secret to cooking healthy, yet scrumptious meals?***
Abigail: My secret to cooking healthier meals starts with embracing local and seasonal ingredients. I opt for using

My secret to cooking healthier meals starts with embracing local and seasonal ingredients. I don't believe people should be subjected to bland meals.

herbs instead of spices when flavoring my meals. I don't believe people should be subjected to bland meals. Different methods and out of the ordinary processes such as using a smoker at home enhances the flavors without having to add a high dose of salty spices.

SADTJ: Now for the million dollar question; how did you get involved in Master chef SA?

Abigail: I was convinced by my dear friend Joyce, my son and my step son. Every year since Master Chef SA started they'd encouraged me to enter. This year they made sure send me reminders so I don't miss the auditions.

SADTJ: I have to confess that I have never watched Master chef SA before. I am aware that this is not the first series though. Tell us a bit more about the competition.

Abigail: Contestants are given a task to complete within a specific time. You have to impress the judges with self-taught culinary skills, as well as showing some level of creativity.

SADTJ: Dental technologists are usually working behind the scenes. What was the experience like to cook in front of the cameras in such a competitive environment?

Abigail: I have the ability to close off anything happening around me and this has been an advantage for not to be distracted by what happens around me.

SADTJ: Do you think that your background as dental technologist, working under pressure in the lab was of any value to you in this competition?

Abigail: Yes it was of great value. It became second nature to me.

SADTJ: What did you take from the Master chef SA experience?

Abigail: I've been most inspired by the guest Michelin starred Chefs which in turn has made me realize that I need to up my game. This has helprf to enhance my culinary skills.

SADTJ: What does the future hold for Abigail Mbalo?

Abigail: I see myself helping change people's lives through food. I am in the process of launching a food truck business that will offer well balanced meals alongside Tshisanyamas in the townships. This will bring an alternative to the braai meat as well as accompaniments to the braai, providing people with healthier options. I will also be supporting a local vegetable garden called 'Umoya Wekahaya' a sustainable organic garden in Khayelitsha.

Congrats Abi, we are proud of you!

Photos for official Masterchef Website

Interview with

MARK Jackson

If there is one thing universal, it is that Dental Technicians have a passion you rarely find in other fields.

SADTJ: You have been in contact with South African dental technicians on Facebook for a number of years. How did your idea of the Dental Technology Industry in South Africa differ from what you have experienced here?

Mark: I have always had a lot of respect for the South African Technicians. I have worked with several in the US, and they always impressed me with their skills. They (you) rank right up there with the best in the world. There is a lot of weight given to the German and Swiss dental training, but I think the SA system is probably even better.
I sat in on some student presentations and was very impressed with the dedication and breadth of knowledge in these young people. I love to see them so excited about the future, and that is exactly how I feel after over 30 years in this industry. If there is one thing universal, it is that Dental Technicians have a passion you rarely find in other fields.

SADTJ: You have visited a couple of labs during your stay here in SA. What would in your opinion be the major differences between South African and American labs?

Probably most striking to me was the lack of large laboratories. The trend in the US seems to be towards consolidation. Fewer, but larger labs. Part of this of course is driven by the high cost of emerging technologies, and the manpower required just to stay current. Plus, we have a tightening of regulatory requirements in terms of FDA (US Food and Drug Administration) that also requires some more sophisticated management and administrative programs. These take precious time from a small business owner, so larger corporate laboratories are better equipped to get and stay compliant.

On the other hand, this has created some rifts and fragmentation within the industry that sometimes feels like an "us against them" mentality. Many small labs feel that there is a predatory environment, not conducive to smaller boutique operations, so that is exactly how they have aligned themselves. It sometimes feels unhealthy and I hope we can heal this fragmented mentality, for a united industry is a strong industry.
In the US, there are NO requirements regarding who may or may not own and operate a dental laboratory, so naturally there is a wild variety of labs and huge discrepancies in quality and price. Laboratory registration is handled at the state level, and federal compliance is helping to improve this situation and hopefully will help weed out unscrupulous operators.
SA Laboratories operate in a completely alien atmosphere for someone like me. I am an aggressive marketer and take for granted the freedom we have here in that regard. I would find the rules and regulations a bit oppressive. I'd like to see a balance somewhere in-between what we have and what you have. In terms of education standards, you are decades ahead of our formal education system.
Like labs all over the world, you walk in a SA lab and feel right at home. The equipment, materials and people are all the same. I could see myself working quite comfortably in that

beautiful country, rules and regulations regarding marketing notwithstanding.

SADTJ: From an outsider's point of view, how do you see the future for dental technology in SA?

Mark: I see nothing but opportunity! Areas such as 3D printing, computer guided surgery, and immediate load implant bridges are growing rapidly here, yet do not seem to have the same kind of trajectory there...yet. I would expect these areas to boom in the future.

From a strictly OUTSIDE perspective, my gut instinct is that SA is a country on the rise. I felt a lot of optimism in the air. I saw people working. I saw new developments being built everywhere. I saw a clean and efficient infrastructure, and the hotels where I stayed were filled with international business people. These are believers in the South African growth story, who do not need convincing; they are growing their investments, creating new jobs and focusing on long term, sustainable growth opportunities.

But as we know, perception is not always reality, and I heard the plight of many discouraged people, but that is not unique to SA. Patience and persistence = results: while it is often said that rewards go to the bold, in any small business (in just about any country) it is also true that patience is a virtue (and pays).

With so much rural area, and such a large part of the population undeserved how can one NOT feel optimistic? I am very impressed with the people involved in the Denturism (or Clinical Dental Technician) movement, and I think that has an especially high growth potential.

SADTJ: What would be your advice to established labs in SA to build out their market?

Mark: There is popular analogy in the US about bottled water. We have an abundance of good, clean drinking water in the US, yet the market for bottled water is estimated to be close to $20 billion dollars this year. Why, when it's plentiful and free at home?

The water companies have done an excellent job of convincing the public that bottled water is a more healthy alternative to tap water, and each company has attempted to carve out a unique niche as being cleaner, fortified, fresher or something else that makes them BETTER than the competition, yet the difference cannot be seen, tasted or objectively measured. To me, water is water.

There is no shortage of competition in the lab industry, but we DO have the benefit of having products and services that are unique, visible and quantifiable. I would recommend looking at the strengths and weaknesses in ones business, and those of their competition. Capitalize on both. I am also a big fan of surveys.

Surveys tell us what customers (and prospective customers) want from their laboratories. It's easier to give them the things they already need, than to try and convince them that they need what we have. My laboratory has become known for our educational programs, early adoption of new technologies and superior technical support. All things we discovered surveying dentists in our market segment.

SADTJ : What would your advice be to young technicians who just started their career?

Mark: Be forever a student! Never, ever feel that you have learned all there is to learn. Do not get caught up in a Ford-vs-Chevrolet mentality where you become aligned with a certain discipline. Have an open mind. Learn from the best resources you have available. Attend lectures that dentists attend. Subscribe to every free publication, and if they aren't free, pay for those you can afford. Use the Internet. The Dental Laboratory Technicians forum on Facebook is an excellent example of a free, instant and international brain trust of dental technology.

For decades I have been attending engineering and manufacturing conventions and subscribed to their journals and magazines. Be creative, look at how other manufacturers solve problems and use materials. How can those be adapted to what we do? How can their solutions become our solutions? I was the first lab in the world to have 3D printers for powdered metal. I met this company at a manufacturing technology show, and convinced them they had a market in dentistry. 3D printing has been a part of the rapid prototyping industry for two decades before they knew we were even here. I was also the first lab in the world to have a Cone Beam CT scanner in my lab and thus befriended the pioneers in Computer Guided Surgery. It was my natural curiosity and open mindedness (as a life-long student) that allowed me to use these tools well before my competitors knew they existed. Because of this, every day is an adventure and I love my job more today than any other time in my career.

SADTJ: What is the market like in America? Is there many active labs? What impact has outsourcing to China had on your local market?

Mark: In 1997, there were over 15,000 dental laboratories in the US that we knew about. Because there are no rules and regulations over who can own and operate a dental laboratory, this has been a difficult number to ascertain, but we

know today that number is less than half, with only about 7000 remaining.
It has been estimated that as much as 40% of the work in the US is being done by off-shore labs, primarily in China, Viet Nam, the Philippines and Cambodia. India is starting to make headway as well. Any place there is low labor costs, there will be dental laboratories, and until more stringent regulations are in place, there will continue to be wildly fluctuating quality and prices available from overseas. Material safety will be an on-going concern.
CAD CAM has changed this, and I see more "re-shoring", or a return of US dentists to their domestic lab partners. Lower priced monolithic restorations and faster turnaround times have had a big influence on this, but make no mistake, off shore labs have these technologies too, and this has significantly leveled the playing field.

SADTJ: What are the latest trends in Dental materials in America?

Mark: At the moment, monolithic ceramic restorations are the most popularly prescribed products in the US. BruxZir and IPS e.Max are our top sellers, with porcelain-fused-to-metal restorations making up only about 10% of the sales in my laboratory. 85-90% of our restorations and made using CAD CAM technology, with even our PFM frameworks milled from wax rather than waxed my hand.
I believe Nano technology will finally help resin restorations overcome the stigma they received as a result of significant performance failures back in the days of ArtGlass and Targis Vectris. This new generation of materials, processed using CAD CAM technology, such as 3D Printing and milling will offer performance and esthetics rivaling ceramics, and will be manufactured in a fraction of the time. I could go on for hours about the benefits of resins. Their time in the sun is not far off.

SADTJ: How will you describe the uptake of digital technology by South African Labs and dentists?

Mark: I don't think people are in denial any longer. Digital dentistry is not a fad, and worldwide statistics are steeply reflecting this trend. In the US, we see more and more small labs with in-house milling operations, but large milling centers are still very popular as they are in South Africa.
I don't think there is any less interest on the part of South African dentists and labs to increasingly adopt these technologies, but rather the access to them that holds them back. As more manufacturers and distributors offer their wares to SA, the implantation will be exponential.

SADTJ: Having visited labs in SA do you think DAMAS accreditation is achievable for labs here?

Mark: Yes, I think DAMAS can be implemented in any laboratory of any size. DAMAS was originally intended to be a way for laboratories to comply with the European Medical Device Directive (MDD), which is almost identical to the US FDA's Good Manufacturing Practices (GMP).
In the past, the easiest route was for a manufacturer to gain compliance was to become ISO Certified, however our industry is unique. ISO is fine if you are turning out thousands or even tens of thousands of identical parts. But for us, essentially every "part" is a unique and individual component, and is really a kind of prototype, with no two pieces identical. The ISO standard is just too intrusive to be practical in a dental laboratory.
I look at DAMAS as a kind of ISO-lite. It is just rigid enough to meet all the FDA and MDD quality standards, yet not so rigid as to create an unnecessary burden on small businesses. In a prior life, I was the Implant Product Manager for the US distributor of VITA products, and we were required an ISO certification. I saw the benefits of the GMP's. After all, they don't call them "Good Manufacturing Practices" for nothing!
We became the second lab in the US to have DAMAS accreditation, and the system paid for itself in the first year in terms of improved quality and efficiency. And I know it meets the standards, because I have passed two surprise government inspections.
It may sound overwhelming, and the acronyms would confuse a military man, but in reality, it's very simple and when broken into manageable, recognizable components, it's not as intimidating as it first seems. You can see a simple illustrated example by logging into my Facebook page and looking at the Album entitled "FDA GMP's".

****** I would like to thank you for asking me to participate in this interview and thank everyone in South Africa for extending such a warm welcome and for the family style hospitality I have grown to love so much in my previous visits there. ******

PROGRESS OF THE INTRODUCTION OF DENTURISM In South Africa

By Duffy Malherbe

Reporting progress for the introduction of Denturism in South Africa:
This overview aim to reflect briefly on three recent events that gives momentum to the progress of the initiative of The Society for Clinical Dental Technology (SCDT) to introduce a new Oral Health Care category of Denturist in South Africa, namely:

- Presentation at the working dinner of the SADTC in Cape Town
- The SADTC reflecting to the profession during the DENTASA summit in JHB.
- South Africa attending the AGM of the IFD in Dublin

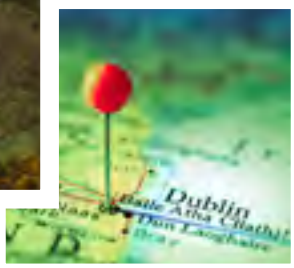
On the 20th June 2014, three Denturism Advocators: Ish Larney, Duffy Malherbe and Oliver Meier presented position papers to a Working Dinner of the SADTC and presented the efficiency advantages of Denturism to the consumer, the demographics and a special focus on the needs of the old and the poor. These position papers were presented from an Australian, South African and New Zealand perspective, but echoed the same urgent underlying message. As a consequence, the Council agreed to include the establishment of a Register for Denturists under the stewardship of the Dental Technicians Act, in its legislative review by a Legislative Review Task Team (LRTT) working in close consultation with the Department of Health.

During the DENTASA Summit on the 4th August 2014 the SADTC had an opportunity to address the delegates and confirmed in no uncertain terms that the Regulator has accepted the challenge and is committed to the task to steer the introduction of a category of Denturist in South Africa. In the days that followed it was decided that the SCDT (specialization affiliation of DENTASA and member of the IFD) needs to attend the next annual meeting of the IFD in order to strengthen and refresh relationships with the leaders in the International Denturism profession. This is part of the process of international benchmarking and assessment of the ideal training model for consideration of local application.

The SCDT is indebted to the gracious sponsorship from a number of colleagues and local Dental Traders who made it possible for South Africa to be represented in Ireland at the annual general board meeting of the International Federation of Denturists (IFD). This meeting was held from 8-10 October 2014 in Dublin and attended by 20 delegates from various member countries. This dynamic organization is entirely run by volunteers and made up from representatives of National Associations sharing the same vision and objectives to establish the Denturism profession wherever there is a need. It was wonderful to eventually meet many old friends, some of whom the SCDT have been corresponding with for more than a decade. Many of the senior stalwarts have since retired, but the younger advocators amongst the delegates shares the same camaraderie and passion to globalise the profession. Personal interaction elevates relationships to a new level and the time invested in conversations augers well for the sharing of information we may need, to take our initiative to the next level in South Africa.

The meeting was opened by a member of the Irish Parliament who gave a glowing report of the value that Clinical Dental Technicians provide to the Irish people and the positive impact they have on the oral health and general health of Ireland. This was followed by 2 days of intensive discussions related to various administrative matters including the appointment of a new Chief Executive and new website for the IFD, Regional issues and Country Reports, continuous and new business. The format of reporting makes provision for the discussion of support required and how the structures of IFD can assist member countries to progress. During the meeting the representative for Belgium received good news when the results of their national elections filtered through, with a narrow victory for the opposition Party. The shadow-Minister of Health in the opposition has a long working relationship with the Belgium Denturism Association and this elevates the potential for an imminent breakthrough for the cause. The European Committee was regrouped and a new strategy was forged in order to address the mounting challenges they are facing within the EU. During the meeting, Duffy Malherbe from South Africa was nominated as the inaugural editor of the anticipated Newsletter for the IFD.

The IFD now has 3 regional committees to focus localized matters, in Northern America, Europe and AustralAsiaAfrica. The SCDT are looking forward to a cordial relationship under the new structure, with the new Vice President of the IFD for AustralAsiaAfrica, Mr John Rogan from Melbourne. John is



the current National President of the Australian Dental Prosthetics Association representing 1200 practicing dental prosthetics and almost 60 years of legislated Denturism in the region.

