

ESTHETIC EXPRESSIONS



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ESTHETIC EXPRESSIONS

Official Journal of IAACD
INDIAN ACADEMY OF AESTHETIC
AND COSMETIC DENTISTRY



"The object of Education is to prepare the young to educate themselves throughout their lives."

- Robert M. Hutchins

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EDITOR'S DESK

EDITORIAL



Dear Colleagues,

Warm greetings!

It is my honour to present to you “Esthetic Expressions”, the official journal of IAACD for the fourth consecutive term. This year, the IAACD annual conference and journal have been made completely virtual, conforming to the new normal scenario due to the Covid-19 pandemic.

Through its exemplary work during the last 29 years, IAACD has left a remarkable signature in the field of dental education by bringing world leaders and pioneers in dentistry from all around the world to India. The vision of our founder president Dr. Sandesh Mayekar has always been to raise the standards of Indian dentistry to an international one. We have witnessed the rapid transformation to digitalization in almost all spheres of life, and even dentistry has not been an exception to this. The 2020 IAACD conference therefore offers a digital extravaganza, with 13 international speakers greeting you virtually to give you a scientific feast.

In this year, the likes of which have been entirely unprecedented, dentists are looked at with fear of viral spread, due to high exposure to bacteriological aerosols. I am extremely happy to see that we dentists have adopted a new normal strategy with strict barrier measures and have continued our practices without fail.

The period of lockdown and quarantine have taught us the importance of the irreplaceable feelings of togetherness and intimacy. Let us hope that these life lessons and values are not lost due to the distancing that we are forced to maintain.

I am sure that, as in previous years, the annual issue of “Esthetic Expressions” will enlighten you with regard to the latest advancements in dental protocols and help you to enhance your knowledge and clinical skills. Enjoy!

Dr. Segin Chandran
Chief Editor
Esthetic Expressions
IAACD.

FROM FOUNDER PRESIDENT



Dr. Sandesh Mayekar

Founder President, IAACD

Dear Colleagues,

It's my pleasure to greet you through this digital journal that is enriched with scientific contents and many case reports from our accredited members. In this year of global pandemic outbreak dentistry is looked at with a scare off, but we are supposed to relieve the pain with emergency treatments. We moved from need based dentistry to a want based one. Even in COVID time whatever dentistry we practice need to be aesthetic and acceptable to our clients. Dentistry is aesthetic driven and its importance will never fade. Like warriors we fight to protect our health, wealth and practice. We extend our helping hand to the lost and needy. IAACD 2020 Annual Conference is meant for this noble cause. We are going virtually and globally this time with 13 International speakers. Let me congratulate the editor Dr. Segin Chandran and his team for bringing out this journal well in time.



FROM FOUNDER SECRETARY

A. Kumaraswamy

Founder Secretary, IAACD

IAACD Virtual conference

Little did we realize that as we touch the 30th milestone we could get "Distanced" in a way. Our elders always taught us to live in the NOW and to a large extent we have been there and done that.

The memorable events, conferences, fantastic speakers, glittering and heady banquets are all memories and strong flavors that the IAACD was known for.

As the changing dynamics ordained, we too at the IAACD have started charting the new normal and are blessed to have a great spread of topics and speakers.

As I relax on my rocking chair, am consumed by a satisfying feeling of the next generation doing a great job of holding the mast high and allowing the IAACD standard fluttering high. Kudos to the President Dr Shail Jaggi, the conference chairman Dr. Mohan and their respective team to put together this event.

A special word of appreciation is in place for Dr. Segin Chandran and his editorial team for yet again ensuring the published version of the Esthetic Expression, the official journal of IAACD. God bless IAACD.

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INSIGHT**Membership to the IAACD**

The IAACD now offers dentists registered with the Dental Council of India to become life members with a one-time payment of Rs 5,000/- only. The details of the life membership are presented below.

Criteria for application as a Life Member as per the constitution of the IAACD

- Any person interested in the Art and Science of Aesthetic & Cosmetic Dentistry and interested in furthering the Goals of the IAACD.
- Any dentist on payment of the prescribed entrance and life membership fees as determined by the Board and as his/her application being approved by the board may be permitted to become a life member.
- The current Life Member fees has been set as Rs.5,000/- subject to changes on approval of the General Body
- The Life Membership would be valid for 15 years
- All life Members would be entitled to receive
 - A Certificate from the Academy with a validity period mentioned
 - A discount on all IAACD meetings and conferences
 - The IAACD Journal

FROM PRESIDENT'S DESK



Dear Friends and Colleagues ,

Let me extend to every one here a warm welcome on behalf of the IAACD. This year has been very different for all of us the world over and I'm sure we will remember it for a long time to come .

But I contemplated on the uniqueness of the year and realised there was so much we took for granted and never thought about.....But actually 2020 put a PAUSE button to our life and helped us re-evaluate and actually reclaim our lives.... helping us get closer to people who matter, spending more time with our loved ones, and realising how little we need to be happy !

It took teaching and learning to whole new level turning the entire world into a small global village

We had the best Mentors being magnanimous and teaching and conducting Dental Courses without charging and a whole lot of dentists from the fraternity benefiting immensely I would not be wrong to say —These Six months actually upgraded our profession to a completely new level of Proficiency Globally

Keeping that in mind we at the IAACD also decided to hold our 29th Annual Conference digitally !

We have picked for you'll the best International Clinicians who will share with you some fantastic and upgraded Dental Lectures and Techniques.

What is also special this year is we are going to be driving funds collected from the conference toward COVID RELIEF for all the Dental Assistants and their families in case they get affected !

At the IAACD we always believe in shining bright and provide enlightening and futuristic Aesthetic Learning for all our Fraternity !

Here is looking forward to seeing everyone at the 29th VIRTUAL IAACD CONFERENCE !

Till then Stay Healthy Stay Fit !

Dr. Shail Jaggi
President
IAACD

GREETINGS



FROM THE SECRETARY'S DESK

Dear IAACD Family.

Happiness is a Direction...Not a place...

The vision of a few, the hard work of many and good wishes of plenty, that is how I would summarize the journey of IAACD.

Entering the third decade of spreading smiles, the seeds sown ages back has conceptualized into a generous philosophy of learning and sharing quality education.

It gives me immense happiness that even after facing the current pandemic situation, IAACD stood up to its commitment of maintaining the tradition of an annual scientific meeting for enriching the knowledge and enhancing the clinical acumen of colleagues and interested fellow dentists.

I wish to congratulate the Organizing Committee on organizing the 1st Digital and the 29th Annual Conference of the Indian Academy of Aesthetic and Cosmetic Dentistry. Would extend my heartfelt gratitude to the handpicked International Faculty who agreed to share their knowledge with us even in these pressing times.

A big word of appreciation to the Editorial team on the successful publication of yet another issue of our scientific chapter, the official publication of IAACD.

The direction shown to us by the visionaries who laid the foundation of IAACD, the organization and awareness created by the current generation and the promise shown by our generation next, the happiness and satisfaction will always exist that we are on the right path of creating a parallel level of Indian Dentistry at par with the Internationally practiced standards.

Wishing the 29th Annual Conference of IAACD a big success.

Thanks & Regards,

Dr. Nikhil Bahuguna
Secretary
IAACD.



2020: The Show Goes On... IAACD Virtual Annual Conference

Introduction:

As our dedication to the continuing dental education remains intact during the unprecedented and unpredictable year of 2020, Indian Academy of Aesthetic and Cosmetic Dentistry has planned their 29th Annual Conference virtually for the first time ever.

Keeping with the norm of diluting the mundane and adapting to the ever evolving aesthetic dentistry science, our first ever virtual conference is a step towards assimilating such renewed learning methods by providing an opportunity to the practitioners world wide to upgrade their knowledge sitting right in the comfort of their homes and offices.

The Conference:

The conference even though virtual will give an opportunity to interact with colleagues and dentists from across the globe through our virtual lounge area. Along with scientific sessions by 13 renowned international speakers, our conference will also provide and encourage paper presentations, eposters and accreditation examinations. With the commitment to make this first ever virtual conference of IAACD a memorable one, we are planning meticulously to run this virtually without any technical difficulties.

Venue:

The First Annual conference is being held in every other delegates home / office. We bring the conference and it's activities of paper presentations, eposters, demo videos right to where you are through your laptop and mobile gadgets

Dates:

The conference is being planned over two days, a weekend on 31 st October and 1 st November, 2020. Along with the main speaker events on these two days, the paper and e poster events will be held on 30th October, 2020 so everyone gets an opportunity to participate in it without missing the main speakers and their lectures.

I look forward to presenting this unique conference to all our delegates. I'm thankful to the evergreen founder president of IAACD, Dr Sandesh Mayekar for his ready and enthusiastic help to bring in Sun Pharma group as the main sponsor for the entire event. Colgate has agreed to encourage continuing dental education by sponsoring our e-journal. I'm sincerely thankful to the tireless efforts of conference organising team members, unconditional support and timely advice from the Board of directors and trustees. I also would like to thank the technical partners who are providing their best knowledge to make this conference glitch free and an enriching experience.

Dr. V.S. Mohan

Conference Chairman
Immediate Past President
IAACD.

IAACD ACCREDITATION



Dr. Hemant Sachdev

Accreditation Chairman, IAACD.
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The Indian Academy of Aesthetic & Cosmetic Dentistry offers its Life Members an opportunity to become accredited members of the Academy. The accreditation process provides an excellent opportunity for members to enhance their clinical skills as well as their knowledge with respect to Restorative & Aesthetic Dentistry.

Accreditation Criteria & Process

Life Membership to the IAACD is a primary requirement to become an Accredited Member. The validity period of the membership is a minimum of 13 months to allow the candidate to start the Accreditation process. Further, the candidate should have attended at least two national level meets in the past four years. Such a candidate, on completion of the above-mentioned criteria has to pay the Accreditation fee (Rs. 2000/- for Part 1 & Rs. 3000/- for Part 2) and can appear for the Accreditation process. The accreditation process consists of two parts.

Part 1 of the Accreditation Process:

The candidate must submit before/after photographs of five aesthetic clinical cases - preferably in a Power Point (.pptx) format along with the application to appear for the Part I examination.

The Part I exam is essentially a multiple choice written examination where the candidate has to answer 50 MCQs pertaining to various aspects of Aesthetic & Restorative Dentistry. The time allotted for this is 1 hour. A minimum of 70% marks (35/50) must be obtained to clear the Part I process.

Part 2 of the Accreditation Process

Upon clearing the first part, the candidate is eligible to appear for the Final (Part 2) exam during the subsequent IAACD conference (registration to the conference is compulsory). The Part II Exam consists of a Bench Test, Aesthetic Case Presentation & the Grand Viva.

Bench test: Candidates have to do a direct composite veneer buildup on a prepared natural central Incisor as well as an esthetic buildup for a large Class 1 cavity prepared on a natural molar. The total time allotted for this is 1.5 hrs. Participants have

to bring their working model with neatly mounted (anatomically with a clear gingival profile) 3 extracted anterior teeth (preferably from the same patient) - two upper centrals & one lateral incisor in contact with each other. The molar (upper or lower) should be mounted on the same model too. Please make a preparation for a composite veneer on the middle central incisor & a large Class 1 cavity (involving at least 3/4th of the occlusal surface) on the molar beforehand.

The veneer and the posterior restoration will be judged on various parameters such as the overall form & anatomy, marginal adaptation, contours, line angles, surface texture, internal characterizations, color match, finish & polish etc.

Participants will be provided an air-rotor connection and a micro-motor and light cure unit (if possible, please bring your own micro-motors & light cure units). Participants are required to bring their own air-rotor as well as a micro-motor contra-angle handpiece. Participants are also required to bring all the composite material that they will be using along with all necessary instruments, burs and finishing/-polishing kits.

Grand Viva: During the Grand Viva, the candidate will have to present an Anterior Aesthetic case- properly documented from the start to finish. The case presentation will have to be made on a PowerPoint or a Keynote presentation (either on a Laptop or on a screen if logistics permit it). The presentation will be only for 5mins and the candidate will be asked questions on the case in addition to other aspects of Aesthetic & Restorative Dentistry.

Repeat Exam: In case a candidate is unable to clear the exam, there is a provision for a repeat exam. There is no fee for 1st attempt for Part 1 exam if the candidate appears for it at the next conference. Full fee for repeat of Part 2 Bench test. There is no fee for repeat of the Viva.

The candidate, upon clearing the final accreditation exam, will receive the IAACD Accreditation Plaque & Certificate during a special ceremony at the subsequent Annual IAACD Conference and will join a niche group of Accredited Members of the Indian Academy of Aesthetic & Cosmetic Dentistry.

**Hearty Congratulations to the newly accredited members of IAACD.
Welcome to the family of IAACD.**



Dr. Ramesh Bopanna
(Bangalore)



Dr. Smita Kole
(Maharashtra)



Dr. Amit Khammar
(Gujarat)



Dr. Bhushan Kalaria
(Gujarat)

EVENTS

28th IAACD ANNUAL CONFERENCE DEMYSTIFYING SMILES

2019, INDORE

The 28th IAACD Annual Conference at Indore was a resounding success. Planned as a three-day event from 9 August to 11 August 2019, everyone — speakers, workshop conductors, trade partners, sponsors, and all the delegates from around the country — praised each aspect of it. The hospitality of and support from the staff of the venue, Brilliant Convention Centre, was second to none.

The Organizing Team, lead by Dr Rumpa Wig, the Organizing Chairperson, and Dr Swarnjeet Singh Gambhir, the Organizing Secretary, were acclaimed far and wide for their grand conception and for immaculately seeing it through from start to finish.

Almost every subject pertaining to the theory and practice of aesthetic dentistry was exposted over the three days of this magnificent Conference.

Day 1 (Pre-Conference) 9th August 2019

The Courses and Workshops were scheduled for the first day of the Conference, seven in all, six of them for the morning sessions, and one for the afternoon. Such was the enthusiasm shown by the participants that every Course was bursting at the seams with overfull attendance. Many leaped at the opportunity to simply be observers of the sessions.



The 'Divas in Dentistry' lecture program took place in the afternoon. An IAACD initiative, this series of presentations was hailed by the audience and much appreciated. The Organizing Team received plaudits for envisioning this. The Trade Exhibition, featuring leading national and international companies, was inaugurated, and visited continually and the night-out dinner program, by a trip to Indore's highly famed Saraafa, a late-night food zone. All came back sated, having indulged their taste buds.



Day 2 10th August 2019

The Organizing Team had planned a trip to Mahakaal Temple in Ujjain in the morning before the events of the second day were to begin. Those who went for this visit came back refreshed and rejuvenated.