16-19 September 2015 will see the 9th Denturist World Symposium hosted in Alexandra, VA USA and during 2016 the Board will meet in Switzerland. The IFD received the bid from South Africa to host the World Symposium in 2017 with enthusiasm, but the decision to accept or decline the bid to host, was postponed in view of the historic low pattern of attendance from other continents and a host of complicating factors affecting the economic viability of hosting the event so far away from where Denturists are generally located. This gives us an opportunity to review the options and format for this event to prevent potential economic shortfall which will be unfair on DENTASA and the local Dental Traders. If we can't find solutions, the IFD may consider to meet in Cape Town for the annual Board meeting only and skip having a World Symposium that year, as there are no other contenders tabled as yet. The physical presence of the IFD meeting in our country could be useful for marketing our cause to the media and create an opportunity for political exposure.

Although the program in Dublin was full, with an extensive Agenda, there were also time in the evenings and the Saturday to experience something of the Irish culture and scenery. This also presented ample opportunity to have in-depth one-to-one conversations with individuals. Central Dublin presents a wealth of historic landmarks, from ancient cathedrals to gracious Georgian buildings that pay testimony to days gone by. Goals, castles, museums and the birthplace of famous poets and writers. Dublin is also famous for its vibrant nightlife and the bustling Temple Bar area did not disappoint. We joined the festive atmosphere with thousands of friendly youngsters on their evening out, gaining access on foot over cobblestone streets to seemingly unending numbers of Pubs, Cafes and Restaurant to choose from. Numerous bands were out on the buzzing pavements, performing open air to the appreciative crowds. One evening we were treated to a show of traditional Irish Pub music and traditional dances. The food and drink lived up to its reputation, our Irish hosts were most hospitable and made all feel welcome. Our stay in Dublin coincided with excellent weather, which suited our sightseeing tour to the Wicklow Mountains, where hills and glens, forests and waterfalls enchanted visitors. We visited the ruins of the Glendalough Monastery which was often raided by the Vikings. Ireland hosts numerous film shoots and we were fortunate to see the site were a current TV series, "Vikings" are filmed on the shore of the Lake Guinness and a short distance from there the scenery made famous by films such as "Braveheart" and "P.S. I Love You". We also had a brief tour of the oldest Weaving Mill of Ireland and drove through a number of small scenic towns in the beautiful lush green Irish countryside.

During the planning stage of the trip to Dublin, it was intended to also include a visit to a retired pioneer in the UK and the training facility in the Netherlands, but eventually the extended exposure was curtailed for economic reasons and also to rather save some of the sponsored funds for a follow-on visit to the USA next year for perceived better exposure. The visit to Dublin was brief, but fruitful and we anticipate to see the results of the friendships, relationships and networking via the IFD, getting transformed into positive results in terms of getting Denturism established for our people in South Africa in the near future.

EMPLOYEE ENGAGEMENT AND WHAT YOU CAN DO TO INCREASE IT

By James R. Clark

POSTED BY JDTUNBOUND ON OCTOBER 31, 2014 IN UNBOUND EXCLUSIVES |

If you have employees you need to be concerned about employee engagement. Ensuring that your workforce is happy and engaged with the organization is vital if good productivity and low attrition are to be maintained. What can you do to keep engagement high and retain staff?

Good employee engagement is not just about paying high wages, giving extra holidays and some beanbags in the staff canteen. Companies that excel at engaging with their staff take this very seriously and will invest time and money to make sure their staff want to come to work and are happy when they get there.

Promoting good engagement levels encourages loyalty and can help ensure that staff stay with a company long term.

When an employee feels valued and engaged they are more likely to work harder and more productively.

Some steps that can be taken to increase engagement are:

Survey the employees,
Ask what they think and quantify this. By having a base to work on you can measure increases in employee engagement easily. Surveys will also throw up areas that may need improvement that can sometimes be less obvious.

Communicate with the workforce.
Good communication in both directions is healthy and goes toward helping staff feel that their views are considered worthy. Workers who are included in decision making processes are more likely to get behind decisions and take ownership.

Have fun at work and make it a place you want to be at.
No one wants to work in a company who have a dull image. People will not stay where they feel unhappy and a dull outlook will have staff leaving in droves.

Be the best not just average.
When it comes to looking after staff organizations that offer terms and conditions which are market leading tend to be the ones that have big engagement scores.
Settling for the industry average on holiday entitlement, pay, perks means that more than half your competitors can offer more. Be the leader and you will attract the best talent and retain them.

Ask those who leave where it went wrong and what went well.
Leavers leave for a reason mostly. It could be salary, lack of prospects or the job was just not for them but there is a reason. Conducting an exit interview can mine information which can be used to improve things for the employees who remain.

Investing in good relations will reap rewards through increased retention and more productive staff.

About the Author:
James R Clark is a HR Professional, Blogger, Daddy, Husband, Dog Owner and Tech Geek. James writes on many subjects and has his own blog where you can find out more about James R Clark.

IF I KNEW THEN WHAT I KNOW NOW

by Kelly Carr and Maribeth Marsico
Reprinted with permission by
LMT Communications, Inc. • Digital Dentistry • November/December 2014

It's been more than a decade since digital technology came to fruition in our industry.

LMT taps into the expertise of 20 laboratory owners from all size labs who've successfully incorporated digital technology into their operations, offering real-life experiences and tips on what we all wish we would have known before taking the plunge.

Change Your Culture

Employee buy-in makes the difference between success and failure with new equipment implementation. Our first step was to create a sense of urgency; we talked to our team about how quickly the industry is changing and if we were to survive, we needed to adapt.

So when we were ready to invest in CAD/CAM, our top managers had already bought into the idea of implementing the technology. They became a coalition that championed new products and processes to the rest of the employees and also the guides to help us navigate the process of evaluating and selecting the right equipment and additional personnel." ~ Alex Frangadakis, Vice President California Dental Arts, a 90-person lab in Cupertino, CA

"At Keller, our culture is one of a learning environment and our team members understand that the expectation is they will learn something new if the need arises. Every year, we have a state-of-the-lab event for employees and their spouses/significant others to talk about the coming year. The year we planned to switch to digital, we explained why we were making the change and how it would impact their jobs, whether it be waxers learning scanning and designing or metal finishers becoming zirconia or porcelain finishers. You need to have a tactical plan for your employees in place before you start bringing in new equipment." ~ Larry Weiss, President, Keller Laboratories Inc., a National Dentex Laboratory

> ***"You need to have a tactical plan for your employees in place before you start bringing in new equipment."***
> ***Larry Weiss***
> ***President***

Training and Implementation

"Technicians can struggle with the switch from a brush/wax carver to a mouse. They can be so concerned about their artistry that it's hard for them to see how they can combine technology and art and still turn out a customized product. You have to be patient with the training process and come up with a plan to slowly integrate digital technology into the work flow." ~ JD Henderson, Manager, Utah Valley Dental Lab, a 60-person lab in Provo, UT

"Rather than sending one or two people for training at the scanner distributor's facility, we made the investment to have the trainer come to us so the entire six-person fixed department could sit in. This way, there were six brains in the room and we could all learn together; it was also beneficial for morale and team cohesiveness.

Later, we consolidated one technician's highly detailed notes with additions from others to create a manual that's like a cookbook, providing step-by step instructions for designing and milling. We literally can bring in anyone who knows how to use a computer mouse, leave him in the room alone with the manual, and he can design and mill a restoration just by following the steps described in it.

During the month after training, all of the technicians in the department had to scan at least two cases—even if it wasn't their regular responsibility—so everyone could put the training into practice and retain what they had learned. The goal: to have all six technicians in the department able to scan and design so production would never slow down or come to a halt due to vacations or other absences. We also chose to do the training in phases: first, we focused on zirconia copings, full contour and bridge frameworks, since that's what we had been outsourcing. Too often labs

try to learn everything a scanner and milling machine can do right off the bat, and then it's difficult to be productive because they are trying to remember too much and spreading themselves too thin.
We wanted to hit the ground running and get comfortable with zirconia so that we could immediately realize a return on our investment, then move on to more options like implants, complicated cases, and even removable designs with future training." ~ Bill Mrazek, CDT, Lighthouse Dental Studio, an 11-person lab in Racine, WI

"You can't buy a mill and expect it to be up and running 100% right away. If, for example, you're outsourcing zirconia copings to another lab, continue to do so and do one unit at a time in house and slowly build up your capacity as you build your expertise." ~ Edward Peay, CAD/CAM Manager, Utah Valley Dental Lab, a 60-person lab in Provo, UT

"In my experience, it took a good year to fully implement scanning and milling technology into our lab. The learning curve is steep and every hour we spent learning the new system seemed to put us behind even more because initially we weren't able to produce the same amount of work we did by hand; we also had a good number of in-lab remakes until we were satisfied with the results.

Also, we needed a new type of employee who better understood complex software programs. We found dental technicians don't seem to be the best candidates for most of the scanning and delving into the computer systems, but when it comes to designing, you need a good technician who understands the essential elements of each case.

In the three years after we purchased a CAD/CAM system, we had a 25% employee turnover; some we had to let go, and some chose to leave rather than work with the new technology. We now have a great group of people who are all on board and moving in the same direction." ~ Ronald Breuklander, Owner, Spectrum Dental Laboratories, an 18-person lab in Santa Ana, CA

Get Clients on Board

"When we decided to jump into the digital arena a few years ago, we knew there would be a learning curve, but we didn't fully anticipate the time and effort we'd need to spend educating our doctors on the value of digital work-flows. Many orthodontists see the value of intra-oral scanners for Invisalign and records, but not necessarily for appliance fabrication.
Initially, many of them are confused, thinking technology should make the process less expensive, saying, 'I had to buy this scanner, pay for monthly support, and now my lab bill goes up because you're charging me to 3D print the model.' So I talk to them about the fact that new technology is always a more expensive undertaking—look at the data plan we need for our iPhones—but the money is made back in other places, such as the savings in materials, shipping and time.
Also, many doctors are naturally timid about implementing change, so I talk to them extensively about the fact that new technology requires shaking up the "old ways" in order to reap the benefits. I often visit their practices to give personalized work-flow suggestions, and continue to work closely with them through the first few cases.

To further encourage them, we revamped our website to educate them and to help bring digital full-circle with our on-line script portal. Doctors can go paperless by logging into their accounts with pre-set preferences, upload scans or notify us of scans in the cloud, check case status and even track UPS shipments. Our goal was to make it easy for them to submit cases digitally because once they see the 3D model and resulting appliance, they're completely wowed.

Luckily, we consistently hear from doctors thrilled with the new process—a testament to the fact that helping them during their learning curve has been well worth our efforts." ~ Christian Saurman, Vice President, 36-person New England Orthodontic Lab, Wilmington, MA

"Before you make any purchasing decision, reach out to your customers and conduct interviews to help you make a better decision about which type of system to invest in. Ask them, 'What are you willing to try? Excited to try?' Dentists who have been practicing 30-40 years may say, 'I'm retiring soon and sticking with PFMs.' If you own a small lab with a few of those customers, you want to know that before investing thousands of dollars.

Having these conversations with clients also helps you better gauge how open they are to the technology and new materials and restoration types; this helps you buy for the future. For example, perhaps they're just asking for zirconia now, but it may be worth it to invest in a dry/wet mill so that you can access other materials down the line." ~ Bill Mrazek, CDT, Lighthouse Dental Studio, an 11-person lab in Racine, WI

Know Your Provider

"Get to know your equipment provider/seller, and make sure you're comfortable with their service. They're your lifeline when something goes wrong, which is inevitable. Typically, service contracts cover service and labor; parts are separate." ~ Travis Zick, President, D&S Dental Laboratory and D&S Dental Group, 103 employees among five locations

"Make sure the company you choose to work with is willing to spend time to ensure you can produce the quality of products you need. Get referrals from other labs, visit them to see how they've integrated technology into their work flow and ask if they have gotten the service they needed from the manufacturer. Is the technical representative always available? Can he remotely log into your system to solve problems ASAP? Are there time zone issues that could cause you to lose a half day of production?" ~ Ron Breuklander, Owner, Spectrum Dental Laboratories, an 18-person lab in Santa Ana, CA

Outsource or In-House?

"Any decision as to whether or not to outsource starts with the question, 'Is this product part of our core business? If it isn't, we'll likely outsource that manufacturing function; if it is, then we lean toward doing it in house but there are other factors, such as volume, we consider before making that decision.

For example, our volume of zirconia materials has risen dramatically over the past two years. What used to make sense to outsource is no longer such an obvious decision for several reasons. There's no question that milling our zirconia products in house is more profitable. However, because of increased competition among milling centers, outsourcing fees have gotten much lower. At the same time, technology continues to advance so the cost of the milling units has dropped while their precision has increased.

The question we now ask is, 'do we really want to chase milling technology given the technical knowledge that's required and how quickly systems become obsolete?' For now, we've decided to continue to outsource our zirconia frames even though we spend several thousand dollars each month outsourcing this one product.

A final consideration concerns our ability to grow and scale our production operations. When you're faced with whether or not to hire a new technician, outsourcing bridges the gap. As we get busier, we can rely on our team of quality outsource providers until our volume is sufficient enough to hire and train our own internal staff.

Our lab grew 34% last year, largely by using great outsourcing partners. We feel pretty good about our growth rates to be sure but managing work flow is much easier using excellent outsourcing teams rather than trying to find, hire, train and manage new staff. There's definitely a balance but strategic outsourcing has been a tremendous operational benefit to our business." ~ Mike Hill, President, 6-11 Dental Studio, a 20-person lab in Lake Forest, CA

Shopping Tips

"Before investing in new equipment, do an internal needs analysis. Ask yourself: What are you trying to do or improve? What do you expect from the technology? Can the technology be multi-purposed? Does it look like a technology that might be around for a while?

Look at production costs to determine your cost recovery period and make sure your volume is enough to justify the investment.

Chris Waldrop CDT, President, Burdette Dental Laboratory

As with any equipment purchase, the unit, material, training and labor costs all have to be factored into the equation. Look at production costs to determine your cost recovery period and make sure your volume is enough to justify the investment. Annual maintenance programs, uncovered parts and downtime are all important costs to keep in mind. The machine is going to break at some point, so what will you do in the interim and how much will it cost?" ~ Chris Waldrop, CDT, President, Burdette Dental Laboratory, a 64-employee lab in Birmingham, AL

"Digital technology is just another tool and different labs will use it differently. Just because the lab down the street buys a piece of equipment, doesn't mean you have to buy it too. You have to do your homework; figure out what will work for you based on the size of your lab and where you're positioned fee- and quality-wise in the market, and then purchase and/or outsource accordingly." ~ JD Henderson, Manager, Utah Valley Dental Lab, a 60-person lab in Provo, UT

"Ask about the costs for additional software modules and upgrade fees. Every time we want to do something new, it means an additional expense. For example, we had to buy an additional module to design implants and another module to accept scans from all intra-oral scanners; some of them cost thousands of dollars. You want to know these fees before you buy your scanner." ~ Ted Yannotti, CDT, Co-Owner, Smartlab Inc. (formerly Herminie Dental Lab), a 32-person operation in Greensburg, PA

"Ask time-related questions to get a true understanding of your production time. In addition to 10 minutes for scanning and designing, you need to virtually place the unit into the disc, add connectors and wait for the data calculation to finish. I've learned to multi-task, meaning while one case is scanning, I design another one so I maximize my time." ~ Angelika Oeckl, Owner, Subrisi Smile Technology, a two-person lab in Kirkland, WA

"Before you purchase a scanner, make a very specific list of all the types of restorations you want to fabricate and all

the other systems/companies you want to work with, give it to your sales rep and ask, 'Can I be plug-and-play with all of these?' and 'Do I need to purchase additional software modules or a file converter?'

Some scanner systems are all inclusive but others aren't. If all modules aren't included in the price and you decide, for example, you want to do custom zirconia abutments after you've bought the scanner, you'll need to pay for the additional module and scan bodies for various types of implants; scan bodies can be $50-70 each if bought separately or up to $1,000-2,000 if you buy a kit. Knowing what you really need comes with a lot of experience; you can't do too much homework.

Also before you buy, ask about licensing fees: how much are they, for which modules do you need them and are they paid annually (most are). These fees can get expensive so you want to know about them up front." ~ Edward Peay, CAD/CAM Manager, Utah Valley Dental Lab, a 60-person lab in Provo, UT

"Get the biggest computer monitor that will fit your space. I bought a 27" monitor but wish I'd bought at least a 32" one. It's easier on your eyes, easier to see detail when designing.
I got a gaming computer with a really good video card. It cost $1,800 and makes so much difference in the speed with which I can design. Some designs only take five to 10 seconds but when you can cut that in half, it makes a huge difference at the end of the day." ~ Al Fillastre, CDT, Owner, Ceram-O-Arts, Inc., a six-person lab in Lakeland, FL

"It's been our experience that when a computer comes packaged with CAD/CAM equipment, it's not adequate to run the software (and in some cases, the hardware) when designing large cases of eight units or more. We always obtain computer specifications prior to purchase and if the manufacturer won't upgrade the specs to our requirements, we will build CAD workstations to meet our best practice specs." ~ Greg Thayer, CDT, and Rob Gitman, Owner and Company Administrator, Thayer Dental Laboratorym a 46-person lab in Mechanicsburg, PA

Open Vs. Closed?

"Everyone says their systems produce .stl files that can communicate with everyone else's systems. Not true; not all .stl files are created equal. Sometimes you have to use file converter software or try a different scanner in order to get files to be compatible." ~ Edward Peay, CAD/CAM Manager, Utah Valley Dental Lab, a 60-person lab in Provo, UT

"I initially purchased a closed system but it was too specialized and I soon wanted to expand my product line. Now I also have an open system; I use my closed system exclusively for custom implant abutments and a few name-specific products; I use the open system for everything else." ~ Michael Brock, CDT, Owner/President, Brock Laboratories, Inc., a five-person lab in Creighton, PA

ROI/Financial Considerations

"Five years ago, about half our cases were milled zirconia and we were spending about $5,000 a month to outsource between 150 and 200 units. I shared my concerns with Rob Nazzal, CEO of Customized Automated Prosthetics, who ran the numbers to see if it made sense for us to purchase our own in-house equipment and found that given our fees and potential volume, we could likely pay off a system within two to three years. I decided to go for it.

In 2012, I got a loan and spent about $80,000 on a scanner,

design software, mill and sintering furnace. The $5,000 we were spending on outsourcing turned into a $1,200 monthly loan payment, plus the cost of materials, so we saved a lot of money. Now, 98% of our work is milled zirconia and profits have gone through the ceiling.

If you have a viable business but things are starting to slow down, don't wait until things are in dire straits to invest in equipment; go for it." ~ Bob Iuliano, CDT, Owner, Adirondack Dental Ceramics, a three-person lab in Queensbury, NY

"My perspective is probably a bit unusual. I think smaller labs get too hung up on ROI! It's very difficult to accurately predict ROI because there are a ton of variables and intangibles—lower stress levels, more free time and much happier employees—as a result of increased efficiency, productivity, consistency, control and quality. ROI tends to become another fear-based sticking point that contributes to the general paralysis that prevents labs from moving ahead.

The truth is, if you want to even have a chance of being in business five years from now, you need to go digital! I went digital two years ago and I wish I had known how awesome the journey would be in so many respects and that the fear I had was totally unfounded; trust me, I lost a lot of sleep… unnecessarily!" ~ Al Fillastre, CDT, Owner, Ceram-O-Arts, Inc., a six-person lab in Lakeland, FL

"Talk to your tax professional about using shorter depreciation times for digital technology. Advances in technology and the need for more computing power cause digital systems to be obsolete quickly. Instead of the normal seven-year equipment depreciation, we use only two or three years.
If you are fully committed to digital, plan on having this kind of expense for the life of your business, because you're always going to need to upgrade. Each generation of systems does more and more and you have to keep current to maintain your competitive edge." ~ Mark Frichtel, President, 57-person Jesse & Frichtel Dental Labs, locations in Pittsburgh and Indianapolis

"In addition to speaking to your supplier about financing, be sure to explore your options with several banks since there are different equipment loan products out there. We found a credit-line-to-term loan worked best for us; you're given a time frame—typically a year—to borrow against a set amount of credit and at the end of the time frame, the bank converts the outstanding balance to a term loan. It's a good solution, because it provides capital when needed without the risk of over or under borrowing." ~ Alex Frangadakis, Vice President, California Dental Arts, a 90-person lab in Cupertino, CA

Changes to Infrastructure

"Like many other laboratories, we quickly found that the cost of the digital equipment and software is only the beginning. In order to be sure our facility could support the addition of our CAD/CAM equipment, we've invested thousands of dollars to upgrade existing systems.

For example, our new industrial mill required 5 CFM of air more than our current equipment could produce, so we invested $6,000 in a new air compressor and tank and to run the plumbing into our CNC room. The CNC machine we purchased from Germany required an unusual power supply so we had to buy a step-converter for $1,800.

Now, when we're ready to invest in new technology, we prepare a checklist of the equipment's requirements and compare it to our current set-up. Then we create a Gantt chart, a type of bar chart that outlines the start and finish dates for each step in the project. It's a visual tool for project management and helps create a systematic path for completing the facility upgrades before the equipment arrives. After management reviews and approves the Gantt chart, the budget is created, and our Project Manager handles the bidding, hiring and oversight process." ~ Alex Frangadakis, Vice President, California Dental Arts, a 90-person lab in Cupertino, CA

"Consider how the technology fits into your facility as far as space and infrastructure before your equipment arrives:

- When I set up my design station, I didn't have nearly enough shelf space and what I had was in the way of the scanner door. Take measurements in advance and make sure there is enough space to accommodate the height of the scanner.
- Even if you initially only get a scanner and don't purchase a mill or printer right away, plan ahead. For example, when you have the Category 6 network wire (a shielded wire that's faster and has less interference) installed for the scanner, also wire up any spot in your lab that may eventually have digital equipment.
- In order to accurately scan implants and other shiny objects, you need to scan spray on them. Locate your spray booth near the scanner and the area needs to be vented. I purchased an Apache Spray Booth on-line (typically used for hobbies/crafts).

- If possible, have a separate room with additional AC vents for your milling unit because it generates a lot of heat and noise."

~ Al Fillastre, CDT
Owner, Ceram-O-Arts, Inc., a six-person lab in Lakeland, FL

"Measure your space! Years ago we ordered a piece of equipment thinking we knew what size the machine was, but when we got it, the unit was .5" wider than the entrance door! We had to install a new door." ~ Larry Weiss, President, Keller Laboratories Inc., a National Dentex Laboratory
Workflow Efficiency

"For efficient work-flow, I'd rather have work coming through in small batches than have one large run come up at once. For example, if you're designing and printing copings on a large unit, you have to wait eight hours for the tray of 150+ units to print. Then when it's done, you have 150+ units to start moving all at once.

However, if you have a few smaller machines printing or milling wax, you can stagger them to continually produce batches on a regular schedule. We moved to milling wax in batches of six to eight units at a time, which takes between 1-1.5 hours, but it allows us to keep work moving through the lab in manageable increments." ~ Travis Zick, President, D&S Dental Laboratory and D&S Group, 103 employees among five locations

"Have separate scan and design stations. When I bought our scanner, I didn't realize that the single-user dongle fee applies to two workstations so we were splitting the scan and design time and it was inefficient ('I'll design while you're at lunch,' etc.).

If you're a 3+ person lab, have two stations: one dedicated to scanning and one for designing so you can work simultaneously; this helps tremendously with work-flow and the only additional cost is the computer and monitor.

Also, for the most effective work-flow, position your scan and design stations really close to the model department." ~ Al Fillastre, CDT, Owner, Ceram-O-Arts, Inc., a six-person lab in Lakeland, FL

Have a Backup Plan

"What is your back-up plan when a machine goes down? If you're a small lab or if you're just getting into digital, find a good outsourcing lab partner you can trust so if your mill goes down for three days, you have someone you can turn to. We're a larger lab and fortunate to have back-up equipment in house; for instance, we have two printers, six mills, etc." ~ Travis Zick, President, D&S Dental Laboratory and D&S Group, 103 employees among five locations

"3D printers, milling machines and the like are all subject to breakdowns—even when such machines are properly cleaned and maintained. Service contracts are a necessary evil because laboratories with a service contract get equipment repaired faster than those without a contract.
Also keep in mind that redundancy allows you to maintain a consistent work-flow. If you have a 3D printer you rely on for your wax patterns, you'll require a second printer to back up the primary printer when it malfunctions. Many resellers and manufacturers offer to print or mill those wax patterns from your designed .stl files when your equipment is down, but that costs the laboratory in additional days to complete the case, shipping charges and, depending on the situation, for the cost of materials and printing." ~ Greg Thayer, CDT, and Rob Gitman, Owner and Company Administrator, Thayer Dental Laboratory, a 46-person lab in Mechanicsburg, PA
Update Challenges

"The speed of obsolescence is incredible. It's a constant challenge to keep pace with CAD software advances and continually train technicians to be proficient with the full capabilities of the design software.
With your CAM systems, you must be diligent to install firmware upgrades to keep the hardware running efficiently." ~ Greg Thayer, CDT, and Rob Gitman, Owner and Company Administrator, Thayer Dental Laboratory, a 46-person lab in Mechanicsburg, PA

"Software updates can be time consuming because you need to learn new features, as well as which features are no longer available. My advice: update your software on Friday afternoons when you don't have any work going out the door in case you run into a glitch." ~ Edward Peay, CAD/CAM Manager, Utah Valley Dental Lab, a 60-person lab in Provo, UT
Marketing Strategies

"When you initially invest in digital technology, I think your first efforts should be developing new products—say full contour zirconia—to yield the greatest immediate financial returns. If your main goal is to streamline a process, like increasing waxing productivity, then the payback period will be longer.

In addition, I recommend marketing your new CAD/CAM services to existing customers first. Since you already have a relationship with them, they're the most likely to trust you and try the new product. While CAD/CAM will be an arrow in your quiver when discussing your lab with new accounts, that business takes longer to build." ~ Alex Frangadakis, Vice President, California Dental Arts, a 90-person lab in Cupertino, CA "Before CAD/CAM, the most expensive piece of equipment in the lab was the porcelain furnace which has a life expectancy of 20 years. When you purchase CAD/CAM equipment, at least one component needs to be updated every one to two years.

Everyone is focused on how cheap they can make and sell CAD/CAM restorations. In my opinion, this is a big mistake because the cost savings from labor are offset by the equipment loans, upgrades and maintenance costs. Consequently, the industry as a whole is suffering due to reduced profits made per restoration, but it is our own fault because we made it happen.

Dentists assume that CAD/CAM will enable labs to lower their prices and they put pressure on the labs to do so without really understanding the costs involved in purchasing and operating digital technology. Keep in mind your selling price doesn't have to be tied to specific manufacturing costs. Here's a little secret: It's OK to make a decent profit." ~ Jon Brooks, MDT, Laboratory Director, Smile-Vision Inc., a 10-person lab in Newton, MA

Roland

DWX-4

Dental Milling Machine.

Roland is leading the digital dental revolution.

Today, digital dental technologies are transforming every aspect of the dental industry. The days of tedious, manual production of crowns, copings and bridges are fast disappearing. The latest technologies advancements in scanning, CAD/CAM software and CNC milling allow digital dental labs to deliver custom production with speed and precision. Better fit and aesthetic promote patient satisfaction, while labs enjoy greater productivity with faster turna-round and optimal accuracy and repeatability.

Virtual Machine Panel and a wide variety of material

Built for any size lab and powerful yet easy to use

www.roland.co.za | martin@rolanddg.co.za | 0800 Roland (765263) | DBN: (031) 705 5530

TIME MANAGEMENT IS IMPOSSIBLE

By Peter R. A. Johnson
Posted by jdtunbound on October 31, 2014 in unbound exclusives

Are you a business owner or manager who is constantly frustrated with not being able to control your time and get everything done?

Life is busy, we have a lot of things we want to do both in our personal and business lives. Some people are blessed with a natural talent of being able to manage their time and look to have everything under control. For the rest of us (probably 90% of the population) time management just doesn't seem to work for us.

A lot of us will attend time management courses, learning how to set SMART goals, how to plan the activities to achieve them, how we have to focus on them every day. We leave the course all fired up on what we are going to do and when we arrive back at the office the next day, the phones start ringing, people are at your doorstep, problems pop up, etc., etc. By the end of the day, we have done nothing with our new planning process and by the end of the week, the course and the new process is just a memory and we are simply doing what we have always done.

Why does this happen?

It's because there is more to learning how to manage your time than just going to a one day course where someone shows you to set goals and how to achieve them.

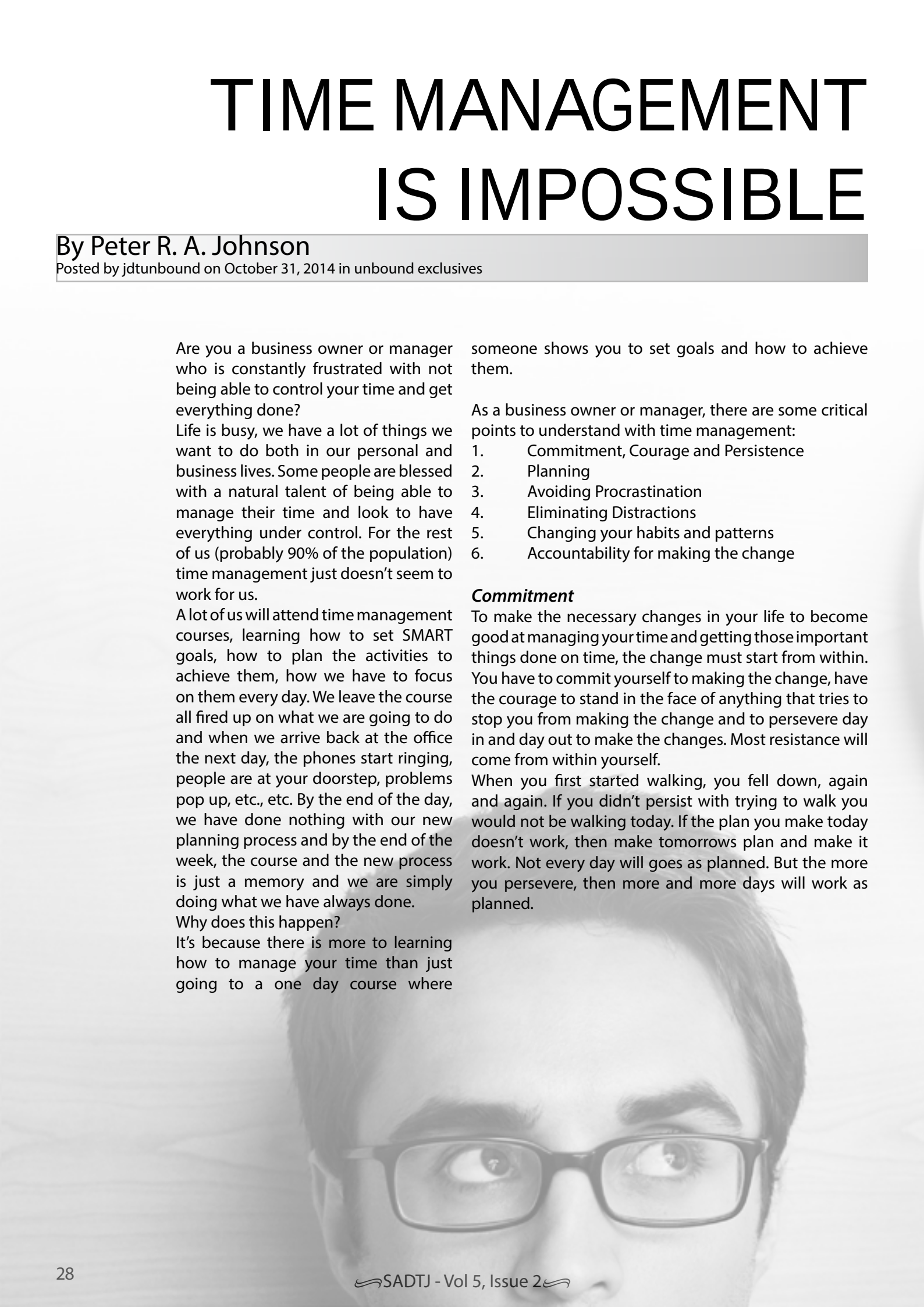
As a business owner or manager, there are some critical points to understand with time management:

1. Commitment, Courage and Persistence
2. Planning
3. Avoiding Procrastination
4. Eliminating Distractions
5. Changing your habits and patterns
6. Accountability for making the change

Commitment

To make the necessary changes in your life to become good at managing your time and getting those important things done on time, the change must start from within. You have to commit yourself to making the change, have the courage to stand in the face of anything that tries to stop you from making the change and to persevere day in and day out to make the changes. Most resistance will come from within yourself.