The second day of the Conference was packed to the rafters with Keynote lectures delivered by renowned speakers from India and abroad. The audience was enthralled by the smorgasbord of knowledge and learning on offer. All seats for every lecture were occupied. There was a spirit of discussion and delight in each hall. Both the morning and the afternoon sessions were lively and very much enjoyed by all. The last presentation session stretched till 7:30 pm in the evening, having begun a little after five o' clock.



Trade partners were happy with the inflow, queries & sales.

10 August was also the Anniversary of the IAACD. This was celebrated in grand style. The Inauguration Ceremony of the Conference was held after lunch.



It was a privilege to be in the august presence of Dr R S Sharma, the Vice- Chancellor of the M.P. Medical University at Jabalpur. We were honoured that his blessings and guidance were with us on this auspicious occasion. There was a Gala Banquet at night.



Day 3
11th August 2019

The last day of the Conference was a continuation of the assortment of knowledge and learning seen on the previous day. Distinguished lecturers delivered energetic presentations, exhibiting the deep understanding acquired from many years of expertise. The audience for the morning and the afternoon sessions commended and extolled them.



In parallel with the lectures, another IAACD initiative was going on. This was the Technical Trainers workshop, a result of IAACD's commitment to the dental profession. The workshop was aimed at dental technicians, but they were not the only members in the audience, as many doctors too came to attend.

Summing up

The 28th Annual Conference of the IAACD for the year 2019 was, by any standard, a great success and a remarkable achievement for a dental organization. IAACD, whose flag has been fluttering highly and mightily for over two decades now. This 28th Annual Conference 2019 in Indore will be an exemplar, adhering to the IAACD's mission and values, set forth so long ago; they will endure far into the times yet to come.

IAACD STUDY CLUB, UTTARAKHAND

IAACD STUDY CLUB was held in Kashipur, Uttarakhand on 7-9-2019. This was the second study club organized in succession after 2018. 13 participants attended and 2 delegates did paper presentation.

Dr. Nikhil Bahuguna, Secretary IAACD discussed role of fibers in dentistry with the participants as a part of scientific deliberation. Dr. Niket Mehrotra from Kashipur was instrumental in organizing the event.



IAACD @ CAMPUS- BJS DENTAL COLLEGE, LUDHIANA, PUNJAB

16th October, 2019

A very fruitful interaction was held with staff and students of BJS Dental College. Dr. Nikhil Bahuguna, Secretary-IAACD spoke about the philosophy of IAACD and its contribution towards creating awareness about Aesthetic and Cosmetic Dentistry in India. He discussed the current scenario and future of Aesthetic Dentistry in India and opportunities for the young dentists in this field.





IAACD @ CAMPUS -GENESIS DENTAL COLLEGE, FEROZEPUR, PUNJAB

17th October, 2019

A well attended event by over 200 delegates saw a mixed crowd of students, staff and practitioners from neighboring cities of this small border town.

Dr. Nikhil Bahuguna, Secretary-IAACD spoke about the role of IAACD in establishing Aesthetic Dentistry as an integral part of dental practice's in India.

He discussed about prefabricated restorations and their role in smile design.



IAACD STUDY CLUB - LUCKNOW, UP

12th January 2020

An IAACD study club was organized in collaboration with Superdentist in Lucknow. This was the second in series after the first once was inaugurated in 2019.

There were two delegate paper presentations on Pediatric Aesthetics and Photography in Dentistry. Dr. Praveen Rai introduced the concept of IAACD Study club to the delegates. Dr. Nikhil Bahuguna, Secretary - IAACD discussed the role of fibers and low modulus restorations in creating esthetic restorations. The event was attended by 15 local practitioners.



IAACD STUDY CLUB- JAIPUR, RAJASTHAN

16th February, 2020

IAACD STUDY CLUB was organized in collaboration with Rajasthan Association of Conservative Dentists and Endodontists. 30 local dentists attended the event.

Dr. Amit Patodiya, BOD, IAACD, helped organize the event and also introduced the concept of IAACD study Club to the audience. Guest Speaker Dr. Nikhil Bahuguna, Secretary IAACD spoke about simplifying smile design utilizing prefabricated composite veneers and occlusion vd's. 3 delegates presented scientific papers of various topics related Aesthetic Dentistry.



Guided Implantology: The SMART Guide



Dr. George Freedman (Canada)

He is a founder and past president of the American Academy of Cosmetic Dentistry, a co-founder of the Canadian Academy for Esthetic Dentistry and the International Academy for Dental Facial Esthetics, and a Diplomate and Chair of the American Board of Aesthetic Dentistry. He is Adjunct Professor of Dental Medicine, Western University, Pomona, California and Professor and Program Director, BPP University, London, UK, MClindent programme in Restorative and Cosmetic Dentistry. His most recent textbook is "Contemporary Esthetic Dentistry (Elsevier). He is the author or co-author of 14 textbooks, more than 800 dental articles, and numerous webinars and a Team Member of REALITY, and the International Editor-in-Chief of Dental Tribune. Dr Freedman received the Irwin Smigel Prize in Aesthetic Dentistry (NYU College of Dentistry). He lectures internationally on esthetic restorative dentistry, adhesion, composites, implants, oral health maintenance, porcelain veneers, 3D printing, and dental technologies. A graduate of McGill University in Montreal, Dr. Freedman is a Regent and Fellow of the International Academy for Dental Facial Esthetics and maintains a private practice limited to Esthetic Dentistry in Toronto, Canada.



Dr. Mark Antal (Hungary)

He is a senior lecturer at the Faculty of Dentistry, University of Szeged, Hungary. After earning his DMD, he specialized in operative dentistry and oral surgery, with internships in Halle-Wittenberg, Martin-Luther University, (Germany), Boston University, (USA) and New York University (USA). He is member of the Education Committee at FDI and an Honorary Lifelong Member of the International Association of Dental Students. He is a member of the Hungarian Academy for Esthetic Dentistry and the Hungarian Implantology Association.

The tremendous proliferation of implant services worldwide has created a need for simplified and more predictable treatment guidance modalities. There are currently a number of surgical guide platforms that are available, but most systems are strictly limited to specific implant catalogues, typically the products sold by the surgical guide sponsor. Other surgical guides are "open systems" and allow the practitioner to use any selected dental implant. The practitioner has the options of freehand, partially guided, and fully guided implant placement surgery. Guided surgery resulted in more accurate results than freehand surgery. Computerized treatment planning and guided

surgery provides improved accuracy, predictability and patient care.

Given the wide selection of high quality implants that can be utilized by the dental practitioner, the implants' very large variation in cost to the dentist, and the regional disparity in product access, it makes more sense to develop a treatment plan based on the patient's needs and anatomic suitability rather than on a specific implant manufacturer's product lines. Thus, the ideal guidance system can be adapted to a variety of implant brands and types, offering recomme-

ndations that are patient-centered rather than product-centered.

The SMART Guide Technology System (dicomLAB Dental Ltd., Szeged, Hungary) provides complete case analysis and preparation, shortly after imaging, enabling immediate treatment planning for any type of implant placement; it is possible to set the implant length with 0.5mm increments and the diameter with 0.1mm accuracy. The surgical protocol of the system is entirely dependent on the properties of the implant which is selected by the practitioner. The shape of the implant is also at the discretion of the dentist: conical or parallel shapes can be selected.

The following presentation is a detailed, step-by-step presentation of a case where planning and surgery were both accomplished with the assistance of the SMART Guide system. The female patient (age 39) presented with a broken left upper first bicuspid (tooth 24). The tooth previously had endodontic treatment; a subsequent vertical fracture of the root and un-restorable coronal structures made the case for an implant treatment the best choice. Figs. 1,2, 3

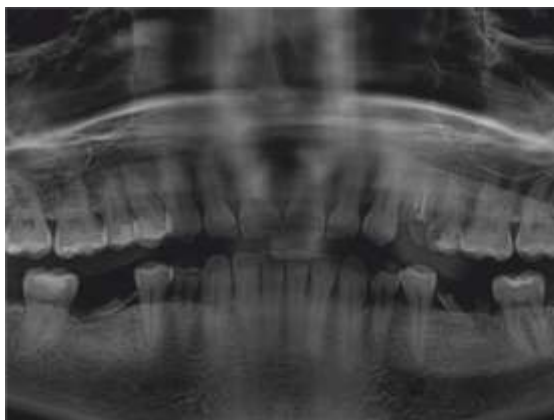


Fig 1: Panoramic radiograph

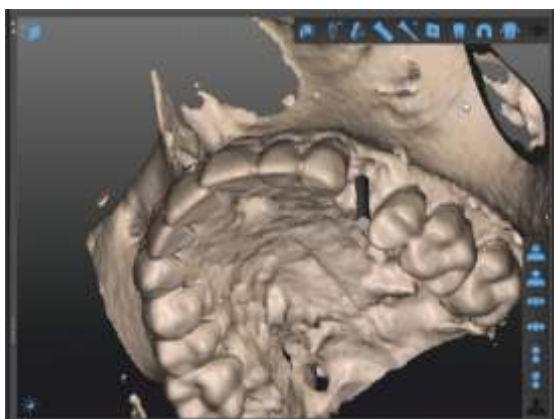


Fig 2 Virtual model of fractured 24

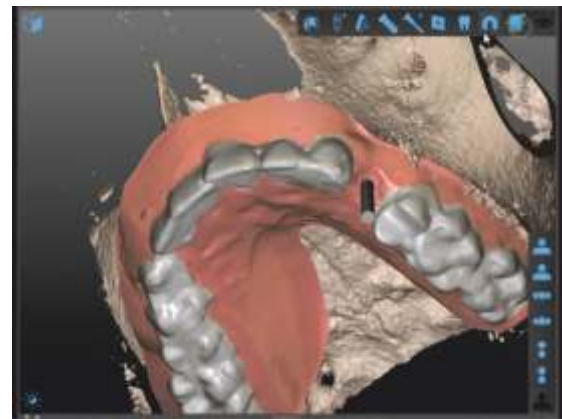


Fig 3 Virtual model of fractured 24 with SMART guide visualization

The remaining dental structures of tooth 24 were extracted. In order to avoid any complications due to residual bacteria or possible periapical or periradicular infection, a two-month healing time was mandated. After the initial healing step, a CBCT was taken, and an intraoral impression of the patient was made with a custom-made plastic impression tray and C-silicone. This is the SMART Guide “Simple CBCT Protocol”. This approach does have some limitations as the superimposition of the CBCT to the silicone impression requires the presence of a minimum of 8 sound teeth to be present as reference points on the dental arch to be treated. The silicone impression must be scanned with an extraoral scanner for the digital superimposition of the CBCT to the impression. Another option is to use an intraoral scanner. The same limitations regarding sound teeth apply, however. The reference teeth must be sound or restored with metal-free restorations; any metal restorative components, such as amalgam fillings, PFM crowns or bridges and/or metal posts interfere with the CBCT data acquisition.

After the CBCT of the patient and the scanned impression were completed, both data sets were uploaded, without patient identifying information, to the SMART Cloud. Then the SMART Guide center checked the quality of the pictures.

In cases where the patient is completely edentulous or where there is not enough metal-free, sound or restored teeth to provide the required minimum 8 reference points, the “Double CBCT” technique can

be employed. This procedure consists of an initial impression of the patient. Then, radio-opaque gutta percha markers are positioned on the tray. The patient then wears this tray intraorally during the second CBCT. Thus, there are two separate CBCTs, one of the gutta percha marked tray extraorally and one of the marked tray intraorally – hence “Double CBCT”. This process ensures a precise fit in those cases where the numbers of sound tooth reference points are limited.

Once the dicomLAB Dental SMART Guide center has prepared the case, the operator receives a notification e-mail or text. This is typically within approximately 4 hours after successful data upload. The practitioner then downloads the patient data to the practice computer on which the Smart Guide software has previously been installed. It is now possible to plan the optimal positioning (location, angulation, depth, and diameter) of the implant, considering the implant properties (length, diameter, and shape) as indicated above. Figs. 4, 5, 6, 7, 8



Fig 6 Panoramic view of the planned implant in the smart guide software



7 Zoomed in view of the planned implant in the Smart Guide Software



Fig 4 Planned with OV view

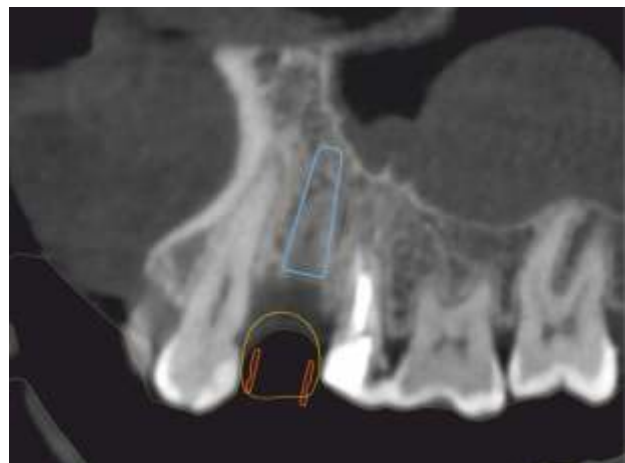


Fig 8 Zoomed in view of the planned implant in the smart guide software

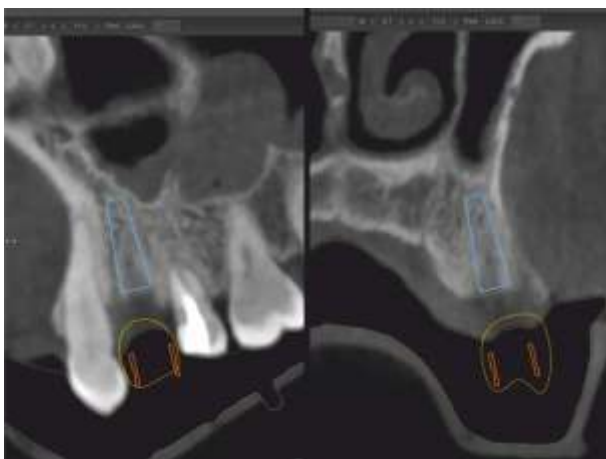
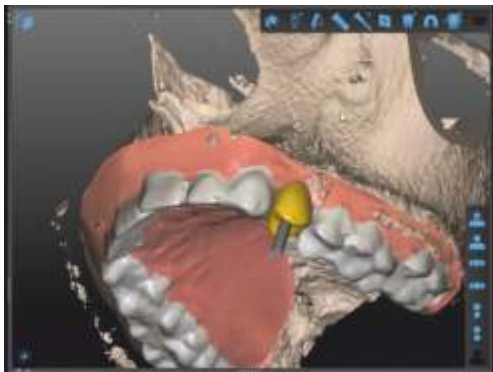


Fig 5 Planned with OV view and MD view

In the current example, the replacement of the earlier extracted left upper first premolar with an implant and an implant-borne crown are demonstrated. The software makes it possible to visualize the bone, the soft tissue, and the intraoral impression taken of the

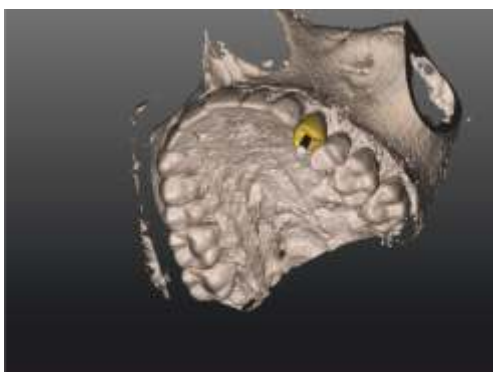
patient. The software then suggests a crown shape, which assists with the planning of the implant angulation and the ideal emergence profile of the restorative crown. The recommended shape considers the anatomical properties of the adjacent and opposing teeth and the soft tissue condition. In cases where screw-retained crowns are planned, this process is essential in ensuring the proper location for optimal angulation and access of the retention screw. Figs. 9, 10, 11, 12



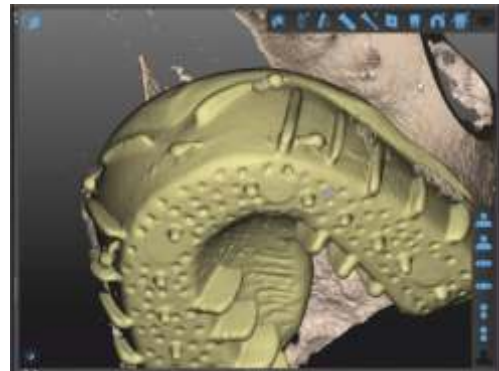
9. Digital tooth setup visualization in the SMART Guide Software



10. Implant for fractured #24 planned



11. Planned implant in the 3D Visualization in the SMART Guide Software



12. SMART Impression tray visualization in the SMART Guide Software

Once the planning phase is completed, it is possible to ask for a treatment plan review by a contracted expert implant specialist within the SMART Guide System who is able to mentor the practitioner. This approach offers confirmation of treatment approach and direction prior to beginning any surgical steps. For those who are less experienced in treatment planning, this is an invaluable and highly protective service. A comprehensive “Preplan Service” (that begins immediately after data uploading) is also available.

In all cases, however, the final decisions are always in the operator's hands. Further planning and modifications are always possible before the SMART Surgical Guide is ordered.

A short time after it is ordered, the printed surgical guide arrives at the practice. It is a good idea to sterilize it in an autoclave. Along with the printed surgical guide, the operator is provided with a specific surgical protocol which matches the planned implant. Figs. 13, 14, 15, 16, 17, 18, 19



13. First preview picture of the case in SMART Cloud



14. Second preview picture of the case in SMART Cloud



17. The surgical guide after arrival



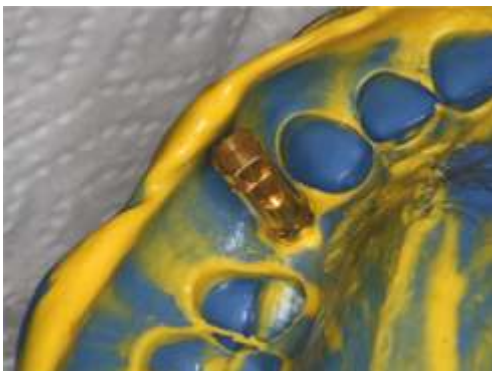
15. SMART Guide Surgical Protocol



18. The surgical guide after sterilization



19. The surgical guide in the patient's mouth



16. Abutment in the model

During the actual implant placement surgery, the sequence that is suggested on the attached drilling protocol chart should be followed. The Surgical Kit of the SMART Guide System consists of 20 mm, 24 mm and 28 mm long, each with a diameter of 2,0; 2,5; 3,0; and 3,5. Figs. 20, 21, 22, 23, 24, 25, 26, 27



20. Preparation



25. The second drill with its spoon



21. Start long drill



26. Inserting the second drill



22. The first drill goes in with the spoon to stabilize the drill



27. The third drill with the corresponding spoon



23. The first drill with its spoon

The final drilling step is done with the final core drill of the selected implant system, at the proper depth and diameter to ensure perfect implant placement. The final implant drill can also be used without the surgical guide, since the direction and depth of the bone preparation are already pre-established with the SMART guide. The bony housing is already prepared to a size which almost matches that of the intended implant. Figs. 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43



24. Inserting the first drill through the surgical guide after the start drill



28. After the preparation, use the implant drills up to the last drills needed



29. Implant insertion



34. Checking vertical position through the surgical guide with depth control



30. Implant insertion (2)



35. Healing cap insertion



31. Implant insertion (3)



36. Post-OP Panoramic radiograph



32. Implant insertion (4)



37. Healing



33. Implant insertion (5)



38. Healing (2)



39. Implant is exposed



43. The missing #24 tooth replaced using SMART Guide



40. Abutment

The SMART Guide Technology offers a versatile implant placement guidance system that can be adapted to most implant brands and types, making implant surgery patient-centered (rather than product-centered), more predictable, and more efficient.



41. Abutment inserted



42. Before the final step

Bioactivity in Restorative Dentistry: A User's Guide



Dr. Fay Goldstep (Canada)

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Introduction

The word “bioactivity” is one of the latest buzz words in the dentistry. It is highlighted as a feature in many restorative products with different and conflicting claims. This has stirred up confusion and controversy surrounding the concept. This article will attempt to provide clarity for the practicing restorative dentist: What is bioactivity? What are bioactive products? How can they be used to provide the best dental care?

The term “bioactive material” originated with Dr. Larry Hench in 1969. He was looking for an improved graft material for bone reconstruction needed by injured returning soldiers of the Vietnam War. Hench was searching for a material that could form a living bond with tissues in the body. All the available materials at the time were rejected by the body. He developed bioglass (calcium silicophosphate glass), a completely synthetic material that chemically bonds to bone.¹

Hench defined a bioactive material as “one that elicits a specific biological response at the interface of a material which results in the formation of a bond between the tissues and the material”.²

Today there are many different definitions of bioactivity found in the dental literature, dependant on the research and on the researcher. The definition fits the research, whereas it should fit the concept. To achieve clarity of meaning, it is best to go with what can be most easily understood by clinicians and patients alike—the definition found in the dictionary:

Bioactivity: noun—any effect on, interaction with, or response from living tissue

Historically dental materials were designed to have a “neutral” effect on the tooth.³ Many current dental materials are not neutral. They are “active”, not “passive”, participants in the restorative process. New materials are being developed to harness this potential behavior. These are “bioactive” materials. For simplification and clarity in discussing bioactive restorative materials it is best to separate them according to their mechanism of action. There are 3 separate mechanisms that are demonstrated by bioactive restorative materials.

A bioactive restorative material can display one or more of the following actions:

1. Remineralizes and strengthens tooth structure through fluoride release and/or the release of other minerals
2. Forms an apatite-like material on its surface when immersed in body fluid or simulated body fluid (SBF) over time⁴
3. Regenerates live tissue to promote vitality in the tooth

Table 1 lists some examples of bioactive restorative materials by their mechanism of action.

PATHWAYS TO PERFECTION

	MECHANISM OF ACTION	MATERIAL CATEGORY	PRODUCT EXAMPLES
NON-BIO-ACTIVE	INACTIVE FILLING RESTORATION	AMALGAMS	
		COMPOSITE RESINS	
BIO-ACTIVE	REMINERALIZATION	GLASS IONOMERS	<i>SDI – Riva Self Cure, GC – Equia Forte</i>
		GLASS IONOMER DERIVATIVES	<i>Pulpdent – ACTIVA BioACTIVE</i>
		GIOMERS	<i>Shofu – Beautifil II and Flow Plus</i>
	DEPOSITION OF HYDROXYAPATITE	CALCIUM ALUMINATES	<i>Doxa – Ceramir Cement</i>
	PULP REGENERATION	CALCIUM SILICATES	<i>Mineral Trioxide Aggregate (MTA)-based materials</i>
<i>Septodont – Biodentine</i>			Crown and root dentin restorative substitute. Pulpal healing and endo repair

Some examples of bioactive restorative materials by their mechanism of action, bioactivity increasing with each mechanism as you go down. Materials that remineralize, only remineralize. Materials that deposit hydroxyapatite also remineralize. Materials that stimulate pulpal regeneration also remineralize and deposit hydroxyapatite.

MATERIALS THAT REMINERALIZE

Dental decay is the cumulative result of consecutive cycles of demineralization and remineralization at the interface between biofilm and the tooth surface. Oral bacteria excrete acid after consuming sugar, leading to demineralization. Hydroxyapatite crystals are dissolved from the subsurface. Remineralization is the

natural repair process for non-cavitated lesions. It relies on calcium and phosphate ions, assisted by fluoride, to rebuild a new surface on the existing crystal remnants in the subsurface.⁵

Under normal physiological conditions at pH7, saliva is supersaturated with calcium and phosphate ions, making caries progress slow. As the pH is lowered, higher concentrations of calcium and phosphate are required to reach saturation with respect to hydroxyapatite.⁵ This is called the “critical pH”, the point where equilibrium exists and there is no mineral dissolution and no mineral precipitation. The critical pH of hydroxyapatite is around 5.5 and that of fluorapatite is around 4.5. This varies with individual patients. Below critical pH, demineralization occurs while above critical pH, remineralization occurs (Figures 1 and 2)⁴³.

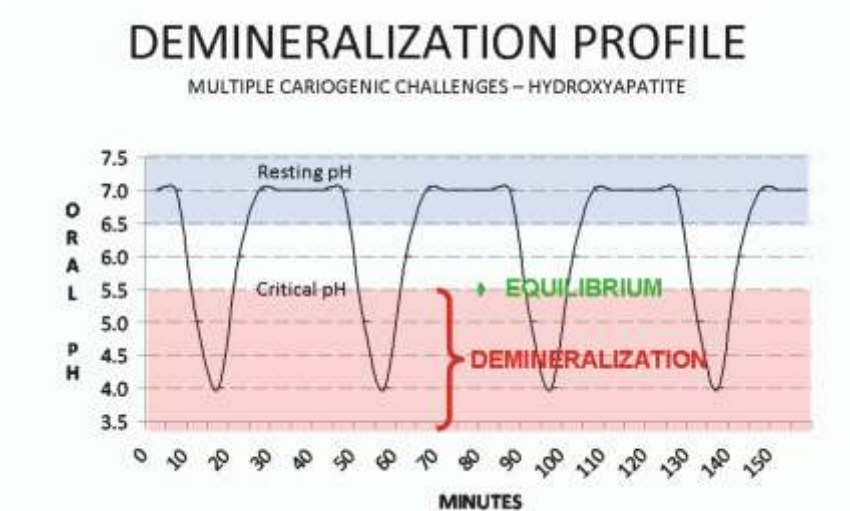


Figure 1 - Cycling of oral pH during cariogenic challenges in naturally occurring hydroxyapatite

DEMINERALIZATION PROFILE

MULTIPLE CARIOGENIC CHALLENGES – **FLUORIDATED** HYDROXYAPATITE

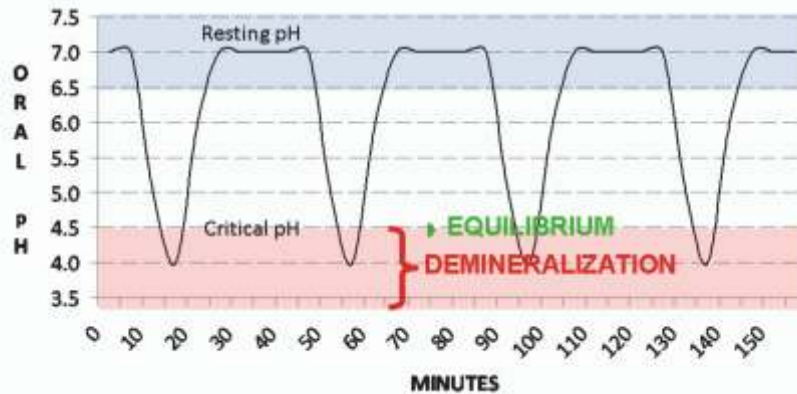


Figure 2 - Cycling of oral pH during cariogenic challenges in fluoridated hydroxyapatite

If fluoride is present in the plaque fluid, it will penetrate the enamel, along with the acids at the subsurface, adsorb to the apatite crystal surface and protect the crystals from dissolution.⁶ This coating makes the crystals similar to fluorapatite (critical pH of 4.5), ensuring that no demineralization takes place until the pH reaches this point. Fluoride present in solution at low levels among the enamel crystals can markedly decrease demineralization.^{7,8}

When the pH returns to 5.5 or above, the saliva which is supersaturated with calcium and phosphate, forces minerals back into the tooth.⁸ Fluoride increases remineralization by bringing calcium and phosphate ions together and is also preferentially incorporated into the remineralized surface, which is now more acid resistant.

The benefits of fluoride are maintained long-term through the mechanism of fluoride reservoirs. Fluoride is retained intraorally after fluoride treatments such as fluoridated toothpaste and fluoride varnish application and is then released into the saliva over time.^{9,10} Fluoride can remain on teeth, mucosa, dental plaque or within bioactive restorative materials. Fluoride retention is clinically beneficial since it can be released during cariogenic challenges to decrease demineralization and enhance remineralization.⁵

When the enamel and dentin no longer have adequate structure to maintain their mineral framework, cavitation takes place and simple remineralization is an insufficient treatment. Tooth preparation and

restoration are now required. Bioactive restorative materials replace dental hard tissues and help to remineralize the remaining dental structures. Glass ionomer cements and their derivatives, such as resin modified glass ionomers, compomers and giomers, fall into this category.

Glass Ionomer Cements

Glass ionomer cements were developed in the early 1970s. They are particularly valuable for caries control in high caries risk patients and in areas where location or isolation create restorative challenges (Figure 3).