When you first started walking, you fell down, again and again. If you didn't persist with trying to walk you would not be walking today. If the plan you make today doesn't work, then make tomorrows plan and make it work. Not every day will goes as planned. But the more you persevere, then more and more days will work as planned.



Planning

It is impossible to have good time management without planning. The only way you can start managing your time properly, is to understand what is most important to you. You need to be clear about what you want to achieve, how you are going to achieve it and what needs to be done today towards achieving it.

The Planning process is what you will learn in a time management course. The basic steps are:

a. Understand Why you do what you do.
b. Having a clear picture/vision on what you want to achieve
c. Set Goals based on the SMART principle and prioritize them
d. Determine what activities you need to carry out to achieve them
e. Create and action plan. (no more than 3 months)
f. Plan each week
g. Plan each day – Daily prioritized To Do list
h. Review each week, month, quarter, year.

"A good time manager doesn't have time and then plan, they have time because they plan"

There is no chicken and egg theory here, you will never have the time unless you plan. The saying, "I don't have time to plan" is rubbish. Your lack of planning is why you don't have the time.

Avoid Procrastination

Procrastination is the biggest killer of time management, it leads to failure. Procrastination means you are putting things of and avoiding doing them. They are generally things you are uncomfortable doing, it may take a long time to do, it may cost you money etc. These things are on most occasions, the most important things you need to do to achieve what you want to achieve and yet you will put them off. The biggest issue is, you know you are doing the wrong thing.

The main reasons you procrastinate is because you don't have a clear enough picture of what you want to achieve, have no real goals and no action plan in place to guide you. By working through the planning process, you will reduce procrastination significantly, as you will have a clear picture on why you need to do it now.

Eliminating Distractions

It is great to have a plan and have a do it now focus, but if you do not know how to elimination distractions and have the determination to not let distractions get in your way, your time management will be nonexistent.

You will need to set a process in place to clearly understand what distracts you. The Time Retriever Distraction Buster tool is great for this. Once you understand who and what distracts you, can start eliminating these distractions, starting with what or who distracts you the most.

Emails, phone calls, interruptions etc., all need to be managed in a way that enables you to focus on the important things you have planned to get done.

One of the biggest areas of distractions for business owners and managers is your employees/ team members. Learning how to manage people is critical to good time management. The amount of issues you have when dealing with people is infinite, a plan of continued learning and mentoring on people management must be in place if you want to improve your time management skills.

Changing Your Habits and Patterns

This is the most difficult part of improving your time management skills. The process has to start from within. To improve your time management skills, you have to change yourself. Human beings live their life within entrenched habits and patterns that have been developed over years, even decades and when we try changing and going outside of those patterns and habits, our natural instinct is to draw back to what we know and are comfortable with. Even if that habit is bad for us, we naturally want to stay within that habit, because we are comfortable with it.

When we say start from within, it means we need to change our internal (subconscious) thoughts that have developed inside us over years. We all have a past, we all have a future, and whether our future is what we want will depend on how we change our thoughts. You have seen people that live in the past and struggle to move forward, but to move forward you need to use the past as your education and utilize positive thoughts to achieve your future.

Achieving high levels of skill in time management will only happen if you are prepared to change your habits and patterns.

Accountability for Making the Change

To become skilled at time management will take time, it is not an overnight or one day course change. You will need to commit to each of the 5 steps above to create this new skill.

If you really want to create significant improvement in your time management skills, seek out a coach or mentor who understands each of these points vividly and can take you through the process of learning, implementing and creating fundamental changes in the habits and patterns of your life.

Kick the "I don't have the time mentality." Make the decision that I am going to get control of my time and my life today. Commit to following these 6 points and start to enjoy the results.

About the Author :

Peter Johnson is a highly experienced business coach and mentor.

http://www.timeretrievers.com.au

Hindawi Publishing Corporation
Case Reports in Dentistry
Volume 2014, Article ID 485387, 5 pages
http://dx.doi.org/10.1155/2014/485387

DENTAL EROSION

From an Excess of Vitamin C

Priya Bahal and Serpil Djemal
Restorative Dentistry,
King's College Dental Institute,
Camberwell, London SE5 9RS, UK

Correspondence should be addressed to Priya Bahal; priya.bahal@nhs.net
Received 29 March 2014; Accepted 4 May 2014; Published 4 August 2014
Academic Editor: Bennett T. Amaechi

Acid erosion of enamel is the chemical dissolution of the superficial layers of teeth without the presence of bacteria. If the presence and exposure of a demineralising agent such as vitamin C is frequent and prolonged, it can lead to significant tooth wear. This case report discusses one such presentation and as a result of the occlusal relationship, this serves to effectively demonstrate the localized effects of vitamin C-induced acid erosion. The management of localized tooth wear with composite restorations utilizing the Dahl principle to replace lost tooth tissue is also reported. Clinical Relevance. Patients should be made aware of the erosive nature of chewable vitamin C tablets and their potentially harmful effects on the dentition if consumed in excess. Objective Statement. The reader should understand the clinical implications of an excessive intake of vitamin C. This demonstrates the importance of the manufacturer's instructions and the clinician's role in advising patients with regard to the correct therapeutic doses.

1. Introduction

Dental erosion can be described as the irreversible loss of tooth structure due to the chemical process of acid dissolution which does not involve plaque bacteria. Sources of erosion can be intrinsic such as acid reflux and vomiting or extrinsic, from the ingestion of food, drink, or medication. Lifestyle and occupations can also influence the multi-factorial pattern of tooth wear, and erosion frequently coexists with attrition and/or abrasion. The degree to which each of these factors contributes to the overall clinical picture will vary from patient to patient, and it is important that a detailed medical and clinical history is taken with patient-specific questioning in order to form a comprehensive differential diagnosis.

Vitamin, derived from the word vitamine, describes a group of organic compounds which are essential to life. They are present in natural products or made synthetically and are required in small quantities in the diet of animals and humans. Many vitamins are synthesized within the human body; however, some, such as vitamin C, cannot be produced naturally and must be gained from sources within the diet. Vitamin C (ascorbic acid) is a water-soluble compound and is necessary for enzyme activation, oxidative stress reduction, and immune function. It is present in fruit and vegetables including oranges, peppers, and broccoli. Chewable vitamin C tablets have been reported to have a pH of 2.3
and the critical point at which enamel dissolves is around pH 5.5 [1]. The buffering potential of saliva and the salivary pellicle act to counteract the effects of the acidic challenge. If, however, the protective potential is limited and the exposure of acid is continual and at a lower than critical pH, the irreversible loss of dental hard tissues will ensue.

On a microscopic level, the pattern of erosion initially follows the prismatic structure of enamel where either the prism cores or inter-prismatic areas dissolve first. This dissolution then leads to a less regular pattern within the aprismatic enamel and finally, once the enamel is breached, this affects the peritubular and then intertubular dentine [2]. Clinically, this can be seen as hard, smooth surfaces with cupping of the occlusal surfaces. If the process of wear is slow, the dentine is frequently stained and often, when this develops as a slow, chronic process, the patient will not experience any dentine sensitivity despite the significant tooth wear.

This report describes an extreme example whereby chewable vitamin C tablets were consumed on a frequent basis over a three-year period leading to marked tooth surface loss. This case illustrates how dental erosion, if not controlled, can lead to potentially harmful effects on both the dentition and stomatognathic system.

2. Case History

A 51-year-old fit and healthy Nigerian male engineer presented himself to the emergency department of King's College Dental Institute complaining of a left-sided jaw ache, an "uneven bite," and being unhappy with the appearance of his front teeth (Fig1). He explained that this pain had been ongoing for the previous two to three years; however, this "ache" had become more apparent over the previous two months. He explained that the issues of appearance had been raised following comments from family members.

Extra-oral examination revealed slight tenderness to palpation on the left masseter and lateral pterygoid muscles. He

exhibited good opening with no deviation or marked antegonial notching. Intra-oral examination revealed healthy soft tissues with racial pigmentation, an unrestored dentition, and fair oral hygiene. The periodontal status appeared stable with no tooth mobility or bleeding on probing. The patient had a class one incisal relationship with a right sided scissors bite. (Fig 2), and the UR6 and UR7 were partially over-erupted.

Marked tooth wear was evident on the upper and lower incisors and left-sided posterior teeth only (Fig 3). There was loss of the outer two-thirds of enamel on the mesial aspects of the upper 5 incisors and the lower incisors had lost around a third of their clinical crown height. Significant tooth wear was present to varying degrees on the occlusal aspects of the left premolar and molar teeth only; all teeth on the right side were of normal anatomy and form. Chipping of the lower lateral incisors was noted and there was characteristic "cupping" of the enamel with staining of the underlying dentine.

A full mouth OPT (Fig 5) was taken to assess any condylar abnormalities and to exclude any dental pathology. Radiographic examination revealed around 5% generalized horizontal bone loss and a localized vertical defect was associated with the UL6 and UL7. A supernumerary was present distal to theUR8 and the occlusal anatomy of the left-sided molars appeared significantly flatter in comparison to their contra-lateral teeth. Figure 3: Marked tooth surface loss affecting the upper incisors and left posterior teeth only. Figure 4: Tooth surface loss affecting teeth in the lower left quadrant. Note the normal anatomy of the teeth on the right side in Fig 3 and 4.

A detailed history was taken to establish the cause of the localized tooth surface loss. The patient was questioned to assess if any specific intrinsic or extrinsic factors could have contributed to the patterns observed. The patient admitted to a three-year history of chewing multiple vitamin C tablets on almost a daily basis. The patient explained that he had been advised by a friend to increase his intake of vitamin C as it was beneficial for general health. He felt that the tablet form would be a convenient source of the vitamin and so he purchased"Superdrug" (Croydon, United Kingdom) own-brand chewable vitamin C tablets from various Superdrug stores. 5-6 of these chewable tablets would be kept in his pocket each day thereby enabling him to continuously suck and chew on these each weekday during his 90-minute morning commute to work. In addition, the patient developed a habit to "snack" on these tablets throughout the morning leading to lunchtime when he would then eat his first meal of the day.

This continual intake of tablets meant that there would be no more than a 45–50-minute break between each tablet being consumed. He explained that, during the winter months, the quantity and frequency of the tablets would increase as a result of the colder weather. He reported no systemic adverse effects.

The following diagnoses were made:
1. left-sided myofacial pain,
2. erosive and abrasive tooth surface loss,
3. right-sided scissors bite


Fig 1


Fig 2


Fig 3


Fig 4


Fig 5

The oral and maxillofacial team supplied the patient with a lower soft acrylic mouth guard in an attempt to ease the left-sided facial pain. Following a three-month review and relief of his symptoms, the patient was referred to the joint orthodontic-restorative team to assess if any treatment was indicated for correction of the crossbite and to see if this would be implicated with any potential restorative treatment for the tooth surface loss.

At the time of presentation to the joint orthodontic restorative clinic, the patient's complaints were limited to the aesthetic issues only. He no longer had pain but still wished to proceed with treatment to aid his appearance.
The following treatment options were discussed:
(1) fixed orthodontics to correct the scissors bite,
(2) direct composite build-ups on

1/1
2 1/1 2 6 7

utilizing the Dahl concept to create interocclusal space. The erosive nature of vitamin C was explained and detailed advice was given with regard to its appropriate intake. As the primary source of the erosion and abrasion was no longer present in the patient's diet, the treatment was limited to direct, freehand composite build-ups of the anterior teeth and the LL6 and LL7.

The teeth were initially cleaned with pumice and water, etched with 37% phosphoric acid and then restored with direct composite resin (Gradia, Belgium) shades B2 and B3 to replace the lost tooth tissue (Figure 6). Posteriorly, the composite was bought up to the enamel rim and, anteriorly, the
restorations were placed again freehand with no beveling of the enamel. At a three-month review the patient had no complaints and the composite restorations were sound. He was happy with both the appearance and function of the restorations and had adapted well to the slight increase in occlusal vertical dimension. He continued to be in good general health and was obtaining his daily vitamin C intake from fruit and vegetables.

3. Discussion

It is well known that vitamin C (ascorbic acid) has a low pH and so can contribute to dental erosion. In comparison to citric and phosphoric acid, which is found in many carbonated drinks, ascorbic acid has been proven to be relatively more erosive. The erosive potential of vitamin C and that in particular which was caused by the long-term use of chewable vitamin C tablets was clearly illustrated in 1982 [3]. Therefore, over thirty years ago this issue was highlighted and it was suggested that, as professionals, we should help our patients through supportive education and advice to focus on the causation and prevention of dental erosion throughout their lives. This case however has demonstrated that despite our increased awareness and knowledge of the topic, patients can still remain oblivious to the harm that an excess of vitamin C can cause on the dentition.

As vitamin C cannot be stored in the body, it is imperative that some is obtained from the diet on a daily basis to maintain health. The exact amount required for an individual is dependent upon their gender, weight, and general health but it has been suggested that, for an average 70 kg male, around 60 mg/d of vitamin C is required on a daily basis [4]; this can be gained from one large orange.
One study has shown that individuals who consume less than 50mg of vitamin C daily have twice the risk of developing cancer than one who consumes more than 100mg [5]. It should be noted that once an individual's daily requirement has been reached, any additional vitamin C becomes surplus to the body and is excreted as waste in urine. With regard to safety, there have been reports on individuals taking doses of up to 1,000mg per day for over


Fig 6


Fig 7


Fig 8


Fig 9

one year with no adverse effects on their general health. This is of course separate from any adverse effect that could occur on the dental hard tissues. It has been shown that patients commonly misunderstand dosage information on prescription drug labels [6], and it can be argued that over-the-counter supplementary products require an increased level of knowledge to ensure compliance is within the safe range. Supplementary medicaments are not always directly prescribed by a medical practitioner and so there is arguably more scope for misinterpretation of drug usage. Often as was the case here, patients are drawn towards increasing their vitamin C intake for so-called "health benefits." Systemically, it has been reported that vitamin C can be beneficial in the prevention of heart disease and certain cancers due to its anti-artherosclerotic and anti-cariogenic properties [7]. It can be seen how the general public can be guided towards seeking additional sources of vitamin C with a view to improve their general health following health promotion.
The degree of acid erosion experienced by an individual will depend on numerous factors, for example, the acidity of the tablet, the pH of the individual's saliva, and of course their own frequency and pattern of use. It has been shown that tablets containing 60 mg, 250 mg, or 500 mg of ascorbic acid will all cause a reduction in salivary pH. Furthermore a tablet

containing 500mg of vitamin C, a so-called "mega-dose," will not only dramatically cause a pH drop to below the critical pH, but also cause a sustained drop below the pH 5.5 for up to 25 minutes after the initial acidic challenge [8]. This illustrates the highly erosive potential of the tablets and in this case the tooth surface loss was exacerbated from the continual direct contact with the teeth. The acid served to initially soften the surface enamel making it more prone to wear from the abrasive tablets.

When used in moderation and in line with the manufacturer's instructions, chewable vitamin C tablets pose no obvious risks to health or the dentition. This case has shown that if their use is excessive, frequent, and limited to certain pairs of occluding teeth for a prolonged time, it will lead to significant tooth surface loss. Here the source of acid was via large, hard, round tablets and so there was limited physical space available for the saliva to act as a buffer during episodes of acid attack. The teeth which were spared from the acidic challenge showed no evidence of erosion which demonstrates that otherwise the patient had normal saliva which was capable of acting as a suitable buffer under normal physiological conditions.

The presence of a scissors bite caused the patient's chewing habit to be limited to the anterior and left posterior teeth only (Fig 7 and 8). This corresponds with the clinical result as the molar teeth, those which would have been used for chewing and grinding, showed significant areas of erosion on the occlusal aspects.

The left-sided occlusal surfaces had characteristic shallow, cupped surfaces which were hard with stained dentin which was non-carious and indicative of an extrinsic source of acid. Also, as a result of their increased surface area, the molar teeth had more tooth surface loss than the premolar teeth on the same side. The canine had only normal physiological tooth wear which was consistent with the patient's age. It has been shown that extrinsic acid erosion was due to the ingestion of carbonated and sports drinks and, more recently, so-called smoothies which are all popular choices with the younger generation and this has resulted in an increased prevalence of acid erosion in this cohort. Typical presentations are thinning of the labial/facial aspects of enamel on the upper teeth with concave-shaped lesions.

With intrinsic sources such as vomiting or reflux, the palatal surfaces of the upper teeth are usually affected, leaving the labial and occlusal surfaces of the upper teeth and the lower teeth untouched. The observed pattern of tooth surface loss again correlated with the patient's history as he reported initially holding each tablet vertically (Fig 9) between the anterior teeth before moving it to the left posterior region for continual sucking and biting.

In all patients who suffer from erosive tooth surface loss, the initial priorities are to establish its cause and to consequently prevent further irreversible loss of tooth structure. This could be through patient awareness and dietary modification or it could require further investigation to detect an underlying cause of intrinsic acid. In this case, the patient had ceased chewing the vitamin C tablets and replaced this habit with a moderate intake of fruit and vegetables.

The pragmatic, conservative approach to treatment of the tooth wear was both cost-effective and acceptable to the patient. The material was placed in compression in an attempt to increase its longevity, and being fully dentate and male, the patient coped very well with the slight increase in occlusal vertical dimension in line with the Dahl concept [9]. Following the treatment and a period of adaptation, a balanced occlusion was reestablished following relative intrusion of the anterior teeth and extrusion of the posteriors.

4. Summary

A patient demonstrated moderate to severe dental erosion which was attributed to the almost daily intake of chewable vitamin C tablets over the course of three years. Once the cause was established, detailed preventative advice was given and localized composite resin restorations were placed to replace the lost tooth tissue. The patient coped well with the treatment and his vitamin C intake was reduced to a moderate, healthy intake. This case demonstrates how, as clinicians, we are responsible for advising the patients on potential sources of acid erosion and guiding them towards safe levels of use to prevent any adverse effects on their dentition.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

References

[1] S. M. Blacker and R. G. Chadwick, "An in vitro investigation of the erosive potential of smoothies," The British Dental Journal, vol. 214, no. 4, article E9, 2013.

[2] J.H.Meurmanand J.M. TenCate, "Pathogenesis andmodifying factors of dental erosion," European Journal of Oral Sciences, vol.104, no. 2, pp. 199–206, 1996.

[3] J. L. Giunta, "Dental erosion resulting from chewable vitamin C tablets," Journal of the American Dental Association, vol. 107, no. 2, pp. 253–256, 1983.

[4] M. Levine, C. Conry-Cantilena, Y. Wang et al., "Vitamin C pharmacokinetics in healthy volunteers: evidence for a recommended dietary allowance," Proceedings of the National
Academy of Sciences of theUnited States ofAmerica, vol. 93,no. 8, pp. 3704–3709, 1996.

[5] G. Block, "Vitamin C and cancer prevention: the epidemiologic evidence," The American Journal of Clinical Nutrition, vol. 53, no. 1, pp. 270S–282S, 1991.

[6] M. S. Wolf, T. C. Davis, W. Shrank et al., "To err is human: patient misinterpretations of prescription drug label instructions," Patient Education and Counseling, vol. 67, no. 3, pp. 293–300, 2007.

[7] K. A. Naidu, "Vitamin C in human health and disease is still a mystery? An overview," Nutrition Journal, vol. 2, no. 1, article 7, 2003.

[8] G. L. Hays, Q. Bullock, E. P. Lazzari, and E. S. Puente, "Salivary pH while dissolving vitamin C-containing tablets," The American Journal of Dentistry, vol. 5, no. 5, pp. 269–271, 1992.

[9] N. J. Poyser, R.W. J. Porter, P. F. A. Briggs,H. S. Chana, andM. G.D. Kelleher, "TheDahl concept: past, present and future,"The British Dental Journal, vol. 198, no. 11, pp. 669–676, 2005.

Address correspondence to this author: 3302 Gaston Ave, Dallas TX, 75246,

Tel: 214-828-8990; E-mail: jgonzalez@bcd.tamhsc.edu

Re-printed from The Open Dentistry Journal, 2014, 8, (Suppl 1-M6) 85-94
Author: Jorge Gonzalez* Center for Maxillofacial Prosthetic Clinic, Baylor College of Dentistry, Room #169;

Abstract:

Since the immemorial, the replacement of missing teeth has been a medical and cosmetic necessity for human kind. Nowadays, middle-aged population groups have experienced improved oral health, as compared to previous generations, and the percentage of edentulous adults can be expected to further decline. However, with the continued increase in the number of older adult population, it is anticipated that the need for some form of full-mouth restoration might increase from 53.8 million in 1991 to 61 million in 2020 [1]. Denture prosthetics has undergone many development stages since the first dentures were fabricated. The introduction of computer-aided design/computer aided manufacturing (CAD/CAM) has resulted in a more accurate manufacturing of prosthetic frameworks, greater accuracy of dental restorations, and in particular, implant supported prosthesis.

Keywords:

Cantilevers, complete edentulous, computer-assisted design/computer-assisted machining (CAD/CAM), dental implants, hybrid prosthesis, intra-oral scanner, zirconia.

HISTORIC PERSPECTIVES

Since the immemorial, the replacement of missing teeth has been a medical and cosmetic necessity for human kind. Denture prosthetics has undergone many development stages since the first still preserved dentures were fabricated. While 3,500 years ago, the ancient Egyptians carved false teeth out of mulberry wood and tied them to the adjacent teeth with gold wire, the Etruscans arrived at considerable skill, producing construction made of gold and bovine teeth, which were already guided by principles used in denture prosthetics today [2].

Dental technology remained virtually undeveloped until the 18th century. Candidate materials for artificial teeth during the 18th century were (1) human teeth, (2) animal teeth carved to the size and shape of human teeth, (3) ivory, and finally (4) "mineral" or porcelain teeth. Other than for costly human teeth that were scarce, the selection of artificial tooth materials was based on their mechanical versatility and biologic stability. Animal teeth were unstable toward the "corrosive agents" in saliva, and elephant ivory and bone contained pores that easily stained. Hippopotamus ivory appears to have been more desirable than other esthetic dental substitutes [3, 4], John Greenwood carved teeth from hippopotamus ivory for at least one of the four sets of complete dentures he fabricated for George Washington [5]. Lower dentures, made of ivory with inset of cadaver teeth, worked reasonable well and managed to stay in place without too much difficulty, especially if weighted with some lead. The difficulties really came to the fore with the upper denture, which refused to stay in place due to both the heavy weight and the poor fit. In order to overcome this problem, upper dentures were fashioned onto the lower dentures by means of springs or hinges. This technique would ensure that the upper denture would always be pushed up against the roof of the mouth [6].

The first porcelain teeth were developed as early as in 1709 after the introduction of porcelain manufacturing secrets by Father d'Entrecolle, a Jesuit priest who had spent many years in China, but their massive production was not undertaken until 1837 [2]. This end the practice of transplanting freshly extracted human teeth and supplanted the use of animal products [5].

In 1774, Alexis Duchateau and Nicholas Dubois de Chemant, made the first successful porcelain dentures at the Guerhard porcelain factory [5, 7]. A new era was marked for dental prosthetics after Charles

Goodyear in 1850 invented the vulcanization process. In this process, rubber was hardened in the presence of sulphur to produce a material call vulcanite, this material was not only cheap but was also easy to work with; it could be molded to provide an accurate fit of the denture base to the model and hence to the oral structures. The first sets of dentures based on rubber and porcelain began to appear in 1881 when the patent expired in and less expensive dentures could be made available to the masses of people in need of them[6].

In 1930's Dr. Walter Bauer introduced polymethyl methacrylate (PMMA), an amorphous polymer, highly transparent and rather brittle, yet highly stable towards aqueous media and UV radiation, tasteless, easy to repair and high shape stability [8], a suitable candidate for vulcanite substitute.

HISTORY OF IMPLANTS

The history of dental implants is as fascinating as it is ancient [9-12]. There do not appear to have been any geographical restraints to the desire of early dental practitioners to provide replacements for missing or diseased teeth. Dental implants and transplant history can be traced to Africa (Egyptians), to the Americas (Mayans, Aztecs and Incas), and to the Middle East. Also in this earliest historical period, tooth transplants can be traced to the Greeks, the Etruscan, and the Romans [13]. The first endosseous implant that present

oseointegration is probably from the Mayans (7th century AD) where sea shells were carved as tooth shape and placed in the mandible [14].

Today dental implants have become one of the most exciting and rapidly developing aspects of dental practice. The rapid increase in the acceptability of dental implants as regular treatment in the late 20th and early 21st centuries is largely attributable to Swedish Professor Per-Ingvar Brånemark during the 1950's, an orthopedic surgeon who turned an accidental discovery into a dental revolution [15] a new form of attachment mechanism; the osseointegration. Osseointegration is a biological concept and refers to the incorporation within living bone of an inanimate (metal) component. Most implants are made out of titanium and placed into the bone of the jaws by surgical means, and protrude through the mucosal tissues to provide attachment anchorage of replacement artificial teeth [16].

HYBRID PROSTHESIS

The fixed-removable prosthesis resembles a flangeless denture that is retained solely by several osseointegrated implants. There is no contact between the prosthesis and the tissues of the alveolar ridge.

The original design of the fixed-removable prosthesis was developed by Swedish investigators using the two-stage endosseous implant system developed by Brånemark. The prosthesis consisted of a gold alloy framework attached to the copings of the implant. Acrylic resin denture teeth were arranged on the framework and secured with acrylic resin [17]. The fixed-removable prosthesis represented a unique aspect of prosthodontics reconstruction for edentulous arches, since implants were situated in the anterior region and the posterior sections of the framework were cantilevered from the anterior portion of the framework (Fig. 1).

The length, height, and width of the cantilever are crucial in minimizing the amount of deformation of the prosthesis (Fig. 2). According to Glantz, the mount of deformation of the cantilever is directly proportional to the cube of the length and inversely proportional of the width and the cube of the height of the cantilever [18]. In addition, there is a direct relation between the amount of deformation and the force of the occlusion (loading force) as well as an inverse relation with the modulus of elasticity of the material to be used for the framework. This relationship can be expressed in the following equation:

$$D = F \times L \times \text{constant} / E \times W \times H$$

Where D is the amount of deformation, F is the force of occlusion, L, W, and H are the length, width, and height of the cantilever, respectively, and E is the modulus of elasticity of the material. Therefore, the length of the cantilever should be minimized while maximizing the height and width of the cantilever. It has been recommended that the cantilever should not exceed 20 mm in length using five or more abutments. If four abutments are used the cantilever should not exceed 15 mm in length [19]. Other studies have shown that the length of the extension should be shorter in the maxillary arch as opposed to the mandibular arch because there is less cortical bone present in the maxilla [20]. The junction of the cantilever and the distal abutments should be provided with added height and width as this area is the primary stress point in relation to the cantilever. There should be about 1 to 2 mm of space between the inferior border of the cantilever and the alveolar ridge to allow for adequate oral hygiene. It is recommended that the metal alloy possess sufficient yield strength (>300 MPa) and modulus of elasticity (>80,000 MPa) to prevent deformation and fracturing of the cantilevers. The literature reports casting the framework in type IV gold or precious metal alloys such as silver-palladium alloy [21]. The use of posterior prosthetic teeth with minimal inclinations is recommended to minimize and lateral forces on the cantilevers during excursive movements. Acrylic resin prosthetic teeth should be used to absorb the shock of occlusal forces [16].

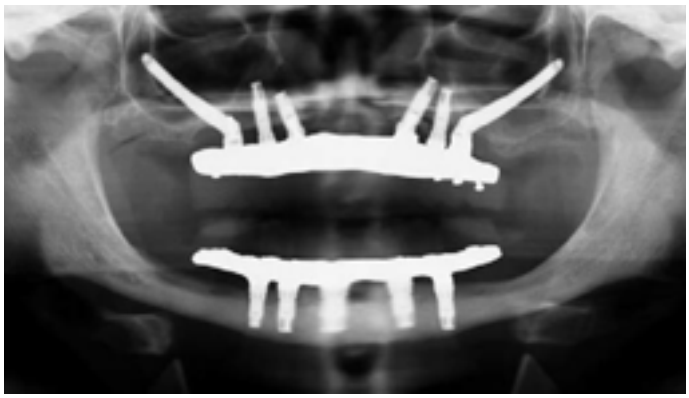


Fig. (1). Conventional design for hybrid prosthesis with long distal cantilevers.

Fig. (2). Catastrophic fracture of distal extension due to extensive cantilever.

Fig. (3). Excellent maintenance and oral hygiene after 3 years from maxillary hybrid prosthesis delivery.

Fig. (4). Intaglio surface of maxillary hybrid has been custom designed in order to improve esthetics and phonetics.