Figure 3 - Examples of glass ionomers, Riva Self Cure (SDI) and Equia Forte (GC). These are bioactive materials that remineralize

Glass ionomers have a true chemical bond with dental tissue. They encourage remineralization of the surrounding tooth structure and prevent bacterial microleakage through ion-exchange adhesion with both enamel and dentin.¹¹ A new, ion-enriched layer is created at the tooth-glass ionomer interface. This layer contains phosphate and calcium ions from the dental tissues, and calcium (or strontium), phosphate and aluminum from the glass ionomer cement.¹¹ The remineralization process creates a harder dentin surface (Figure 4).^{12, 43} Restoration fracture is usually cohesive, leaving the ion exchange layer firmly attached to the cavity wall. The dentinal tubules are sealed and protected from bacterial penetration.¹³

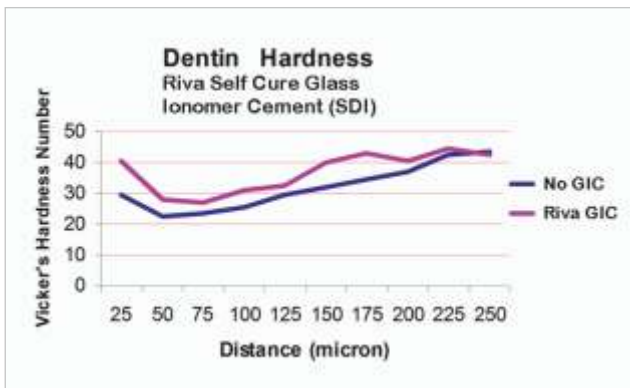


Figure 4 - Glass ionomers create an ion enriched harder dentin surface adjacent to the glass ionomer surface

To eliminate the physical property disadvantages of glass ionomers and harness their remineralizing benefits, dental researchers have produced an assortment of glass ionomers derivatives: resin modified glass ionomers, compomers and giomers.

Two product lines in this category are: Activa BioACTIVE Restorative (Pulpdent, Watertown, MA) (Figure 5) and the Beautifil giomer family of restorative materials including Beautifil II and Beautifil Flo Plus (Shofu Dental, San Marcos, CA) (Figure 6). Studies have shown ACTIVA's remineralization potential through fluoride release and recharge and calcium release.^{14,15} Giomers are used in restorative dentistry as equivalent to composite resin, in all their applications.



Figure 5 – Activa BioACTIVE Restorative (Pulpdent) is a bioactive restorative material that remineralizes



Figure 6 - The Beautifil giomer family of restorative materials including Beautifil II and Beautifil Flo Plus (Shofu Dental) are bioactive restorative materials that remineralize

Giomers

Giomers represent the hybridization of glass ionomer and composite resin properties: the fluoride release and recharge of glass ionomers and the esthetics, physical properties, and handling of composite resins.¹⁶

The giomer concept is based on PRG (Pre-Reacted Glass) technology: a glass core, surrounded by a

glass ionomer phase enclosed within a polyacid matrix. Studies show dentin remineralization occurs at the preparation surface adjacent to the giomer.¹⁷ Gionomers, through the creation of fluoride reservoirs, release and recharge fluoride efficiently, significantly better than compomers¹⁸ and composite resins, although not as well as glass ionomers.¹⁹ The clinical performance of gionomers has been tested against those of hybrid resin composites. Gionomers have been found to compare positively for all criteria.²⁰

MATERIALS THAT DEPOSIT HYDROXYAPATITE

Some bioactive materials not only remineralize by adding minerals to tooth structure but also create an apatite-like material on their surfaces when immersed in body fluid or simulated body fluid (SBF) over time.⁴ There are 2 chemical classes of these bioactive restorative materials: calcium silicates and calcium aluminates.^{21,22}

These materials are non-resin based. Both materials set with an acid-base reaction, and produce an alkaline pH after setting. High pH levels (7.5 or higher) appear to stimulate more active and complete bioactivity.⁴

Ceramir (Doxa Dental, Uppsala, Sweden) (Figure 7) is a calcium aluminate material developed for cementation. An in vitro study found that this apatite-forming bioactive cement can occlude artificial marginal gaps. This is beneficial clinically at the margin of the prepared tooth and cemented restoration. It suggests that bioactive dental materials may significantly improve clinical outcomes and longevity of dental restorations.²³



Figure 7 - Ceramir (Doxa Dental) is a bioactive cement that remineralizes and deposits hydroxyapatite

Calcium silicates have also been shown to deposit hydroxyapatite.²³ Even more importantly, they can stimulate the regeneration of live tissue—dentin, pulp, blood vessels and bone.^{24,25,26}

MATERIALS THAT CAN REGENERATE LIVE TISSUE

Some bioactive materials not only remineralize and form hydroxyapatite but also regenerate live tissue. This is crucial in many restorative as well as pulp related treatments. One major example is vital pulp therapy.

The goal of vital pulp therapy (direct pulp capping and pulpotomy) is to treat reversible pulpal injury arising from trauma, caries or restorative dentistry. These injuries destroy the normal tissue architecture at the pulp-dentin interface but can be healed if the wound is properly protected.²⁷

Treatment must maintain pulp vitality and function and restore dentin continuity below the injury through hard tissue bridge formation.²⁸ Optimal quality of this hard tissue bridge is essential to the long-term success of vital pulp therapy.^{29,30} There is a pulp tissue specific response to the capping material and this determines the quality of the dentin bridge.²⁸

Calcium hydroxide products have been used in vital pulp therapy for many years. The ability of calcium hydroxide to promote dentin bridge formation and enhance wound healing is well established.³¹ However, calcium hydroxide has inadequate physical properties and produces poorly formed dentinal bridges containing tunnels.³² This has directed research to seek out new materials for this therapy.

The first of these materials created for practical clinical use was mineral trioxide aggregate (MTA).³³ MTA was originally developed as a root end filling material for apicoectomy procedures and to repair root perforations.³⁴ Indications for use have expanded broadly within restorative dentistry and pedodontics.²¹

MTA is a calcium silicate based material (derived from Portland cement) with high sealing ability and excellent biocompatibility. MTA-based materials

stimulate faster formation of dentinal bridges that are of better quality than those of calcium hydroxide.^{35,36} Since the mid-1990s, MTA has been recognized as the standard in conservative pulp vitality treatments.³⁷

MTA based materials have limitations however:

- long setting time, weak mechanical properties and difficult handling³⁸
- may produce tooth discolouration³⁹
- may contain heavy metals⁴⁰

Much research has followed to build on the advantages of MTA while eliminating most of the disadvantages. One such material is Biodentine (Septodont, Lancaster, PA) (Figure 8). It was formulated by taking MTA-based endodontic repair cement technology, improving its physical and handling properties, and creating a dentin replacement material with significant reparative qualities.



Figure 8 - Biodentine(Septodont) is a bioactive restorative material that remineralizes, deposits hydroxyapatite and regenerates live tissue

Biodentine can be used as a complete dentin replacement material to treat damaged dentin both in the crown and the root with clinical indications that exceed those of MTA and other related Portland cement calcium silicate products.²¹

Biodentine can be used as a:

- cavity base/liner in deep carious lesions
- pulp capping agent in vital pulp therapy (both direct pulp capping and pulpotomy)

- root repair material for perforations, resorptions, apexification and root end filling material in endodontic surgery
- A restorative material to replace missing or defective dentin. It cannot be used to replace enamel.

The advantages of Biodentine over MTA and modified MTA materials include:

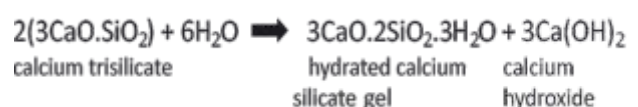
- ease of handling, high viscosity, shorter setting time (12 minutes)
- better physical properties⁴¹
- composition containing raw materials with known degree of purity⁴²
- good colour stability so there is no discolouration⁴³

Biodentine is a tricalcium silicate based material. Its mechanical properties compare to those of dentin and it can be used as a dentin substitute in both the crown and root.^{44,45,46} It stimulates deposition of hydroxyapatite when exposed to tissue fluids.⁴⁷ It is nontoxic as tested on human pulp cells.⁴⁸ Studies have shown complete dentinal bridge formation after 6 weeks in human teeth.⁴⁹

Biodentine provides a hermetic seal that protects the dental pulp by preventing bacterial infiltration. This creates a protected environment where healing can take place. The seal is created through micromechanical retention by infiltrating the dentin tubules as well as by stimulating odontoblasts to deposit dentin.²⁵

It is the calcium releasing ability of pulp-capping materials that induces pulp tissue regeneration. Tricalcium silicate based materials like Biodentine produce calcium hydroxide as a product of hydration.⁵⁰

The calcium silicate setting reaction is as follows:



Calcium silicate in the powder interacts with water, leading to the setting and hardening of the cement. This produces hydrated calcium silicate gel and calcium hydroxide. Calcium hydroxide can now stimulate pulp regeneration within a gel-like material that is strong and not porous; this harnesses the regenerative powers of calcium hydroxide without its physical disadvantages.

Biodentine in vital pulp therapy, through the action of calcium hydroxide in this enhanced physical state, boosts the deposition of reparative dentin by odontoblasts. This creates a dense dentin barrier^{51,52} as well as healing of damaged pulp fibroblasts.⁵³ Clinical results confirm Biodentine's ability to preserve pulp vitality even in very difficult cases. It has the potential to heal pulp, avoiding what may have been inevitable endodontic involvement in the past.

Resin Modified Calcium Silicates

Studies have shown that the presence of a resin matrix modifies the setting mechanism and calcium leaching of calcium silicates.⁵⁴ A partial pulpotomy clinical study compared TheraCal (Bisco, Schaumburg, IL), a light-cured, resin modified calcium silicate base/liner designed for direct and indirect pulp capping, with non-resin containing materials, Biodentine and ProRootMTA (Dentsply Sirona, York, PA). Results showed Biodentine with complete dentinal bridge formation in all teeth. The rates for bridge formation were 56% for ProRoot MTA and 11% for TheraCal.⁵⁵ Normal pulp organization was seen in 66.6% of the teeth in the Biodentine group, 33.3 % of the ProRoot MTA group and 11.1% of the TheraCal group.

The study concluded that the non-resin based partial pulpotomy materials perform better than the resin based materials and present potential for the best clinical outcomes.⁵⁵

Another recent study compared Biodentine with TheraCal with respect to how each of them affect inflammation and regeneration of the pulp in a direct pulp capping in vitro model. TheraCal was shown to increase inflammatory cells and decrease the regenerative processes of the pulp whereas Biodentine did not increase inflammation and supported the regenerative processes of the pulp.⁵⁶

These two studies seem to suggest caution in using resin based materials for vital pulp therapy. Biodentine

has good biocompatibility and bioactivity for use in vital pulp therapy.

Calcium Silicates as Endodontic Sealers

The ability to deposit hydroxyapatite and regenerate live tissue has brought calcium silicate technology into the scope of endodontic sealers. After obturation there is generally contact between the obturating materials and the periapical tissues. The success of treatment greatly depends on the integrity of the obturated seal to prevent recurrent infection of the periapical space.

The introduction of bioactive endodontic sealers has changed the concept of obturated seal from hermetic sealing with inert materials to biological bonding with bioactivity.⁵⁷ The sealer becomes a filler, not only a sealer.

Calcium silicates are well suited to endodontic obturation due to the following properties:⁵⁸

- High pH (anti-bacterial)
- Hydrophilic (use moisture present in dentinal tubules to initiate set)
- Biocompatible
- Do not shrink or resorb
- Excellent seal (bond chemically and mechanically to dentin)
- Ease of use (can be used with many methods of condensation)

And they are bioactive:

- Remineralize hard tissue
- Deposit HA to improve the seal over time
- Regenerate and heal surrounding periapical tissue

BioRoot (Septodont, Lancaster, PA) (Figure 9) has been developed to incorporate these bioactive traits.



Figure 9 - BioRoot (Septodont) is a bioactive endodontic sealer that remineralizes, deposits hydroxyapatite and regenerates live tissue

Research has shown:

Hydroxyapatite formation upon setting reaction—Bioceramic sealers bond to dentin through the process of alkaline etching. This is due to the alkalinity of the sealer. A mineral infiltration zone develops between the dentin and the sealer.⁵⁹

Tissue healing—A study that compared the effects of BioRoot RCS on human PDL (periodontal ligament) cells with the standard zinc oxide eugenol based root canal sealer, Pulp Canal Sealer (Kerr Dental, Orange, CA) showed BioRoot to have fewer toxic effects on PDL cells and it induced greater secretion of angiogenic and osteogenic growth factors. These properties are essential in periapical tissue regeneration.^{60,61} BioRoot also showed excellent biocompatibility when compared with many other contemporary endodontic sealers.⁶²

CONCLUSION

With a bit of simplicity and focus on the essentials of bioactivity in dentistry it becomes clear—bioactivity is now an essential part of the practice of clinical dentistry. Dentists can now harness the potential to remineralize, generate tooth material and heal biological structures for their ultimate objective—attaining the best possible clinical outcomes for their patients.

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Digital Work Flow versus Conventional Approach in Aesthetic Dentistry



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Digital technologies are becoming ever more present in the daily work of dental clinicians, even if sometimes the digital part of the work is done by the dental laboratory using CAD/CAM technology. Nowadays, as dental practitioners, we often ask ourselves which technique we should use—should we trust only new digital solutions or rather stick to conventional, analogue, techniques? In this article, I seek to answer this question by presenting the same case treated in a digital and an analogue way.