Brånemark has stated that "critical to the maintenance of osseointegration the carefully controlled and prostheticinduced loading of the implant-tissue interface". He stressed that a controlled mechanical environment is necessary to assure adequate remodeling stimulus for maintenance of integration [22, 23]. Osseointegrated implants supporting fixed prostheses are exposed to both dynamic and static loading. Dynamic forces on the implants may arise due to chewing and can reach various magnitudes [24]. Static loading on the other hand may be induced by the tension in the bridge locking screws, when securing a misfitting framework to the implants [25]. To help clinicians understand the importance of controlled loading, he stated the precision of the prosthesis fit should be at the 10 mm level.

According to Zarb and Jansson, frameworks in fixed prostheses could be designed in one of the two ways: (1) where metal frameworks comprised the bulk of the prostheses, and artificial teeth and minimal denture bases were the only non-metallic components. (2) Implant fixed prostheses consisting mostly of acrylic resin denture bases (wraparound design) and artificial teeth, with minimally sized metal frameworks [17]. Esthetic demands tend to be more dramatic with maxillary prostheses than mandibular prostheses (Fig. 3). As per Zarb and Schmitt, unlike mandibular implant prostheses were hygienic type designs have proven to be functionally and esthetically acceptable, maxillary implant prostheses demand different sized and shaped labial/buccal flanges that may or may not compensate for optimal esthetics, phonetics, and masticatory function (Fig. 4). Additionally prosthetic gingival tissues are often required due to resorptive patterns of edentulous maxillae. Resorptive patterns in maxillae are dissimilar to mandibular resorption pattern: maxillae resorb superiorly, posteriorly, and medially: mandible resorbs inferiorly, anteriorly, and laterally [26, 27].

ALL ON 4

Implant treatment was based on basic prosthodontics principles that included preliminary and definitive impressions, jaw relation records, wax try-in, metal framework tryin, and insertion of definitive prostheses. Frameworks were fabricated according to the following criteria: bulk for strength, adequate access for oral hygiene procedures, minimal display of metal on the facial and occlusal surfaces, and strategic thinning of implant frameworks to allow for retention of acrylic resin denture teeth and denture basses[28].

Traditionally, and according to the original concept of the Brånemark system, implants are placed in a fairly upright position in the anterior edentulous mandible. Therefore, it is often necessary to fabricate a bilateral cantilever, which is sometimes up to 20 mm long, to provide the patient with good chewing capacity in the molar region. Clinical studies have demonstrated that the distal tilting of implants may be advantageous, with reduction of cantilever length about 6.5 mm in the mandible and 9.3 mm in the maxilla [29, 30]. The introduction of osseointegration to North America in the early 1980's has created new challenges and opportunities for dental technicians. Totally new concepts of prosthesis design continue to evolve. Structural engineering principles are combined with artistic skills to build an accurately fitting, durable and esthetic prosthesis [31]. Introduced by Malo´ et al. in 2003, the All on 4 concept involves the use of 4 implants, including 2 distally tilted ones in areas where bone height; nerve proximity; or the proximity of the sinus, inferior alveolar canal, and/or mental foramen have precluded the placement of axially oriented implants. In addition to preserving the relevant anatomic structures, the distal tilting allows for placement of longer implants with good cortical anchorage in optimal positions for prosthetic support. It also increases the inter-implant spaces, reduces cantilever length, and reduces the need for bone augmentation (Figs. 5 and 6). Published studies on the All on 4 concept have shown cumulative survival rates to range between 92.2% and 100% [32].

Fig. (5). Ideal implant distribution.

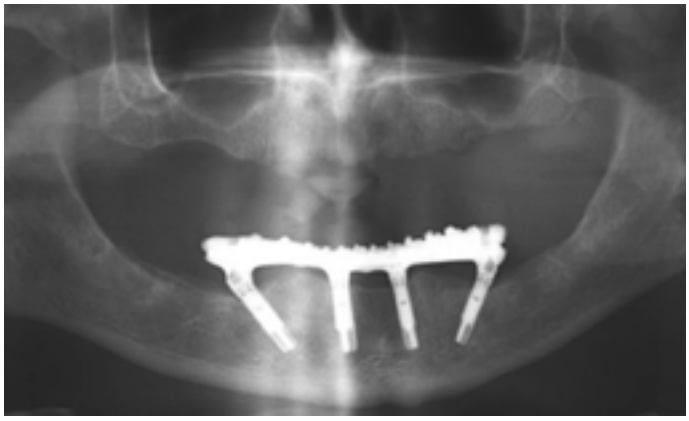


Fig. (6). Prosthetic system out of distal cantilevers.

DIGITAL IMPRESSIONS

A well-accepted principle of restorative dentistry is that the final restoration can be only as accurate and well adapted as the final impression. The clinical challenge is to provide an accurate final impression of the intraoral condition to the laboratory if the impression materials are prone to dimensional changes due to on-going chemical reactions [33] and stone will show expansion due to secondary reactions whilst setting [34]. The misfit of fixed partial dentures on natural teeth will result in forces on the underlying teeth. Natural teeth however can move 25-100 mm in axial direction and 56-108 mm in lateral direction [35, 36] and adapt to a slightly different position in the bone due to the periodontal ligament should there be a slight misfit of the prosthetic work. Implants on the other hand will only show a range of motion of 3-5 mm in axial direction and 10-50 mm in lateral direction after osseointegration due to compression of the bone [36]. Ill-fitting frameworks will generate stress on the implants which may have a biological effect on the boneimplant interface [37, 38]. It has been also shown that stresses introduced by misfit were comparable with that related to occlusal forces [39]. Prosthetic complications as screw loosening or fracture may be also related to ill-fitting framework fit [40]. The aforementioned factors have resulted in the paradigm that passive fit of the framework is one of the key factors for long-term success in implant dentistry [41, 42] stressing the importance of a reliable and precise impression procedure. Several strategies have been developed to ascertain passive fit [35, 43]. An intraoral scanner could overcome some of the errors associated with traditional impression taking [44] and cast production [45], since digital output data can be fed directly into a digital workflow.

In general, all of the current systems follow the basic workflow of computer-assisted design/computer-assisted machining (CAD/CAM) to create a restoration. There are

three main sequences to this workflow. The first sequence is to capture or record the intraoral condition to the computer (Fig. 7). This involves the use of a scanner or intraoral camera (Fig. 8). Once the data has been recorded to the computer, a software program (CAD) is used to complete the custom design of the desired restoration (Fig. 9). This may involve a full-contour design of the restoration or just the internal coping or substructure of the final restoration. The final sequence requires a milling device to fabricate the actual restoration from the design data in the CAD program (Fig. 10) [46].

Fig. (7). Intraoral scanner apparatus.

Fig. (8). Intraoral digital impression.

Fig. (9). Design data in the CAD program.

ZIRCONIA

The introduction of computer-aided design/computeraided manufacturing (CAD/CAM) has facilitated the use of new dental ceramic materials. Zirconium oxide, known as zirconia is currently used as a core material for fabrication of frameworks for tooth and implant-supported fixed partial dentures (Fig. 11). Esthetics is optimized with zirconia restorations due to the natural shade of the substrate, thus eliminating the problem of the gray effect, especially at the cervical area, of implant prostheses with metal alloy substructures (Fig. 12) [47]. Zirconia stabilized with yttrium oxide possesses good chemical and physical properties such as low corrosion potential, low thermal conductivity, high flexural strength (900-1200 MPa), and hardness (1200 Vickers) [48, 49]. In addition, zirconia is considered more biocompatible than other ceramics, titanium, and metal alloys, which may facilitate soft tissue response in terms of heath [50]. However, several authors [51-53] have expressed concern about the long term degradation, or aging, associated with the spontaneous transformation of the metastable tetragonal phase to the monoclinic phase. It has been shown that the spontaneous tetragonal to monoclinic transformation can drastically decrease the mechanical properties of the zirconia by surface roughening, grain pull out, and microcracking [54]. In vivo, these micro-cracks offer a pathway for water to diffuse further into the bulk of the ceramic. This transformation occurs when the tetragonal phase is exposed to elevated temperatures, those approaching 250°C and/or aqueous environments. It is not well understood how the combination of stresses, temperature, acids, humidity, and saliva in the oral environment affects the rate of this transformation [52]. Several studies have shown that the strength of zirconia test specimens has not been significantly affected by aging according to the ISO standard 13356 (steam autoclave: 5 hours at 0.2 MPa and 134 °C) [55]. Molin et al. followed zirconia restorations for at least 5 years concluding that the fracture of zirconia is rare [56-58].

Fig. (10). Milling device.

Fig. (11). Zirconia framework for hybrid prosthesis.

COPY-MILLED ZIRCONIA SYSTEMS

There is a growing array of digital technology and computerized systems for restorative dental treatment. Most zirconia-based restorative systems use computer-aided design/computer-aided manufacturing (CAD/CAM) technology for the design and subtractive rapid prototyping technology for the fabrication of the zirconia frameworks. Once the design of the framework is completed, the data is transferred to a milling unit for fabricating the framework. The frameworks
can be fabricated from fully sintered zirconium oxide or partially sintered zirconium-oxide blanks. The proponents of

partially sintered frameworks claim that micro cracks may be introduced to the framework during the milling procedure of a fully sintered blank, whereas the proponents of milling of a fully sintered blank claim that because no shrinkage is involved in the process the marginal fit is superior [59, 60]. Probably the partially sintered zirconium technique presents several appealing advantages; the fully customization of framework into monolithic shape (Fig. 13) and intrinsic colorization (Fig. 14). Such ability to control the framework contours and colors provides the ceramist and the clinician additional flexibility, while providing the patient with robust and esthetic restorations (Fig. 15).

Fig. (12). Hybrid prosthesis with zirconia framework and porcelain veneering material.

Fig. (13). Monolithic zirconia framework is custom contoured for a partially sintered system.

Fig. (14). Monolithic zirconia framework is custom colored for a partially sintered system.

Fig. (15). Special felthpatic porcelain can be added in order to enhance esthetics in specific areas, optional procedure.

CONCLUSION

This article presented a review of current and past literature regarding the evolution of different materials used for construction of hybrid prostheses. Several advantages can be drawn including CAD/CAM technology, 3D scanning, and monolithic zirconia as framework substrate material. Complications associated with the relative inaccuracy of casting
have been significantly improved with the introduction of CAD/CAM technology in implant dentistry. Errors associated with traditional impressions can be solved utilizing 3D scanning since digital output data is fed directly into a digital workflow. Partially sintered monolithic zirconia as an implant-supported prosthetic material, reduces chipping of the veneering porcelain and may requires less prosthetic space compared to a conventional hybrid prosthesis due to its monolithic nature. Improved aesthetics can be achieved due to intrinsic staining capabilities. Such advantages are revolutionizing industries by enabling the merger of mass production and individual customization into fast, cost-efficient
workflows that assist in the increasing demand for treatment of the edentulous patient.

REFERENCES

[1] Douglass CW, Shih A, Ostry L. Will there be a need for complete dentures in the United States in 2020? J Prosthetic Dent 2002; 87(1): 5-8.
[2] Foser H. Philosophie und entwicklung moderener konfektionszahne. Dental Spect 1999; 15: 185-95.
[3] Baker C. History of crown and bridge prosthodontics. In: Tylman SD, Eds. Theory and practice of crown and bridge prosthodontics. St Louis: The CV Mosby Co. 1965.
[4] Johnson W. The history of prosthetic dentistry. J Prosthetic Dent 1959; 9: 841-6.
[5] Ring M. Dentistry, an illustrated history. New York: Abraham HN, Inc 1985; pp. 160-81.
[6] Noort Rv. Introduction to dental materials: health & fitness. Mosby 1994; p. 236.
[7] Jones DW. Development of dental ceramics: an historical perspective. Dent Clin North Am 1985; 29(4): 621-44.
[8] Vivadent I. Scientific documentation IvoBase 2012; p. 3.
[9] Morse DR. Plantation procedures: history, immunology and clinical considerations. J Oral Implantol 1977; 7(2): 176-92
[10] Smollon JF. A review and history of endosseous implant dentistry. Georgetown Dent J 1979; 63(1): 33-45.
[11] Driskell TD. History of implants. CDA J 1987; 15(10):16-25.
[12] Cranin N, Dennison T. Springfield, Ill. New concepts in blade implantology. In: Cranin AN, Ed. Oral Implantology. Charles C Thomas, Publisher; 1970; p. 166
[13] Reade P. Host reactions to tooth transplants. Aust Dent J 1970; 15(3): 172-8.
[14] Ring ME. A thousand years of dental implants: a definitive history: part 1. Compend Contin Educ Dent 1995; 16(10): 1060-4.
[15] Association: A.D. ADA survey reveals increase in detal implants over 5 year period (News release on the Internet) 2002; Available from: www.ada.org/public/media/releases/0204_release01.asp
[16] McKinney R. Endosteal dental implants. Mosby Year Book 1991.
[17] Zarb GAJT. Prosthodontic procedures. In: Brånemark PI, Zarb G, Albrektsson T, Eds. Tissue-integrated prostheses: osseointegration in clinical dentistry 1985, Chicago: Quintessence Publishing Co., Inc.
[18] Glantz P. Aspects of prosthodontic design. In: Brånermark PI, Zarb G, Albrektsson T, Eds. Tissue-integrated prostheses:
osseointegration in clinical dentistry 1985, Chicago: Quintessence Publishing Co., Inc.
[19] Bergman GT. RL, Laboratory technique for the brånemark osseointegrated implant system. Austenal Dental and Nort western Univerity: Chicago 1987.
[20] Haraldson T. A photoelastic study of some biomechanical factors affecting the anchorage of osseointegrated implants in the jaw. Scand J Plast Reconstr Surg 1980; 14(3): 209-14.
[21] Cox J, Zarb G. Alternative prosthodontic superstructure designs. Swed Dent J Suppl 1985; 28: 71-5.
[22] Brånemark PZ, Albrektsson GA. T, Tissue-integrated prostheses:

osseointegration. Clin Dent 1985; Chicago: Quintessence.
[23] Brånemark PI. Biological principles relative to osseointegrated implants. Continuing Education Course, October 1985; Rochester, MN.
[24] Laurell L. Occlusal forces and chewing ability in dentitions with cross-arch bridges. Swed Dent J Suppl 1985; 26: 160.
[25] Jemt T, Carlsson L, Boss A, Jörneús L. In vivo load measurements on osseointegrated implants supporting fixed or removable prostheses: a comparative pilot study. Int J Oral Maxillofac Implants 1991; 6(4): 413-7.
[26] Tallgren A. The continuing reduction of the residual alveolar ridges in complete denture wearers: a mixed-longitudinal study covering 25 years. J Prosthet Dent 1972; 27(2): 120-32.
[27] Atwood DA, Coy WA. Clinical, cephalometric, and densitometric study of reduction of residual ridges. J Prosthet Dent 1971; 26(3): 280-95.
[28] Drago CK. Howell, Concepts for designing and fabricating metal implant frameworks for hybrid implant prostheses. J Prosthodont 2012; 21(5): 413-24.
[29] Malo P, Rangert B, Nobre M. All on 4 immediate-function concept with Branemark System implants for completely edentulous maxillae: a 1-yea retrospective clinical study. Clin Implant Dent Relat Res 2005; 7 (Suppl 1): S88-94.
[30] Malo P, Rangert B, Nobre M. "All on 4" immediate-function concept with Branemark System implants for completely edentulous mandibles: a retrospective clinical study. Clin Implant Dent Relat Res 2003; 5 (Suppl 1): 2-9.
[31] Winkelman RO, Kenneth O. Dental implants: fundamental and advanced laboratory technology: Mosby 1994.
[32] Babbush CA, Kanawati A, Brokloff J. A new approach to the All on 4 treatment concept using narrow platform NobelActive implants. J Oral Implantol 2013; 39(3): 314-25.
[33] Johnson GH, Craig RG. Accuracy of four types of rubber impression materials compared with time of pour and a repeat pour of models. J Prosthet Dent 1985; 53(4): 484-90.
[34] Millstein PL. Determining the accuracy of gypsum casts made from type IV dental stone. J Oral Rehabil 1992; 19(3): 239-43.
[35] Sahin S, Cehreli MC. The significance of passive framework fit in implant prosthodontics: current status. Implant Dent 2001; 10(2): 85-92.
[36] Kim Y, Oh TJ, Misch CE, Wang HL. Occlusal considerations in implant therapy: clinical guidelines with biomechanical rationale. Clin Oral Implants Res 2005; 16(1): 26-35.
[37] Sahin S, Cehreli MC, Yalcin E. The influence of functional forces on the biomechanics of implant-supported prostheses: a review. J Dent 2002; 30(7-8): 271-82.
[38] Wang TM, Leu LJ, Wang J, Lin LD. Effects of prosthesis materials and prosthesis splinting on peri-implant bone stress around implants in poor-quality bone: a numeric analysis. Int J Oral Maxillofac Implants 2002; 17(2): 231-7.
[39] Zarb GA, Schmitt A. Implant prosthodontic treatment options for the edentulous patient. J Oral Rehabil 1995; 22(8): 661-71.
[40] Sones AD. Complications with osseointegrated implants. J Prosthet Dent 1989; 62(5): 581-5.
[41] Branemark PI. Osseointegration and its experimental background. J Prosthet Dent 1983; 50(3): 399-410.
[42] Ongül D, Gökcen-Röhlig B, Sermet B, Keskin H. A comparative analysis of the accuracy of different direct impression techniques for multiple implants. Aust Dent J 2012; 57(2): 184-9.
[43] Abduo J, Bennani V, Waddell N, Lyons K, Swain M. Assessing the fit of implant fixed prostheses: a critical review. Int J Oral Maxillofac Implants 2010; 25(3): 506-15.
[44] Karl M, Rösch S, Graef F, Taylor TD, Heckmann SM. Strain situation after fixation of three-unit ceramic veneered implant superstructures. Implant Dent 2005; 14(2): 157-65.
[45] Del'Acqua MA, Arioli-Filho JN, Compagnoni MA, Mollo Fde A Jr. Accuracy of impression and pouring techniques for an implantsupported prosthesis. Int J Oral Maxillofac Implants 2008; 23(2): 226-36.
[46] Fasbinder D. Using digital technology to enhance restorative dentistry. Compend Contin Educ Dent 2012; 33(9): p. 666-8, 670, 672 passim.
[47] Sailer I, Holderegger C, Jung RE, et al. Clinical study of the color stability of veneering ceramics for zirconia frameworks. Int J Prosthodont 2007; 20(3): 263-9.
[48] Piconi C, Maccauro G. Zirconia as a ceramic biomaterial. Biomaterials 1999; 20(1): 1-25.
[49] Manicone PF, Rossi Iommetti P, Raffaelli L. An overview of zirconia ceramics: basic properties and clinical applications. J Dent 2007; 35(11): 819-26.
[50] Scarano A, Piattelli M, Caputi S, Favero GA, Piattelli A. Bacterial adhesion on commercially pure titanium and zirconium oxide disks: an in vivo human study. J Periodontol 2004; 75(2): 292-6.

Case Presentation

CAD/CAM manufactured Mesio-bar in CrCo metal on four implants with ball attachments as substructure for a removable full mandibular denture.

Presented by :
Dr Brendin Sparkham - Waterkloof Airforce Base, Dental Clinic & Mr Gerhard Buys –Express Dental Lab.

Initial Situation:

A middle aged female patient came to see Dr Sparkham at 1 Military Hospital in June 2014 after she has broken yet another screw that retained a mesio-bar to support her lower denture.. She has been edentulous for a number of years. Six years ago she received four, 4 mm external hex implants from the Southern Implants system, on the mandible, to re-establish retention and stability of the lower denture. The patient experienced difficulty with oral hygiene and Dr Sparkham decided to change the design of the mesio-bar to facilitate better oral hygiene. Impressions were taken and sent to Mr Gerhard Buys at Express Dental Laboratory to have the entire case re-done, including full upper and lower dentures as well as a new mesio-bar with ball attachments.

The normal procedure was followed and after taking secondary impressions and a bite registration, a wax try-in was done. Once the try-in had been finalized the models containing gingi-mask and lab analogues, together with the wax try-in was sent to GEMCO with the request to manufacture a mesio-bar according to dr Sparkham's design to fit inside the denture as per wax try-in. (fig 1) Mr Buys from Express Dental ordered the bar in CrCo metal from GEMCO, in order to be able to solder the attachments on at a later stage in the process.

Fig 1

Once GEMCO received the models, try-in and instructions a new case was created on the 3 Shape Dental Manager Software.

CAD base models were created from the original implant drawings, and had been imported into the 3 Shape Software. Because designs were created from original drawings and not reverse engineered, the outcome of the manufacturing process is a very accurate restoration that fits passively on the implant interface.

Fig 2

Fig 3

Fig 4

Fig 5

After creating the order, the model as well as the wax try-in was scanned in, using the D800 model scanner from 3 Shape. The D800 scanner uses two 5 Mega Pixel cameras and is accurate to 8µ on implant bars. Fig 2 shows a screenshot of the scanned model without the wax try-in, and in fig 3 the try-in was super-imposed on the implant model. The translucency of the wax try-in can be adjusted using a slider in the design phase of the program. This handy feature allows the designer to view the created bar inside the try-in, for accurate assessment, making sure enough space has been left for the acrylic teeth, clips and processing of the denture. Fig 4 shows a side view of the complete design of the bar and fig 5 gives a top view.

Fig 6

Fig 7

Fig 6 and fig 7 shows the final design with the denture try-in super-imposed . The bar was designed to go directly onto the interface of the implants. No passive abutments were used in this case.

Fig 8

Fig 9

After the design was finalized it was sent from the GEMCO CAD center to the CAM section where it was processed and wet-cut on a 5 axis industrial milling machine, from a solid block of CrCo material 10mm thick and 98mm in diameter. Fig 8 shows the disk of solid CrCo and in fig 9 the disk is loaded in the milling unit, just before cutting started.

Fig 10

Fig 11

The completed bar was delivered to Express dental Lab. After the bar was sent for a try-in, Mr Gerhard Buys determined the best position for the attachments.

Slots were cut into the milled bar and four ball attachments were soldered to the CrCo framework. Fig 10 and Fig 11 shows the bar after soldering and polishing was completed. Fig 12 shows the final bar fitted in the mouth.

Fig 12

Fig 13

After the attachments were soldered to the bar in the correct places, the dentures were processed, and finished with Teflon caps inserted into the metal housings. Two yellow and two red cups were used. Fig 13 shows the Teflon caps in the lower denture. The finished dentures together with the polished bar was sent to Dr Sparkham for fitting in the patients mouth.

Final Restoration and Conclusion.

Dr Sparkham fitted the new mesio-bar into the patient's mouth and was happy with the end result. The new design of the bar will facilitate better oral hygiene, which in turn will preserve the implants and remaining bone. Fig 11 shows the bar in position. The ball clasps provides excellent retention for the lower denture, providing much needed stability.

Fig 14 shows the patient fitted with the new full upper and lower dentures.

Fig 14

CONTINUOUS EDUCATION QUESTIONNAIRE

A pilot study to test the accuracy of 3D printed study models from an intra-oral scan vs a plaster study model made from a conventional impression of the same Patient's maxilla.

Q1: An STL file format describes:
a. A sterolithography file
b. A triangulation file
c. A file format used for digitizing models
d. All of the above

Q2: SLA technology can be described as:
a. A computer program to measure deviation patterns in digital models
b. The file format used in additive manufacturing
c. The process by which a photo-polymer is cured, layer by layer, using a laser.

Q3: FDM technology can be described as:
a. Technology used to hollow out digital models to minimize the volume that has to be printed.
b. Plastic Extrusion
c. Finishing of the models using 99% Isopropanol

Q4: Which scan was used as the reference scan in this study?
a. The scan of the plaster model
b. The scan of the SLA model
c. The scan of the FDM model
d. The intra-oral scan.

Q5: The deviation pattern of the FDM model and the SLA model were similar but more pronounced in the SLA model.
a. True
b. False

Dental Erosion from an Excess of Vitamin C

Q6: Tooth wear due to prolonged exposure of a low PH in the mouth always leads to dentine sensitivity.
a. True
b. False.

Q7: Ascorbic Acid is found to be more corrosive than citric and phosphoric acid and has a PH of around 2.3
a. True
b. False.

Q8: Research has shown that individuals who have a daily intake of Vit C greater than 100mg, _____their risk of developing cancer, as opposed to individuals who take less than 50mg Vit C a day.
a. Double
b. Half
c Eliminate
d. Increase

The Evolution of Dental Materials for Hybrid Prosthesis

Q9: Studies have shown that cantilever bridges should be kept shorter in the mandible than in the maxilla.
a. True
b. False.

Q10: Degeneration of Zirconia takes place when:
a. There is a soft tissue response to the material.
b. The tetragonal crystal structure transforms to a monoclinic structure
c. The material is copy-milled.

Q11: Advantages of monolithic Zirconia used as an implant supported structure over normal hybrid prosthesis are:
a. Stronger
b. Less space required
c. Better esthetic results due to intrinsic staining.
d. All of the above.

Q12: In the 18th century, which dental material was best suited for carving replacement teeth for humans?
a. Animal teeth
b. Bone
c. Elephant ivory
d. Hippopotamus ivory

Q13: Which of the following statements are false:
a. Mr Goodyear invented a process in which rubber and sulphur was combined to form valcanite.
b. The first porcelain teeth were manufactured in 1709s by a priest.
c. In the manufacturing of ivory dentures with the inset of cadaver teeth lower dentures presented more of a problem when it came to retention in the patient's mouth.
d. PMMA was introduced as a substitute for vulcanite.

Q14: The very first dental implants that showed oseointegration were done by:
a. The Egyptians
b. The Mayans
c. Prof Per-Ingvar Brånemark
d. Dr Walter Bauer

Q15: Primary stress points in implant supported cantilever prosthesis are:
a. Cantilever areas longer than 20mm
b. In the locking screws used to secure the bridge
c. Posterior prosthetic teeth
d. The junction between the cantilever and the posterior implant abutment.

A pilot study to test the accuracy of 3D printed study models from an intra-oral scan vs a plaster study model made from a conventional impression of the same patient's maxilla.

Article by:
L.N. Fourie, RDT.
and
D.G Grobler, M.Tech

Corresponding Author:
L.N. Fourie
lyra738@gmail.com

Introduction:

The objective of this study was to compare the accuracy of two 3 D printed study models (one SLA and one FDM) from an intra-oral scan against the accuracy of a plaster study model obtained from a conventional impression of the maxilla of the same patient. In this study open source digital technology was used and the printers tested are desktop printers intended for commercial printing. Specialized software was used to analyse the dimensional differences of each model measured against the intra-oral scan which was used as a reference. In conjunction with this, two retainers were made using a pressure former, one on the plaster model, and one on a 3D printed model and fitted in the patient's mouth for evaluation.

Methodology:

An intra-oral scan was taken of the patient's maxilla using a TRIOS™ cart intra-oral scanner and 2014-1 software version. The file was exported from the intra-oral scanner to 3 Shape, Dental Design Software using the TRIOS™ inbox. Digital data cannot be printed directly from the intra-oral scanner. It has to be prepared and made 'water-tight' before printing can commence. Digital models, just like analogue models need to be trimmed and digitally 'based'. This process was done, using the Model Builder™ module from 3 Shape. The intra-oral scan was trimmed at the sulcus areas and on the palatal aspect, based and hollowed out to minimize the volume that has to be printed and therefore, bring down the cost of the model. Files were exported in STL format. The plaster model was manufactured under controlled conditions using a precisely measured powder/water ratio according to the manufacturer's recommendation.

Two different printers, one Stereolithogrphy (SLA), and one Fused Deposition Modeling (FDM) were used to create two models from the same digital file. Both of these are desktop printers classified for commercial use.

The 3D printer used in this study was a Form 1+, Stereolithography (SLA) printer from FormLabs. SLA technology employs a photopolymer resin that is cured using ultra-violet light, projected onto the resin and the model is build up, layer by layer. White resin material from Formlabs was used to print this model.

Finishing of the models was done using 99% Isopropanol, washed for 2min, soaked for 10 min and washed in the 2nd bucket with cleaner Isopropanol for about 2 min. After washing a self-made fan was used to evaporate the alcohol and speed up the drying process. Prints that still seemed soft or sticky after this process was placed in a light box for 180seconds.

The second additive manufactured model was produced using Plastic Extrusion or Fused Deposition Modeling (FDM). The model was printed on a PP3DP Up Mini printer. These printers uses a "plastic cord" that is extruded through a heated nozzle that melt the plastic as it flows through the tip and lays down the layers. Acrylonitrile butadiene styrene (ABS) material were used to manufacture this model.
No chemical post processing is necessary on FDM manufacturing. Support material is removed by cutting it off. In order to smooth the stepping lines, acetone may be used, either applied on a cloth or in a vapor chamber, but this is an optional step.
The plaster study model was manufacture in a commercial laboratory using yellow plaster, casted in an alginate impression taken of the patient's maxilla by a general dentist in a commercial practice.

Once all three models were manufactured they were scanned using a D810 model scanner by 3 Shaped. These models were scanned by a qualified dental technician, one after the other on a fully calibrated scanner. Both the additive

Trios Intra-Oral Scanner - cart version

Form 1 3D printer -SLA

PP3DP Up Mini printer-FDM

D810 scanner - 3 Shape

a thin layer of scan-spray before scanning in order to ensure accurate results due to the reflective qualities of the printed materials. The plaster model was scanned without adding scan-spray. The models were scanned and exported in STL file format.
Convince™ 2012 software from 3 Shape were used to do a deviation analysis on the tree physical models vs the intra-oral scan. Convince™ is professional quality control software with a powerful alignment function, 2D sectioning and measurable distance maps.

The intra-oral scan was used as the reference scan in each case, and the three STL files from the scanned physical models (two printed and one plaster model) imported as the scanned file. Alignment of the reference model and scanned model was made by using the automatic alignment function build into the software. After a visual inspection of the meshed models to see if alignment was done properly, the Region of Interest (ROI) was defined. In order to avoid that differences in soft tissue will influence the results of this study the teeth surfaces were selected as the Region of Interest in each case. Annotations were added in places where major dimensional differences were indicated by the coloured difference maps. Annotations includes comprehensive information about the deviation in Y,Z, and Z axis between the model and the intra-oral scan, measured at that specific point.
To verify the results obtained from the Convince™ software, open source software call CloudCompare version 2.1 was used. CloudCompare was developed to calculate distances between two dense point clouds and filter out measurement noise from laser scanners to identify true differences. The TRIOS™ intra-oral scan was used as the reference model in each of the three assessments, and the STL files for each physical model loaded as the scanned model. A three point alignment system were used to align the files, after which distance map was used to indicate variants in the models.

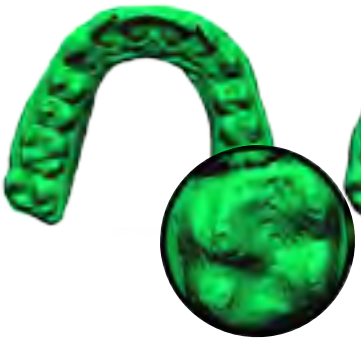
After processing the models, two retainers were made, one on the plaster model and one on the SLA model. Both these retainers were made using a Scheu pressure former machine. Schue Isoflan foil 0.1mm was used as a spacer, and Scheu

Images of scans

Intra-oral scan

Plaster scan

FDM scan



SLA scan

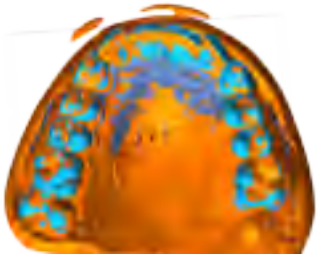
Methodology Images

From left to right: plaster model, FDM model, SLA model

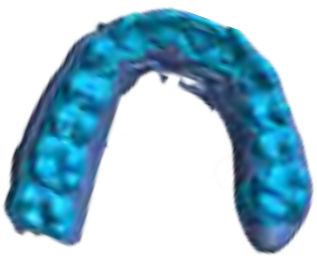
SLA models drying

Retainer on SLA model

Reference and scan file aligned

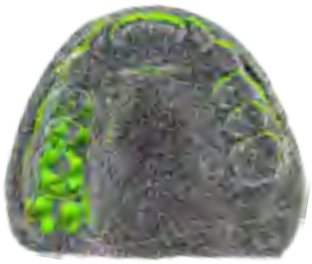


Region of Intrest selected

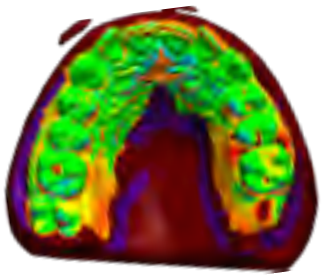


Intra-oral scan vs Plaster model images

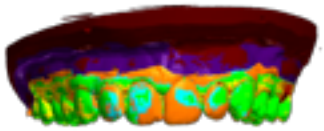
Plaster vs Intra-oral CloudCompare



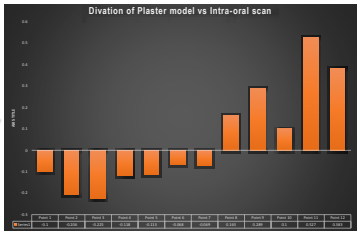
Difference map- Plaster vs Intra-oral Convince Software



Difference map Plaster vs Intra-oral. Convince Software



Plaster vs Intra-oral graph

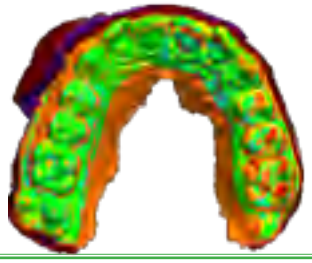


Intra-oral scan vs FDM model

FDM vs Intra-oral CloudCompare

Difference map FDM vs Intra-oral. Convince Software.

Difference map FDM vs Intra-oral. Convince software

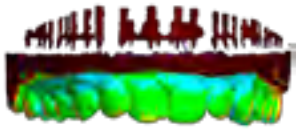


FDM vs Intra-Oral graph

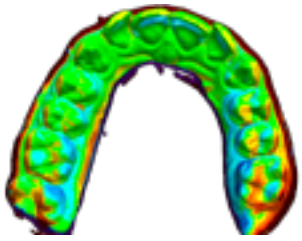
Intra-oral scan vs SLA model

FDM vs Intra-oral CloudCompare

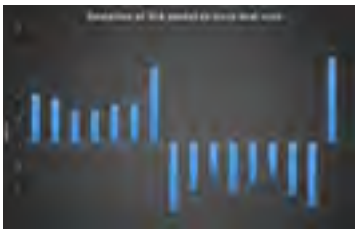
Difference map SLA vs Intra-oral. Convince Software



Difference map SLA vs Intra-oral. Convince Software



SLA vs Inta-oral graph



Duran 1mm material was used to manufacture the retainers.

Results and discussion:

Results gathered during the original evaluation using Convince™ software from 3 Shape were confirmed by the results obtained from CloudCompare. The same trends were visible in both these evaluations. A tolerance level of 0.05mm was used in all examinations of the STL files.

Plaster model vs Intra-oral scan:

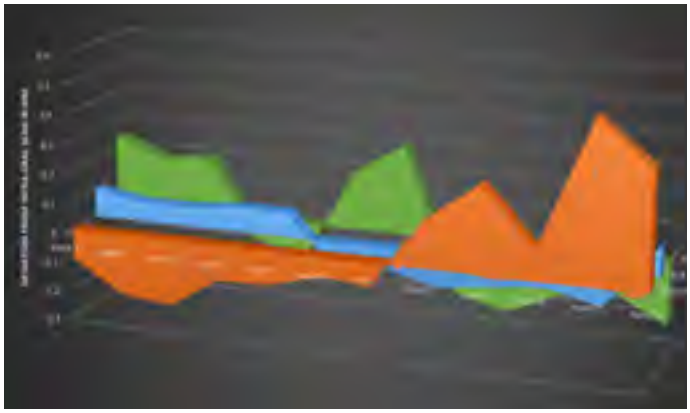
Difference maps of the plaster model super-imposed onto the intra-oral scan reveals the largest deviation between the two files measured in this study. Small bubbles were trapped in the impression material, three of which were included in the Region of Interest defined in this study. These bubbles are situated on the occlusal surfaces of the 16 and 26 and on the palatal aspect of the 11. Although indicated as major deviations, these points were purposely avoided in the calculations. The major deviations of the plaster model to the intra-oral scan can be grouped in 3 areas, the posterior area of the first quadrant, the four anteriors, and the posterior area of the second quadrant. The posterior area of the first

Difference point	*Plaster model deviation value in mm*	*FDM model deviation value in mm*	*SLA model deviation value in mm*
Difference point 1	-0.240	-0.188	+0.085
Difference point 2	-0.207	-0.225	+0.069
Difference point 3	-0.122	-0.206	+0.096
Difference point 4	-0.149	-0.190	+0.108
Difference point 5	+0.384	-0.169	-0.073
Difference point 6	+0.527	+0.305	-0.089
Difference point 7	+0.100	+0.243	-0.114
Difference point 8	+0.289	+0.193	-0.076
Difference point 9	+0.163	-0.158	-0.105
Difference point 10	-0.226	+0.199	+0.112
Difference point 11	-0.182	+0.179	-0.150
Difference point 12	-0.116	-0.113	+0.098

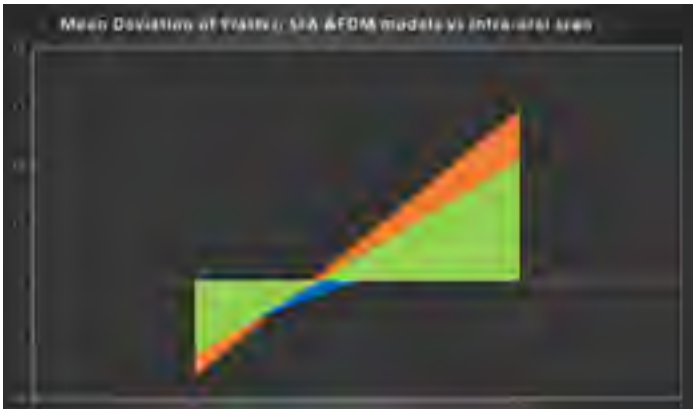
Deviation value	Plaster model	FDM model	SLA model
Average negative value	-0.1774	-0.1784	-0.1011
Average positive value	+0.2926	+0.2238	+0.0946
Total.	***+0.121***	***+0.045***	***0.0065***

Average deviation = Sum of values ÷ number of values (positive and negative values were calculated separately)
Total deviation value = average negative value - average positive value.

Area chart of Deviation, Plaster, SLA and FDM vs Intra-oral



Average Deviation of plaster, SLA and FDM models vs Intra-oral scan



shows negative values on the buccal aspects of the teeth and positive values on the palatal aspects. This reverse is found in the posterior region of the second quadrant. Positive values were measured on the buccal aspects while negative values were measured on the palatal aspects. It seems like a linear shift has taken place in the posterior region toward the patient's left side. In the anterior region, negative values were measured on the labial aspects of the laterals and centrals with greater deviances in the incisal third of the teeth. The greatest volumetric deviances in the anterior region occurred around the midline on the labial aspects of the centrals broadening out towards the incisal edges. Negative deviances are present on the mesial aspect of the 12 and the distal aspect of the 22 which is in line with the linear shift seen in the posteriors although the volumetric deviances are less pronounced here than in the posterior region. The greatest deviations in this study had been found between the plaster model scan compared to the intra-oral scan. The positive mean deviation (+0.2926mm) in this case is far bigger than that of the negative average deviation (-0.1774mm), indicating that the volumetric expansion in this plaster model bigger than that of the volumetric shrinkage. The difference between the positive and negative mean deviation for the plaster model compared to the intra-oral scan is +0.121mm

FDM model vs Intra-oral scan:
Visual inspection of the FDM model shows rather large 'stepping lines' and the effects hereof is evident in the deviations when compared to the intra-oral scan. The anterior region does not show major deviations. There is a small area on the 21 that shows a positive deviance of about +0.077mm and the palatal aspect of the same tooth measures a negative deviation of -0.116.
Major deviations on the FDM model vs the intra-oral scan is situated in the posterior regions of both the first and second quadrants. Negative values have been measured on both the buccal and palatal aspects of the posteriors although the values on the buccal aspects were greater. These measurements indicate a dimensional shrinkage of the posterior teeth from buccal to palatal, which is more pronounced on the distal aspects, moving towards the gingiva. Positive occlusal deviances were measured in both quadrants but are far more pronounced in the second quadrant than the first. The occlusal average deviation of the posterior region of the second quadrant is 0.04mm larger than that of the first quadrant. On the colour deviation map it is also clear that the volumetric deviation in the second quadrant is larger as indicated in yellow, orange and red.

The positive average deviation (+0.2238mm) of the FDM model compared to the intra-oral scan is larger than the negative mean deviation, (-0.1784mm) indicating that this model, like the plaster model had a bigger volumetric expansion than shrinkage. The difference between the positive and negative mean deviation in this model is +0.045mm. This is about 2 ½ times less than that of the plaster model.

SLA model vs Intra-oral scan:
When the difference maps of the SLA and the FDM models are compared the same deviations are noticeable in the same areas, only less pronounced in the SLA than in the FDM model. Negative measurements are present on the buccal and palatal aspects of the posteriors in the first and second quadrants, although larger in the second quadrant. Although small, positive deviations are measured on the labial aspect of the 11 near the incisal edge. Negative measurements are present on the palatal side of both centrals. In the first quadrant a positive occlusal deviations was measured on the 16 and 17. Larger occlusal deviations were measured on occlusal the posteriors in the second quadrant. The positive average deviation of the SLA model (+0.0946mm) is smaller than the negative mean deviation (-0.1011mm). These measurements indicate that the SLA model is the most accurate as the difference between positive and negative mean deviation is only 0.0065mm.

Presence of the same deviation pattern in both the FDM and SLA models indicates a possible deviation from the intra-oral file when the digital model were created, since

both models were printed from the same file. The integrity of the intra-oral scan in this case could not be responsible for the deviance in the printed models as the intra-oral scan

Retainer in patient's mouth.

Conclusion:

The results from this study indicates that the SLA model were the most accurate of the three models included in this study when compared to the intra-oral scan. SLA model showed the least about of deviation and were also the most stable a far as expansion and shrinkage of the final model is concerned.
To put these results to a more practical test, retainers were made on both the SLA and the plaster model and fitted in the patient's mouth. The patient much preferred the retainer made on the SLA model saying that the overall fit and retention of this retainer was better than that of the retainer made on the plaster model.

List of equipment accuracies as stated by the manufacturer:

a. TRIOS™ cart, Intra-oral scanner from 3 Shape.

b. Form 1, SLA printer from FormsLab.

c. Up Mini, FDM printer from PP3DP.

d. D810 model scanner from 3 Shape

Acknowledgements:

The authors would like to thank Ms Anika Troskie, our patient, for her participation in this study and her consent for us to publish this material.

Thank you to Mr Jason Laing for printing the FDM model for this study, and to Snap Dental Studio for printing of the SLA model.

Thank you to GEMCO and Mr Owen Peringuey for the use of the Intra-oral and plaster scanners, as well and the Convince™ Software.

References:

1. 3D Systems. 3D Printer Buyer's Guide for Professional and Production Applications. Rock Hill USA.
2. Jaafar Abduo, Karl Lyons, and Mohammed Bennamoun. Trends in Computer-Aided Manufacturing in Prosthdon tics: A Review of the Available Streams. International Journal of Dentistry . [In press: Online] 2014. Available from: http://www.hindawi.com/journals/ijd/2014/783948/ [Accessed: 2014/10/30]
3. K. Bootvong, Z. Liu, C. McGrath, U. Hägg, Ricky W. K. Wong, M. Bendeus and S. Yeung. Virtual model analysis an alternative approach to plaster model analysis: reliabil ity and validity. European Journal of Orthodontics. [In press: Online] 32 (2010) 589–595. Available from: doi:10.1093/ejo/cjp159 [Accessed:2014/10/24]
4. Mireya A. Perez, Jorge Ramos, David Espalin, Mohammad S. Hossain, and Ryan B. Wicker. RANKING MODEL FOR 3D PRINTERS. Proceedings of the International Solid Freeform Fabrications symposium. Austin, Texas 2013; August 12-14 2013,p. 1048- 1065.
5. ASTM Standard F2792-12a: Standard Terminology for Additive Manufacturing Technologies, ASTM International, West Conshohocken, PA, 2012.
6. 3 Shape A/S, Convince™ Premium 2012 User Manual, 2012, Copenhagen Denmark, Available from: http://www.3shape.com/our-products/quality-control/convince-premium-software.aspx, 3 Shape A/S, 2012
7. Daniel Giradeau-Montaut. CloudCompare (Version 2.1) [Software] EDF & TELECOM Paris Tech. Available from: http://www.danielgm.net/cc/ . 2012.
8. Formlabs: Form1 3D Printer. [Online] Available from: http://formlabs.com/en/products/form-1-plus/tech-specs/ [Accessed 2014/11/01]
9. PP3DP: Up! Mini 3D Printer. [Online] Available from: http://www.pp3dp.com/index.php?page=shop.product_details&flypage=flypage.tpl&product_id=6&option=com_virtuemart&Itemid=37&vmcchk=1&Itemid=37 [Accessed 2014/10/30]

Roland

DWX-50

5 AXIS / AUTO TOOL CHANGER

Dental Milling Machine.

Innovation and affordability for precision dental milling
The compact DWX-50 combines 5-axis simultaneous machining capability and a five-station automatic tool charger to deliver advanced features at a very affordable price point.

Designed specifically for dental labs and technicians, the user-friendly DWX-50 allows for clean, quiet operation and the quality production of complex dental arches, abutments, bridges, copings and crowns from zirconia, wax and PMMA.

Equipped with an integrated air blower and dust collection system, the DWX-50 ensures protection of moving parts while maintaining a clean, safe environment.

Built on open technology, the DWX-50 supports a wide range of industry standard CAD/CAM software and tools, allowing for easy integration with popular commercially available dental prosthetic production solutions.


Detail of abutment and coping made by zirconia


Bridge made by zirconia


Milled zirconia disk


Milled coloured PMMA disk


Copings and bridges made by wax and zirconia

Five-station automatic tool charger

www.roland.co.za | martin@rolanddg.co.za | 0800 Roland (765263) | DBN: (031) 705 5530