Every dental practitioner uses common impression materials; we are used to them, they have passed the

test of time and they appear to be predictable. Therefore, many of us might ask whether digital scanning is reliable and if so which scanner to choose. My colleagues from the Iuliu Hatieganu University of Medicine and Pharmacy in Cluj-Napoca in Romania conducted research on the accuracy of different scanners and milling machines, considering them singularly and in combination (products both from single manufacturers in combination and from different manufacturers in combination; Tables 1–5).¹

Table 1: Precision for various CAD/CAM systems according to product

System kind	Scanner and milling machine (product and manufacturer)	Measurement	Precision (μ)	Median precision (μ)
Complete in-office systems	Lava C.O.S. (3M ESPE)	MVS	46.81	
	E4D (Planmeca)	MVS	85.98	
	CEREC 3MC (Dentsply Sirona)	MVS	102.43	
				78.40
Additive CAD/CAM systems	PM100 dental system (Phenix Systems)	MVS	62.60	
	EOS 3D scanner + EOSINT M 270 (EOS)	MVS	72.60	
	laser sintering (BEGO Medical)	MVS	92.93	
				76.04

System kind	Scanner and milling machine (product and manufacturer)	Measurement	Precision (μ)	Median precision (μ)
Laboratory CAD/CAM systems	Zenotec (Wieland)	MVS	13.78	
	Decim (Dentronic)	MVS	23.00	
	NobelProcera (Nobel Biocare)	MVS	30.78	
	KaVo Everest (KaVo Dental)	MVS	41.50	
	M5 (Zirkonzahn)	MVS	47.26	
	DECSY SCAN (Digital Process)	MVS	49.00	
	CORITEC 250i (imes-icore)	MVS	53.00	
	Lava Is (3M ESPE)	MVS	55.68	
	CEREC inLab (Dentsply Sirona)	MVS	56.10	
	Gn-IMVS		66.80	
	Cerconeye (Dentsply DeguDent)	MVS	66.85	
	Ceramill motion 2 (Amann Girrbach)	MVS	71.31	
	DigiDent (DigiDent Labs)	MVS	75.00	
	CynovadPro 50 (Cybernetic Innovations)	MVS	79.50	
	E4D (Planmeca)	MVS	90.47	
	iTero (Align Technology)	MVS	93.13	
Compartis (Complete Milling Lab)	MVS	114.70		
				60.46

MVS = Medium vertical space

Table 2: Precision for laboratory CAD/CAM systems of different producers

Scanner and milling machine (product and manufacturer)	Measurement	Precision (μ)	Median precision (μ)
TRIOS (3Shape) D900 + RXD5 (Röders)	MVS	19.80	
Dental Wings DW-5-140 (Dental Wings) + D40 (Yenamak)	MVS	29.25	
Lava C.O.S. (3M ESPE) + Mori Seiki (DMG MORI)	MVS	48.00	
TRIOS (3Shape) D900 + Dnm 500 (SMT)	MVS	51.50	
TRIOS (3Shape) D900 + Zanotec (Wieland)	MVS	60.16	
iTero (Align Technology) + E4D milling machine (Planmeca)	MVS	68.50	
Dental Wings 3D (Dental Wings) + DC 40 (Yanadent)	MVS	71.80	
			49.85

Table 3: Median precision according to scanner type

Scanner type	Measurement	Median precision (μ)
Intra-oral	MVS	81.25
Model	MVS	75.32

Table 4: Median precision according to system type

Scanner type	Measurement	Median precision (μ)
In-office	MVS	78.40
Laboratory single brand	MVS	60.46
Laboratory composed	MVS	49.85

Table 5: Median precision and range according to system type

Scanner type	Measurement	Median precision (μ)
In-office	MVS	78.32 (39.60–161.40)
Laboratory single brand	MVS	60.46 (13.78–114.70)
Laboratory composed	MVS	49.85 (19.80–71.80)

Their research found a median precision of 78.40 μ for complete in-office systems, of 76.04 μ for additive CAD/CAM systems and of 60.46 μ for laboratory CAD/CAM systems. When scanners and milling machines from different producers were combined, a median precision of 49.85 μ was obtained for laboratory systems, while complete in-office systems had a precision of 78.32 μ and single brand laboratory systems 60.46 μ . The results of this research demonstrate that the precision is very good no matter which system one uses, that CAD/CAM technology is reliable and that we can count on it in everyday work.

Case report

A 32-year-old female patient came to our clinic for improvement of the aesthetics of her smile. After analysing the initial situation (Figs. 1–4), we recommended veneers on teeth #14 to 23 and ceramic crowns on teeth #15 and 16. To optimise the final outcome, it was decided with the patient to treat this case both ways, analogue and digital.



Fig 1: Initial clinical situation



Fig 2: Initial clinical situation



Fig 3: Initial clinical situation



Fig 4: Initial clinical situation



Fig 6: Functional analysis wax-up



Fig 7: Functional analysis wax-up

Analogue approach

We started with dental impressions taken with common materials. Next, the facebow registration was taken and sent to the dental laboratory together with the impressions. The dental technician then prepared the wax-up and analysed it in an articulator (regarding occlusion and functional movements; Figs. 5–7). The first important observation in this case was the overjet distance. In order to achieve a perfect bite, I would have recommended double veneers (buccal and palatal) from teeth #12 to 22. An analogue approach allows fabrication of double veneers, and it is a common procedure, but a digital approach using a CAD/CAM chair side system does not permit this solution, or makes it complicated (double scanning is necessary and is possible only after cementation of one of the parts of the veneers, palatal or buccal).



Fig 5: Functional analysis wax-up

A mock-up was done, followed by guided tooth preparation through the mock-up in order to have a minimally invasive procedure. Next, we analysed the central incisor (CI) length and ratio, visibility of the anterior teeth in different lip positions (at rest, during smiling and during functional movements), levels of the fixed gingiva and zenith points. If necessary, based on this mock-up, we can perform gingival surgery in order to achieve a highly aesthetic final result.

According to many studies, resin–enamel bonds are reliable and durable. The presence of the enamel at the preparation margin offers a perfect seal against the ingress of oral fluids and bacteria. When the cavity margins are bonded to enamel, bonds to dentine are more durable (even a simplified, more hydrophilic adhesive may survive because of the protective effect of bonded enamel against the diffusion of water across the bonded interface).^{2–4}

The greater the difference between acid solubility of enamel periphery and prism core, the stronger the bond. Resin tags up to 25 μ in length and 6 μ in diameter are formed into microporosities of the conditioned enamel, providing a long-lasting bond by mechanical interlocking (the mean values of tensile and shear stress are 20–25 MPa, higher than

the surface tension after polymerisation shrinkage of the composite resin [16–18 MPa]; Figs. 8–11).^{5,6-8}

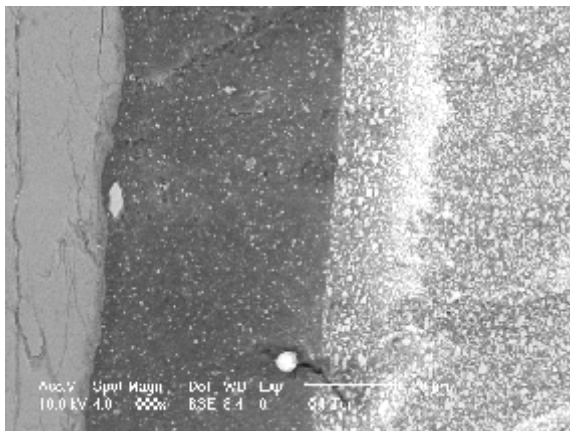


Fig 8: Microscopic views of acid etching of the enamel surface, prisms cut longitudinally and transversally, displaying the three acid etching patterns

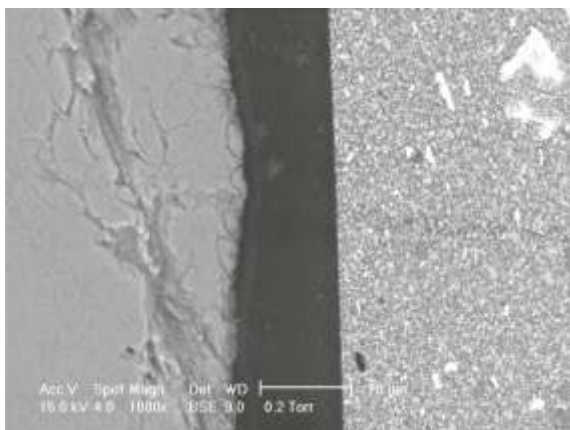


Fig 9: Microscopic views of acid etching of the enamel surface, prisms cut longitudinally and transversally, displaying the three acid etching patterns

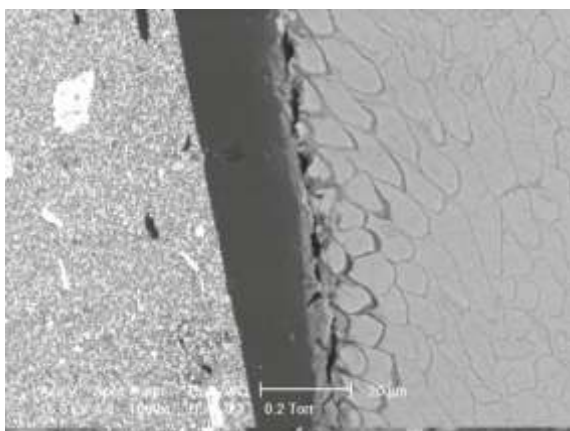


Fig 10: Microscopic views of acid etching of the enamel surface, prisms cut longitudinally and transversally, displaying the three acid etching patterns

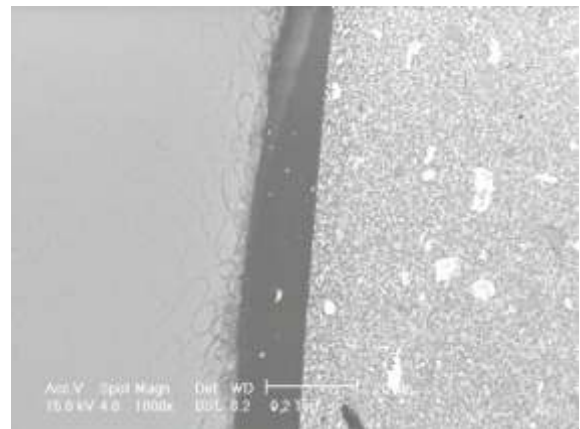


Fig 11: Microscopic views of acid etching of the enamel surface, prisms cut longitudinally and transversally, displaying the three acid etching patterns

While enamel is predominantly mineral, dentine is a vital tissue. Permeability of the dentine depends on the diameter of the dentinal tubules. The smear layer extends 1–10 μ into the initial part of the dentinal tubules. The smear layer is in direct proportion to the grain size of the bur. The smear layer has a weak bond to the underlying dentine. Micro- and nano-leakage phenomena still pose major theoretical and clinical challenges (Fig. 12).^{5, 9–11}

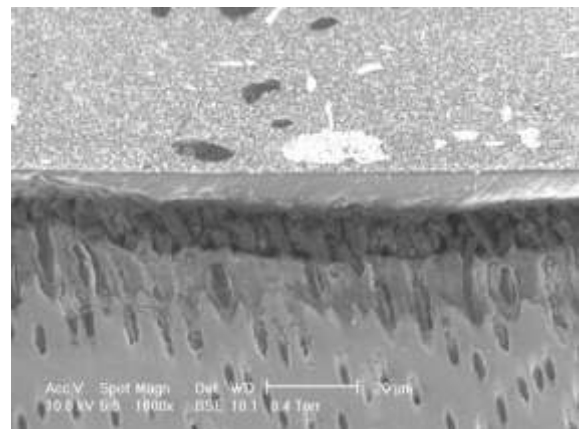


Fig 12: Microscopic view of demineralised dentine and penetration of the hybrid layer into dentinal tubules

Owing to minimal preparation, restricted to the enamel surface, local anaesthesia was not necessary in this case. Vitality of all teeth was maintained. Because of the necessity of closing the overjet, a slightly palatal preparation was performed (Figs. 13–15).



Fig 13: Minimally invasive preparation



Fig 14: Minimally invasive preparation



Fig 15: Minimally invasive preparation

The ceramic preparations were no thicker than 0.5 mm, and because of the minimal thickness of the ceramic restorations, a try-in paste was used in order to determine which cement to use (Figs. 16–19).



Fig 16: Final analogue ceramic restorations



Fig 17: Final analogue ceramic restorations



Fig 18: Final analogue ceramic restorations



Fig 19: Final analogue ceramic restorations

Digital approach

An intra-oral scan of the initial situation was performed (Primescan, Dentsply Sirona) and sent to the dental laboratory. Initially, we planned to scan the wax-up previously prepared in a conventional (analogue) way and to use these references for the final preparations. However, the software of the scanner could not match the teeth from the wax-up model and from the oral cavity, so we had to repeat the scanning and manually prepare the aesthetic modelling. The aesthetic modelling is time-consuming, and this has to be taken into consideration when choosing between a digital and conventional approach. In the digital chairside approach, all work is done in the dental office (Fig. 20).



Fig 20: Digital modelling

If one wants to keep the workflow digital only, a virtual wax-up can be performed as well (3D-printed model), followed by a mock-up and the aforementioned aesthetic analysis. Guided enamel preparation is done through the mock-up in order to conserve as much tooth structure as possible.

Definitive ceramic restorations with a thickness of 0.3 mm were milled. They were sent to the dental laboratory for staining in order to achieve better aesthetics. For a highly aesthetic result, staining or the cut-back technique in the dental laboratory is mandatory. A try-in paste was used in order to observe the transparency of the tooth structure (Figs. 21–24).



Fig 21: Final digital ceramic restorations



Fig 22: Final digital ceramic restorations



Fig 23: Final digital ceramic restorations



Fig 24: Final digital ceramic restorations

Patient's choice

The patient was asked to choose one of the sets of ceramic restorations (Figs. 25–31). From a clinical and technical point of view, both sets of restorations were perfect, both were adapted, functional movements were present for both and both were highly aesthetic. The patient chose veneers and crowns prepared using conventional techniques; her choice was totally subjective, since she did not know which set of restorations had been produced with the digital approach and which with the analogue procedures.



Fig 25: Final results of the analogue and digital approach



Fig 26: Final results of the analogue and digital approach



Fig 27: Final results of the analogue and digital approach



Fig 28: Final results of the analogue and digital approach



Fig 29: Final results of the analogue and digital approach



Fig 30: Final results of the analogue and digital approach



Fig 31: Final results of the analogue and digital approach

Conclusion

Are we able to follow a digital workflow for a major dental rehabilitation? In my opinion, yes; however, some learning is necessary, and in many cases, analogue and digital methods should be combined.

We can conclude the following

Both fully digital and fully analogue treatments are possible and give great aesthetic results, bearing in mind that staining and the cut-back technique is mandatory.

Thickness of definitive restorations can vary between 0.3 and 0.5 mm for both approaches.

Precision is perfect for both approaches.

The double veneer technique is not possible when using the digital approach.

The future belongs to the digital approach certainly. My recommendation is to allow dental practitioners a period of learning in which to integrate digital and analogue methods, to start with minor cases and gradually progress towards fully digital and/or full-mouth rehabilitation.

Anterior Guidance – Watch Your Six!



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A private practitioner in Pune since 2001. He is a post-graduate in clinical dentistry from the prestigious King's College London Dental Institute. His focus in clinical practice includes advanced restorative work and aesthetic dentistry with direct composite restorations, full mouth rehabilitation and conservative occlusal therapy. He is an accredited member of the Indian Academy of Aesthetic & Cosmetic Dentistry. He has also completed the core curriculum of The Dawson Academy (USA) that deals with the concept of 'Complete Dentistry'.

Watch your six!

'Watch your six' is a commonly used phrase with armed personnel going about their job. It implies that one should not only concentrate on what's happening in front of their eyes and overlook what's happening behind their back as it may prove to be even more dangerous by catching them unawares.

The analogy fits perfectly with a dentist at work in the aesthetic zone. While he/she is creating beautiful masterpieces of art by means of composites and ceramics on the visible aspect of teeth, if the palatal contours get even slightly neglected, it may prove to be disastrous as far as long term prognosis of the restorations is concerned. Indeed, the implications may not remain restricted to damage to anterior restorations but may be far reaching as we will understand further in the article.



Fig 1: Ceramic veneers



Fig 2: Occlusal marks on palatal surfaces

Although inconsequential with respect to aesthetics, the palatal surfaces of maxillary anterior teeth play a vital role in the overall occlusal scheme of the patient. It is essential to understand this very significance via the concept of Anterior Guidance.

What is anterior guidance?

Anterior guidance is one of the features of the masticatory system that governs/guides the mandibular movements by means of contact between lower incisal edges to palatal surfaces of upper anterior teeth

It is the anterior determinant of mandibular movements; the posterior being the slope of the articular eminence (Condylar guidance). These two determinants guide the mandibular movements initiating from maximum intercuspation to all excursive movements viz. protrusion and right and left excursions. The guidance is called incisal guidance and canine guidance when it pertains to protrusion and lateral excursions respectively.

The clinical picture of anterior guidance:

Incisal guidance: It is clear from the terminology that incisal guidance is provided during protrusive movement of the mandible when the incisal edges of the lower incisors slide against the palatal surfaces of the upper anteriors.

Ideally, all four lower incisors should be in continuous and simultaneous contact with the palatal surfaces of the upper anteriors to achieve perfect incisal guidance. This enables equal distribution of forces to all anteriors thereby minimizing the trauma to the PDL and bone.

How to check incisal guidance:

The patient is asked to bite in maximum intercuspation position with an articulating paper between the anterior teeth and then asked to protrude the lower jaw without opening it, just by sliding it forwards. The clinical picture would be as shown in fig. 3

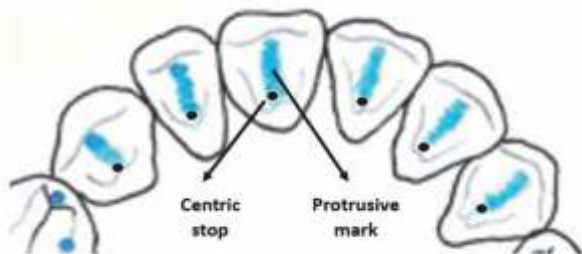


Fig 3: Protrusive occlusal markings

How to check canine guidance:

The patient is asked to bite in maximum intercuspation and then to perform the right and left excursive movements. The clinical picture would be as shown in fig. 4

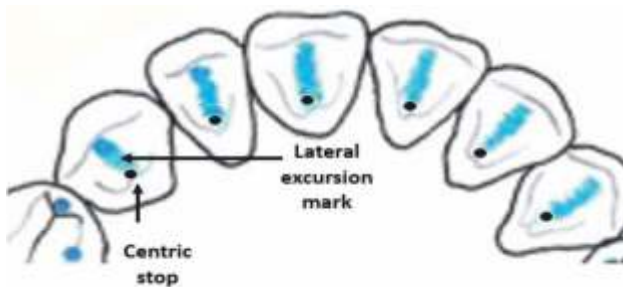


Fig 4: Canine guidance marking

Why do we need anterior guidance?

It is very well known that the functions of anterior teeth apart from incising food are speech and aesthetics. A less appreciated but probably the most important role that the anterior teeth play is that of protecting the

posterior teeth during all excursive movements of the mandible. This happens due to the anterior guidance that creates separation (disclusion) between the posterior teeth in all excursive movements. The disclusion protects posterior teeth from shear forces (tipping forces) in horizontal direction.



Fig 5: Posterior disclusion during protrusion



Fig 6: Posterior disclusion during left lateral excursion

Such forces are extremely detrimental to teeth. They inflict damage to the tooth structure and also to PDL and bone. The damage to teeth is manifested as tooth surface loss in the form of attrition and abfraction. Cracked and fractured teeth can also result from shear forces. Bone loss, mobility and migration of teeth are known to be the manifestations of traumatic occlusion. Tooth surface contact during horizontal jaw movements is the most common mode of trauma from occlusion. Restorations, crowns and implant prostheses are affected in a similar manner as natural teeth as well.

Posterior tooth contact during excursive movements is also thought to be a trigger for elevator muscle hyperactivity that may result in orofacial or myofascial pain.

Thus, posterior disclusion is beneficial for long term stability of the masticatory system including all its components.

The clinical picture of disclusion during excursive movements is depicted by the lack of linear marks on the occlusal surfaces of posterior teeth when the articulating paper is held between the posterior teeth while the movements are being done.

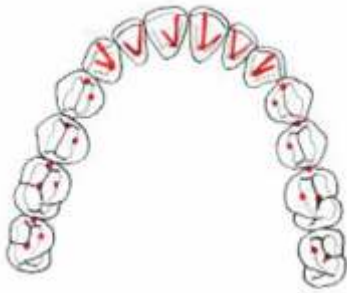


Fig 7: Perfected anterior guidance with no linear marks on posterior teeth

The occlusal scheme wherein the anterior guidance brings about complete posterior disclusion is called as a 'Canine protected occlusion'. If any of the posterior teeth contact during excursions those are called interferences or if most of the posterior teeth contact, it is called a 'group function occlusion'.

Anterior guidance and aesthetic restorations:

These are following possibilities when one is restoring the meeting surfaces of anterior teeth if the contours are not adjusted to get perfect anterior guidance:

1. One or some of the teeth may be subjected to additional untoward forces if they become the only teeth to contribute to anterior guidance.
2. If a clinician decides to keep the restorations in infraocclusion for the want of minimizing the functional load on them the occlusal scheme changes from mutually protective to an interfering one.
3. On the flip side, a clinician may be in a position to potentially improve the existing occlusal scheme from an interfering one to a protective one if he/she designs the palatal contours so that they start having

continuous and simultaneous contact with the lower incisal edges and the canines bring about posterior disclusion in lateral movements.

Managing the forces on anterior restorations:

1. Elimination of guidance from Isolated critical restorations:

Situations like a single Class IV restoration, a single ceramic veneer, a structurally compromised tooth with post-core restoration or a single implant need to be managed by sparing these teeth from contact as far as anterior guidance is concerned. It is advisable that such restorations are contoured in such a manner that they occlude in maximum intercuspation but the area below the centric stop is slightly under-contoured so that they are spared of the guiding force. Clinically, there won't be any linear mark with articulating paper when the patient performs excursive movements.



Fig 8: Class IV restoration



Fig 9: Single ceramic veneer

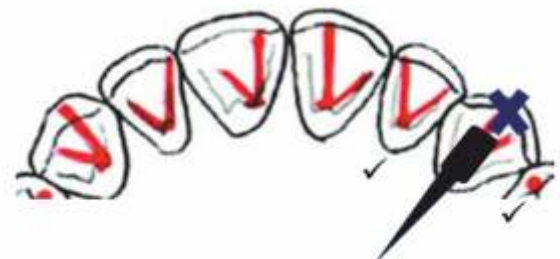


Fig 10: Structurally weak tooth



Fig 11: Single isolated implant

2. Uniform distribution of guidance for multiple restorations:

As the number of restorations in the anterior segment increases, it is easy to distribute guidance across the teeth. It ensures that none of the teeth are overloaded and at the same time there is posterior disclusion.

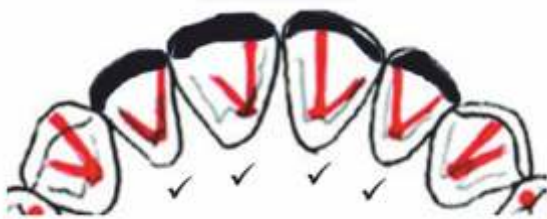


Fig 12: Multiple veneers

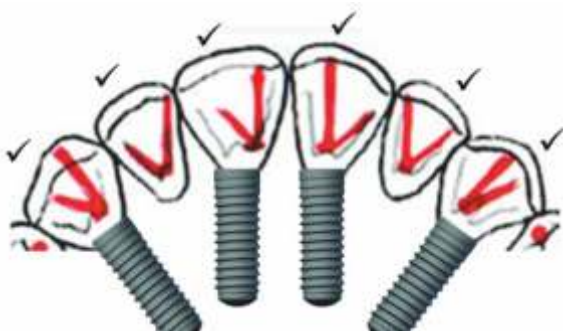


Fig 13: Multiple implants

Therefore, meticulous attention needs to be given while altering the meeting surfaces of anterior teeth. Aesthetic recontouring can also present an opportunity to improve the longevity of posterior teeth and restorations by providing perfected anterior guidance.

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Conclusion:

Anterior guidance is one of the most important factors for occlusal stability and thereby the durability of dentition and restorations.

The Value of Value



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Introduction

The smile is an important facial expression for a human being to transmit emotion and feelings. Restoring a tooth is extremely important not just to reestablish function but also to reestablish the social health of the individual. One of the many ways to restore anterior esthetics is composite resins. However, direct composites can be technique sensitive and challenging, shade matching being the greatest challenge³. However there is not an exact solution to the problem of matching the color of restorative materials to that of the dentition⁴. By understanding the refractive index of composites and analyzing tooth structures, dentists can achieve predictable composite restorations that replicate the optical properties of natural enamel and dentin structures.

Color

“Color is defined as the property of producing a visual perception as a result of the way an object reflects or emits light.” Color in dentistry is usually defined using shade guides based on the 1898 theory of American Painter Albert Henry Munsell, which Dr. Clark applied to dentistry in 1930⁵. Color can be specified based on three color appearance parameters, also known as the three color dimensions: Hue, Chroma and Value (lightness).

Hue

It is the visual perception of stimuli of a wavelength. The main pure hues also called primary colors red, blue and yellow. The mixtures of these generate secondary colors. The mixture of primary and secondary colors create tertiary colors. In VITA shade Guide A (reddish-brown), B (reddish-yellowish), C (greyish), D (reddish-grey) determine the hues. (Figure 1)



Fig 1

Chroma

It is the intensity or saturation of a color. Thus lower chroma indicates less intensity of the color, while higher chroma is more related to a vivid color. In VITA shade guide the number 1 – 4 depicts the level of chroma. 1 determining the low chroma and 4 determining high chroma. A1, A2, A3 etc determine the chroma. (Figure 2)



Fig 2

Value

It is also known as lightness or darkness of a color. Thus it indicates the amount of light that is reflected. (Figure 2) This parameter is the most important parameter while restoring esthetics.

Having understood these three parameters it still is not an easy procedure to completely match the shade of the tooth since teeth are highly calcified complex crystalline structures.

Understanding the natural tooth

Enamel and dentin have different structural characteristics and consequently, they exhibit different light wave characteristics. Due to its highly mineralized prismatic structure, low organic content and a small amount of water, enamel has a higher transmission of light than dentin; dentin has less mineral content, an organic tubular structure, higher water content and is less translucent⁶. The degree of enamel translucency depends on the enamel thickness, which affects the value of the tooth. In natural teeth, value or brightness characterizes enamel, while the chroma and hue characterizes dentin.⁷⁻¹⁰ Young people who are less exposed to damage caused by acids in the diet and by brushing have thicker enamel than older people and consequently, lighter teeth. While wear decreases the thickness of enamel, the translucency of enamel increases, enabling the chroma and hue, which are features related to dentin, to become more obvious. Thus, during the interaction of light with dental tissues, enamel plays the important role of acting as a filter whose greater or lesser thickness accounts for more or less bright teeth¹¹. So we can state that the tooth is a

polychromatic structure and its appearance is a combination of enamel's reflectiveness and translucence, plus the Chroma and hue of the dentin. The restorative composite materials should demonstrate optical properties similar to those of dentin and enamel.^{3, 12-14} Enamel being the most important, as it covers the dentin and thus the translucency and refractive index of composites should closely approximate to that of the tooth. In an attempt to mimic these optical properties of the natural dentition composites shades have been introduced with different opacities and translucencies. They are usually divided into 4 categories. Dentin, body also called as universal, enamel and translucent.(Figure 3)

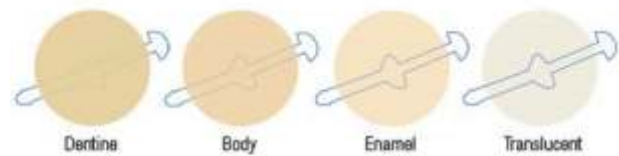


Fig 3

The basic difference between these type of resins is the translucency. The dentin shade is highly opaque, body is lesser opaque than dentin and slightly more translucent. Thus these two shades are used in the deeper layers to mimic opaque dentin. The enamel and translucent composites are used on the superficial layer to substitute enamel. Also the refractive index of natural enamel is 1.62, while the refractive index of composite material is 1.5 which is close to glass. This present problems while managing the relationship between translucencies and value, because increasing material thickness lowers value, while the behavior of enamel is completely opposite¹¹. So the superimposition of these different composites in an orderly fashion will lead to giving similar optical properties of the tooth, hence the need of stratification of composites.

Stratification

Layering is paramount because dentin shades and light properties differ in composites versus real dentin. This is also true for enamel shades. Basically, you have dentin and enamel discrepancies between composites and real teeth in addition to the discrepancies that exist between dentin and enamel.

Precision will impact the final appearance of the tooth, so it's important that you layer composites to get around these discrepancies. The composite materials selected should match for value before chroma and chroma before hue. Because final value is a blend of the individual values of every composite layer, you must consider that each layer is not going to be representative of your intended value. They build on one another to create life-like reflectiveness and translucency.

A number of different stratification techniques for composites have been advocated in the literature.¹⁵ Besides the monochromatic technique all other techniques involve the use of not only chromatic shades but also translucent shades to match the final value of the tooth, thereby giving a natural seamless appearance of the restoration. Studies have shown that to maintain control of the value the thickness should not exceed more than 0.6mm even though the actual enamel may be of greater thickness.

Case report

Presenting a case of a young girl, 18yrs of age, entered the clinic with a fractured central incisor. (Figure 4). On clinical and radiographic examination, tooth number 21 represented Class 4 fracture involving the pulp. Thus the treatment decided was to do endodontic treatment of the tooth followed by a direct composite resin restoration as the most conservative option. During the endodontic treatment an impression was made and was then sent for mock up (Figure 5) to follow the bucco-palatal technique for layering. After the endodontic treatment was completed, the first step to follow was shade selection. The shade selection involved the button technique in which small equal increments / buttons of composites were placed on to the tooth and cured and the desired shade of appropriate opacities was selected for layering (Figure 6).



Fig 4



Fig 5



Fig 6

An important point to remember here is to select the shade before isolation. This is because isolation will cause dehydration which will then change the value of the tooth and can affect in the shade selection. The tooth must be moist while doing the shade selection. Isolation was then achieved with the help of a rubber dam, as the success of composites depends on the moisture control¹⁸ (Figure 7). To achieve seamless restoration it is imperative to have long bevels¹⁹⁻²¹, thus the choice was to go for a direct veneer (Figure 8). A two-step total etch protocol was followed with 37% phosphoric acid for 30 seconds and thoroughly rinsed with water (Figure 9). Universal bonding agent was applied and air dried for 20 seconds and cured (Figure 10). With the help of a putty index (Figure 11), the palatal shell was created on the putty using the selected enamel shade (Figure 12). This putty was then placed onto the tooth flushed with tooth and then cured. A thin palatal shell was then achieved (Figure 13). Here the histologic layering protocol is followed so different opacities of composites were layered one above the other. The sectional matrices were then placed mesially and distally (Figure 14). The concave design of these matrices makes it easier for the practitioner to build up the proximal walls. These walls were made using the same enamel shade (Figure 15). The opaque dentin shade

was then placed in the internal layer to mimic the dentin and cured for 20 seconds (Figure 16). Over which the universal shade was placed and cured (Figure 17), making sure not more than 0.6mm space is left for the final enamel layer. The last step was to place the value shade i.e the enamel shade to match the value of the tooth (Figure 18). The buildup of the tooth was complete but no composite restoration is complete without finishing and polishing procedures. Gross finishing and secondary anatomy was achieved with the help of discs in a step-wise protocol from coarse to extra fine (Figure 19).



Fig 7



Fig 8



Fig 9



Fig 10



Fig 11



Fig 12



Fig 13



Fig 14



Fig 18



Fig 15



Fig 19



Fig 16



Fig 17

The tertiary characteristics were then achieved with red-grit bur using a contra-angled handpiece on a micromotor. As symmetry was achieved final polishing was done using a series of buffs along with polishing pastes (Figure 20). On the same day the natural tooth was completely dehydrated (Figure 21) and so the value changed of the natural tooth but not of the restoration (Figure 22). Thus the restoration seemed gray as compared to the adjacent central incisor. The patient was recalled after 3 weeks for the final shade. After 3 weeks as the tooth regained its original value (Figure 23), the restoration and the tooth now looked completely identical. Thus it is imperative to match the value more than the hue or chroma to give lifelike restorations. A few esthetic pictures depict the surface anatomy and textures that were achieved and maintained (Figure 25, 26).



Fig 20



Fig 21



Fig 22



Fig 23



Fig 24



Fig 25



Fig 26

Conclusion

A dentist combines art and science to replace the natural function and appearance of a human tooth. The success of this procedure is based on how well it replicates the natural dentition in terms of appearance and longevity. Manufacturers of composite systems strive to duplicate the manner in which light interacts with enamel and dentin. Some systems consist of one resin to replace both the dentin and enamel layers, whereas other systems have separate resins for each layer. The color of a tooth is multifaceted because of the complex interaction between light waves that reflect, scatter, and refract differently in each of the enamel and dentin layers.¹⁷

The human eye can detect subtle changes in value more readily than any other color dimension. Visible light falls between 380 and 770nm on the

electromagnetic spectrum. There are approximately 6 million light-sensitive cone cells (which perceive color) and 125 million rod cells (which perceive black and white). 16 Rod cells outnumber cone cells 20:1, which explains why the human eye can detect changes in lightness and darkness (i.e. black and white) more readily than variances in hue or chroma. This also explains how visual tension can easily be sensed when the value of a restoration and the adjacent tooth structure are inconsistent.

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Microscope Assisted Restorative Dentistry



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Restorative dentistry is an integral part of our daily clinical practice. Removal of the diseased tooth structure should be and always our primary objective. However this is not to be performed at the expense of remaining non carious tooth structure. So we should always intend to conserve most of the tooth structure that will make the tooth last.

Magnification has opened new horizons in dentistry. Its use in endodontics is commendable. We, as restorative dentists, spend most of our practice time replacing existing, failing restorations.

The key to a successful composite restoration is healthy tooth structure to bond to and good bonding technique. Good, healthy tooth structure seems fundamental to bonded restorations but without the high magnification and excellent visualization provided by the dental operating microscope there can often be errors of omission.

Working with a microscope allows more conservative cavity preparations, more precise insertion of restorative materials, better finishing of restorations, and a more precise diagnosis of carious lesions and of old restorations that need to be replaced.

Let's see and insight as to what does microscope offer in restorative dentistry.

1. Use of smaller instruments

With the help of magnification we are able to use small

size rotary instruments that precisely remove the caries without cutting the healthy enamel. Bonding to enamel in restorative dentistry is prime. Microscope aids in selectively removing the caries without cutting excessive enamel (Fig. 1).



2. Preserving the vitality

Few cases have caries that has progressed very close to the pulp. In such cases magnification helps us in slow and careful removal of the decay without exposing the pulp (Fig. 2).



3. Preventing over etching of dentin

Enamel has more inorganic content than dentin. The use of total etch technique can have deleterious effect on dentin and the patient can complain of post-operative pain or sensitivity. Therefore it is recommended that we selectively etch the tooth by placing the etchant on the enamel only and then etch the dentin later. To achieve this, magnification helps in placing the etchant precisely over the enamel leaving no room for the dentin to get over etched (Fig. 3).



4. Controlled layering of each increment

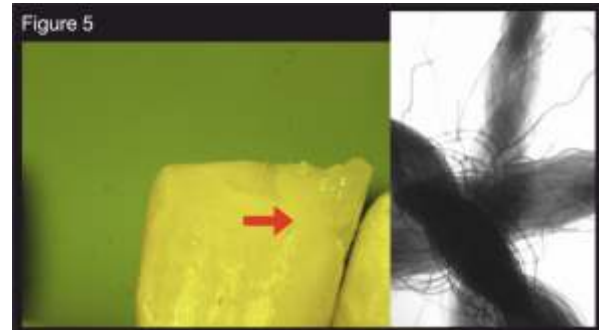
Aesthetic layering of composite for anterior cases required precise placement of the dentin and enamel shades. Excessive placement of dentin shade makes the restoration opaque and excessive placement of enamel shade makes the restoration look dull. So it is imperative we have ability to rightly place the appropriate shades in a controlled thickness. Microscope gives us that ability. It helps us to judge the right amount of shade that has to be placed and gives us a restoration that looks aesthetically brilliant (Fig. 4).



5. Removing impurities

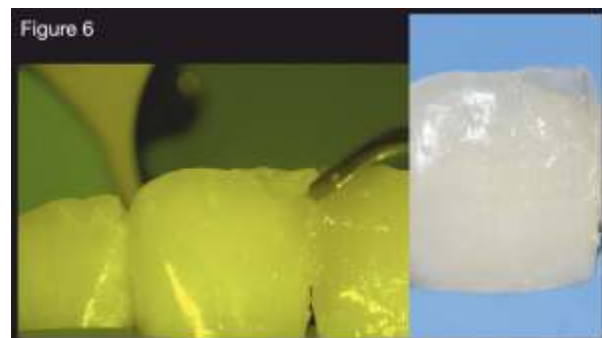
The naked eye gives us a resolution close to 200 micron, whereas with microscope we get a resolution of 10 microns. With this higher magnification we are able

to identify any impurities that come during the restorative process like dust, fibres etc. Any of these impurities, if left behind can hamper the integrity of the composite restoration and can lead to failure (Fig. 5).



6. Restoring small cavities

When restoring small angle build ups or fractures it's practically impossible to place the respective increments in such a small area with the naked eye. Microscope helps in judging the thickness of each increment which provides us with a perfect aesthetic restoration (Fig. 6).



7. Shape creation

As it is rightly said in restorative dentistry, "shape is shade", microscope helps us in creating those perfect anatomies in any restoration. So the line angles, grooves, etc can be very precisely made (Fig. 7).



8. Lustre creation

A well finished and polished restoration is necessary for it to last. A well-polished restoration is also plaque repellent. Microscope helps us in achieving that perfect lustre to create a long lasting restoration (Fig. 8).



Like any technology there is a learning curve where training and application are essential. Obviously there is a financial investment, but there is also an investment and commitment to be the best you can be, provide the best dentistry you can provide for you and your patients. In restorative dentistry, as well as all aspects of dentistry, no magnification or low magnification can easily lead to errors of omission due to lack of complete information. The dental operating microscope goes a long way towards handling this insufficiency of information and the potential sequelae.

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Implant Aesthetics with Trajectory Correction



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Introduction

Dental fractures are commonly observed with other oral injuries. Traumatic injuries of teeth are the main cause of emergency treatment in dental practice.¹ These occurs most commonly in young patients, and varies in severity from enamel fractures to avulsion.² A variety of traumatic conditions can cause dental fractures. Some of the predominant causes include: falling while playing and running, during sports activities, and blows received on the face. Of all, maxillary central incisors are most vulnerable to injury, sustaining approximately 82% of all dental injuries, followed by the maxillary lateral and the mandibular incisors. Fractures to the maxillary teeth are distributed among the central incisors (64%), lateral incisors (15%), and canines (3%).¹⁰ Early recognition and management of these conditions can improve tooth survival and functionality.

When trauma causes dental fractures leading to missing tooth/teeth, a range of options are available such as a removable partial denture, a bridge and a dental implant. The employment of implant-supported crowns and bridges has become a well-established and preferred approach in replacing missing teeth³. Implant dentistry has shown remarkable advancement in past few years and is predominantly being practiced due to its longevity and high clinical success rates. With this progress in the past few years, implant dentistry has witnessed challenging issues concerning the materials and designs related to implants as well as implant abutments regarding achieving maximum clinical success rates².

The two different types of prosthetic restorations fixed on dental implants are screw retained and cemented restorations. Retrievability is the main advantage of screw -retained crowns making it more favourable to many clinicians¹⁰. It allows better control on the hygiene of implants and surrounding mucosa, also crowns can be easily repaired in case of crown fracture. But for the use of screw retained restorations an ideal emergence of screw access hole, a favourable implant position is mandatory⁵.

An unfavourably placed implant results due to an improper positioning or tilting of implants such as to avoid sensitive anatomical structures, or implants placed on best available bone width in the arch which make them out of line⁶. Therefore, it is said that the implant-supported prosthesis planning should start way before the implant placement surgery or even the choice of the implant itself. This is the concept of reverse planning.

Achieving favourable implant position may not be possible when there are deficiencies in the ridge's anatomy. To compensate for ridge topography that is less than ideal or unfavourable, the clinician can follow several scenarios to result in successful placement of implants. Few options available for treating off-angled implants are - performing bone manipulation, using a custom abutment, giving a cement retained crown and using an angulated screw channel technology. Current bone manipulation techniques include inlay and onlay grafting,

guided bone regeneration (GBR), bone expansion, bone splitting osteotomy. A better solution for this scenario, where the grafting surgery can be avoided, would be using an angulated screw channel technology which tilts the prosthetic screw access hole emergence in a desirable direction that is more esthetic and acceptable and onto which a screw retained prosthesis can be given. This article presents a case where a missing maxillary central incisor, resulted by trauma, was replaced using Dynamic abutment solution's angulated abutment.

Case Report:

A 28-year-old healthy male patient presented to our clinic, with concern about replacing his missing maxillary central incisor. The patient gave a history of trauma that resulted in the fracture of anterior tooth 11. The patient desired for a fixed and permanent replacement for his missing tooth and wanted it be esthetically pleasing and long-lasting.

Before the treatment, patient consent form and a thorough history of all the medical conditions were taken systematically, and various medical tests were advised. The patient showed no medical history relevant to his chief complaint and upcoming treatment plan. As the patient desired for a fixed replacement, implant - supported crown replacing the missing tooth was advised and planned.

The importance of bone grafting was emphasized for better implant trajectory for which the patient was reluctant as it involves another surgery and waiting period. Placement of an implant in the trajectory of available bone was done [Figure 1], and good primary stability was achieved. Immediate provisionalization was done with a screw retained crown.



Fig 1 b

The screw access hole was emerging at the labioinciso angle which was sealed with a composite resin. The primary purpose of provisionalization was to avoid social embarrassment and creating an emergence profile as replacement was to be done in the esthetic zone.

After 3 months of successful tissue healing, final impressions of the implant along with the opposing arch were made, and casts were poured to obtain the implant level. An optical scanner was used for scanning these poured casts to acquire the numerical models.

As the implant placed in this case had labial inclination, the screw access hole would emerge labially causing unesthetic profile [Figure 2].



Fig 1 a



Fig 2

The needed angulation correction was determined using the CAD software which came out to be 25 degrees [Figure 3].



Fig 3

The CAD software allows the screw access of implant to be virtually moved more favorably to palatal side using DAS (Dynamic Abutment® Solutions) library. The virtual stereolithography file was sent for milling, and the CAM process fabricated the angulated screw channel. This was layered with emax ceramic layering material and later the entire unit was luted with resin cement onto the dynamic Tibase before delivery of the final prosthesis [Figure 4].

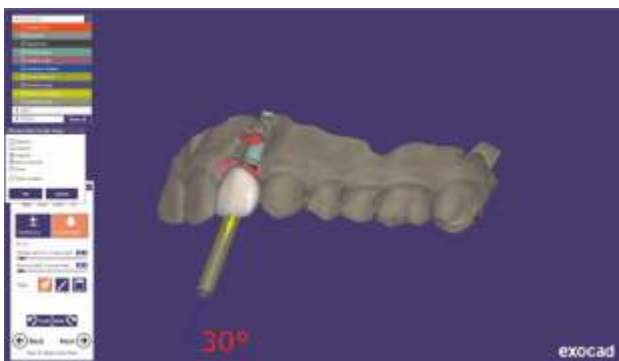


Fig 4a



Fig 4b

This rectification allowed the screw access to emerge from the lingual side, which was earlier emerging from the labial side, solving the problem of unfavorably placed implant and giving a more esthetic outcome with all the added benefits of screw-retained prosthesis. [Figures 5]



Fig 5

Discussion:

Implant placement in aesthetic areas (i.e. anterior maxillary teeth) is challenging, and adequate labial or buccal bone thickness seems to be critical to prevent future bone dehiscence and marginal recession. The clinician needs to evaluate the angulation of the ridge before placing the implant. A critical determinant for placement of an implant is the height and width of bone available in the edentate sites. A 2mm of facial bone thickness has been suggested as a minimum to prevent future recession. Additionally, the bone trajectories in maxillary anterior region are more labial [Figure 7]. This makes employing of implants, in such a zone, very technique sensitive procedure that involves placing of the implant in an ideal position which at a later stage of restoration comes out to be esthetic.



Fig 7

For the final restoration to be esthetic, implant should be placed in such a way that the screw hole emergence results lingually. When this does not happen, a cement retained crown is given to cover the labially emerging screw hole. However, screw-retained restorations are considered to be more favorable due to their ease of retrievability and to facilitate the treatment of any technical and biologic complications⁴.

Previous research suggests to approach ideal implant positioning from a three-dimensional perspective^{7,8}. It states that the most common error in implant placement is to angle it facially, which displaces the soft-tissue contours of the crown apically. Dynamic abutment solution angulated abutment system is unique and exclusive and can be used as a true alternative to grafting procedures and cement retained crowns. These are designed through computer-aided design and computer-aided manufacturing (CAD/CAM) technologies. They fix angulation issues with millimetric precision with the full freedom of movement. An absolute adjustment in the connection geometry with the implant during the production process of the prosthesis is achieved by this technology.⁹ By employing this system any number of teeth can be replaced in almost any situation with a screw-retained restoration and by a graftless procedure.

Conclusion:

After the final delivery of prosthesis, the patient was followed for 3 years [Figure 6]. No technical or biological complications were reported due to the corrections of screw emergence during follow up years.



Fig 6

Dynamic Abutment® solutions best suits the cases like the present one. It provides a graftless solution while avoiding the cons of cemented crowns and has the advantages of screw-retained abutments during placement of off-angled implants.

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Anterior Aesthetics with Minimally Invasive Direct Bonding



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Introduction

Composites can create a better smile for a patient very quickly and efficiently using a non-invasive technique. Direct composite bonding has been around since the 1970s. It has had an enormously beneficial impact, making it possible to improve a patient's appearance via a very simple, straightforward technique without an impression and a laboratory requirement. It is a fairly predictable procedure because it gives full control to the esthetic dentist. It not only allows for modifications in the future as it is very easy to add composites, but patients have the opportunity to influence the outcome as well, making them more likely to be satisfied with the final result.

Abstract

A 12-year boy reported to the clinic with a fractured upper front tooth - 21 due to a football injury. On examination, there was no pain on percussion and the tooth tested positive on a vitality test. Direct composites were planned immediately in the same appointment to restore the smile. The patient has been informed about the prognosis of the tooth and the possibility of an endodontic treatment in the future. Routine follow-ups have been advised for the same.

Direct composite bonding has undergone an incredible evolution, along with an upgrade in materials that help create proper aesthetic anatomy, hue, value, chroma, position, form, function, direction and texture.

Case Presentation:

1] Pre-operative view:



Fig 1: Pre-op full smile view shows a Class IV fracture with tooth no 21



Fig 2: Pre-op retracted 1:2 view showing 4 teeth.

2] Shade selection:



Fig 3: Composite shade selection using the composite button technique.

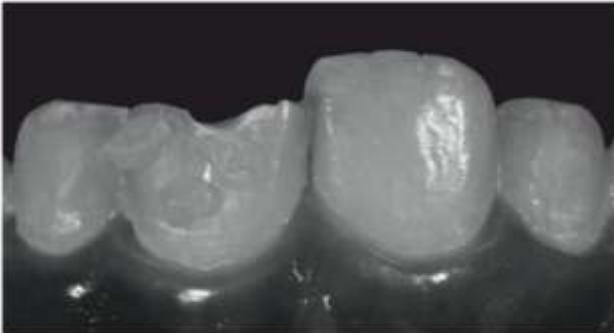


Fig 4: Monochrome photo for selecting the correct enamel shade to match the value correctly.



Fig 5: Cross polarized photo to get the correct core shade of the tooth, thereby helping us understand the intensives and characterization of the tooth better.

3] Rubber Dam Isolation:



Fig 6: Rubber dam isolation prior to composite bonding showing the buccal view



Fig 7: Palatal view

4] Bevel:



Fig 8: The next step is to give a bevel, remove the unsupported enamel rods and polish the bevel to an infinite margin as shown to facilitate blending of the composite. The bevel was given with a red ring TR25F bur and was polished with the help of 3M coarse soflex discs to make sure there are no sharp angles with a smooth rounded surface.

5] Etch:



Fig 9: Etching with 37% phosphoric acid for 15 seconds on enamel. Care should be taken to protect the adjacent teeth with teflon during the procedure.

8] Dentine shade:



Fig 12: Second layer of composite is adapted onto this palatal shell using GC solare sculpt A3 shade composite.

6] Application of Universal Bond:



Fig 10: Universal bond by 3M is scrubbed on for 20 seconds and air thinned before light curing.

9] Application of some tints:



Fig 12: Application of blue and white tints with the help of a silicone brush so as to match the opalescence and intensives of adjacent tooth no 11.

7] Palatal enamel shell using mylar strip:



Fig 11: Palatal enamel shell is created using mylar strip which is supported by a finger with GC Gaenial Adult Enamel composite. The other alternative is to get a wax up fabricated and use a putty index to create the same.

10] Final enamel layer:



Fig 13: Application of final layer of GC Gaenial Adult Enamel shade composite. The basic outline and line angles are created with the help of 3M coarse soflex discs.

11] Finishing steps:



Fig 14: Creating the primary anatomy with markings by a lead pencil, getting it symmetrical to tooth no 11

12] Polishing steps:



Fig 17: Final polishing with eve twist pink and beige polishers by Ivoclar.



Fig 15: Creating the secondary anatomy lobes



Fig 18: Buff with prisma gloss paste fine by Dentsply



Fig 16: Pre-polishing with enhance cones from dentsply

12] Immediate post-operative:



Fig 19: Immediate post-op picture. Waiting for tooth to rehydrate.

13] Post-operative after 48 hours:

Fig 20: Post rehydration after 48 hours.

Conclusion:

With the advancements in techniques and materials with respect to composites, it is completely possible to get the best natural esthetics and restore the smile for your patient in a single visit. The long-term follow-up of these well-polished restorations also retains lustre and gloss.



Fig 21: Post-operative smile

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Isolation Requirements in Restorative Dentistry in the Covid Era



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The Covid-19 pandemic and the challenges faced by dentists

The COVID 19 pandemic, also known as the coronavirus pandemic, is an ongoing global pandemic of coronavirus disease 2019 (COVID 19), caused by severe acute respiratory syndrome coronavirus 2 (SARS CoV 2). Coronavirus disease (COVID-19) is an infectious disease caused by a newly discovered coronavirus. The COVID-19 virus spreads primarily through droplets of saliva or discharge from the nose when an infected person coughs or sneezes.

The scenario in dental practices is very complex and several problems can arise which are dangerous for the dental practice

1) The first problem raised with respect to COVID-19, is related to the easy spread of viral agents in the air during dental procedures.

2) The second problem is related to the persistence of the biological agent in operating rooms.

This COVID-19 pandemic has shown that several people can be positive and spread the viral agents around without any symptoms or signs of biological agents. So, the dental team, a part performing the double triage, should consider each patient as SARS-COV-2 positive until proven otherwise and use protective equipment in order to preserve their own health and the health of all patients attending the dental office.

For an infection to emerge, it is necessary that an adequate number of specific microorganisms can infect a person or groups. The classic contamination paths clearly incorporate all the dental unit (team and patient): body fluids in direct contact with the wound site during operation, injuries of the skin and the mucosa with sharp objects, body fluids and contaminated material contact with eyes, aerosols arising during the operation with air produced by turbine and ultrasonic devices, contamination via droplet, and surgical smoke formed during electrocautery or laser applications.

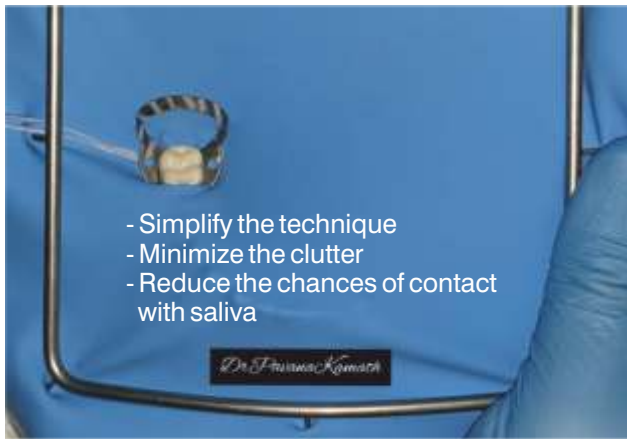
The risk of infection

Three factors determine if an infectious disease will develop:

- The disease-producing potential of the microbe involved;
- The dose of the microbe that contaminates the person; and
- The resistance of the person to the microbe involved.

The practitioner cannot lessen the disease-producing potential of microbes nor make his or her body resistant to microbes in patients' mouths without vaccination

The rubber dam offers an adjunctive method of reducing the spread of infectious disease agents in the dental office²



Rubber dam application

Rubber dam application in Covid times

Using a rubber dam reduces splatter production. Rubber dam must be used during endodontic treatment and in pediatric and restorative dentistry when rotary instrumentation is needed. Also, using rubber dam during fixed partial denture or single-crown preparation should be taken into consideration. For instance, prepare a supra-gingival margin for the posterior bridge or apply a split dam technique. Additionally, it can be beneficial to locate the rubber dam to cover the nose and reduce the transmission of COVID-19.³

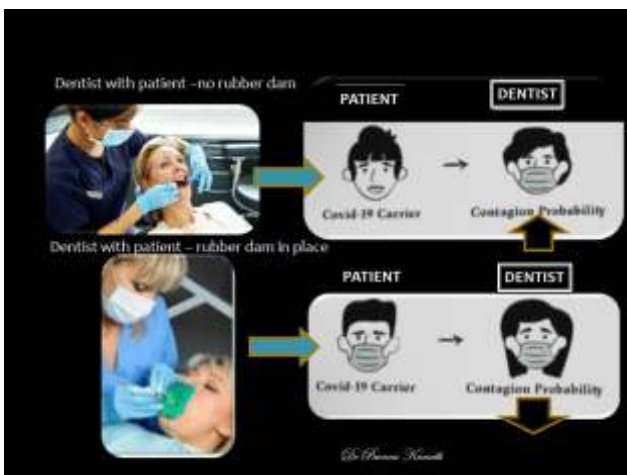


Illustration of benefits of rubber dam isolation

Classic rubber dam application for restorative dentistry

The armamentarium

- Rubber dam sheet

- Clamp

Winged

Wingless

(preferred clamps in restorative procedures)

- Tissue retractors

- Frame

- Punch

- Clamp forceps

- Accessories

Wedgets

Floss

Teflon tape

Rubberdam napkin

Lubricant

Resin blocking agent

Liquid dam

Wedges (for pre wedging)

Basic Steps In Rubber Dam Isolation

- Patient history – for any known allergies
- Evaluate the clinical condition of area to be isolated
- Evaluate the tooth to be isolated
- Determine the choice of rubber dam sheet and clamp
- Check the fit of the clamp
- Punch the sheet
- Lubricate the contact areas
- Anaesthetize the gingiva
- Secure the clamp
- Clamp the tooth and retract the rubber dam sheet
- Mount the edges of the rubber dam sheet on the frame
- Use additional retention when required
- Disinfect the surface of the isolated teeth.

Key isolation requirements in restorative dentistry

Adhesion relies on two key factors to succeed clinically.

A clean surface to bond and isolation from oral contaminants. Isolation is often the area that compromises the efficient completion of restorations. The effective control of moisture and microbes during a restorative dental procedure is a determining factor for the successful restoration.⁴

Primary rubber dam retention helps in attachment of the latex sheet to the anchor teeth bordering the isolated working field. Secondary rubber dam retention is the provision of an effective seal at the dam-tooth junction, which is essential to the maintenance of adequate access and moisture control within the working field.⁵

Secondary Retention

Clinical isolation of a certain kind will always pose a challenge to the experience and expertise of the practitioner. This is frequently encountered in the restoration of carious lesions of the root, difficult to access areas of the mouth and the cementation of porcelain laminate veneers etc. Isolation in these cases strongly require the temporary diversion of the flow of saliva. While stable isolation can be achieved clinically yet microscopically the effects of capillary action along the gingival trough and of seepage of fluids from adjacent gingiva will pose a continuous challenge in maintaining an ideal working environment.

The requirements for additional retention in restorative procedures is almost essential. Some procedures demand minimal secondary retention (single-tooth endodontic isolation), while the success of others is directly proportional to the overall quality of the isolation (bonding procedures). Similarly, the proportion of moisture and access components within secondary retention will fluctuate as a function of the procedural requirements. Some procedures demand minimal seal and maximal access (crown removal), while others require minimal access and maximal moisture control (fissure sealants).



Illustration – use of dental floss to aid in additional retention and inversion

Punching the holes

The rubberdam punch has dedicated holes of different dimensions on a rotating table. Careful selection of hole dimension after studying the tooth/teeth to be taken under isolation, would help achieve a good adaptation of the rubberdam to the cervical margin of the tooth.

Location of holes

The location and distance of holes punched from each other plays a very important role on the amount of tension in the rubberdam once it is stabilised by the frame. The distance between the holes determines the amount of sheet present interdentally, varying the distance helps in stable marginal adaptation, in rotated teeth, buccally placed teeth, teeth which require isolation of deep cervical caries.

Dimension of the holes

Teeth which are prepared to receive a crown will have smaller dimension than intact teeth, it will also influence the choice of clamps and additional retention.

Clean cut holes

A punch which cuts clean and crisp holes is to be used every time. Any tag of sheet left by the punch will interfere with the quality of isolation and can also lead to tearing of the rubber dam sheet.



Illustration –clean cut



Presence of tag which could lead to tearing of sheet

The Interdental dam placement

Placement of interdental dam will influence the moisture control, forceful placement, without lubrication, with application of heavy forces will lead to failed isolation and tearing of the rubber dam sheet .

The sheet is placed interdentially either using the knife edged technique or the floss for optimum isolation.

Rubberdam inversion

A procedure through which the operator slips the peripheral rubber of the hole around the cervical area of the tooth and into the sulcus, and keeps it still during the whole restorative procedure.

A very important rule is that the rubber should sit around the cervical area passively.



Illustration –Unaided inversion and passive adaptation of rubberdam sheet to the cervical margin

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Dual Zone Socket Grafting in Esthetic Zone - A Case Report



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Introduction

One of the toughest challenges for an Implantologist in 21st century is placing and restoring implants in esthetic zone. However, if successfully done, it can be one of the most fulfilling aspects as a clinician and a practice builder in a long run.

Placement of implants immediately after extraction has become an increasingly common strategy to preserve the buccal bone and soft tissues, and to reduce the overall treatment time.¹

The most common complication of immediate implants is the loss of labial bone and the soft tissues, and a resultant elongation of the prosthesis/ implant exposure leading to poor prosthetic outcome.

This case report presents the fine details in the management of immediate implant placed in the esthetic zone to address the issue of labial bone collapse.

Case

A 70 yr old male doctor presented with mobility due to fractured tooth #8. Intraoral radiograph revealed a fracture at the cervical region. Intraoral examination revealed Grade 3 mobility of the crown. (Fig1)

Treatment Plan

Atraumatic extraction of the root piece, curettage of the extraction socket, placement of implant in an ideal 3-d position, grafting the jumping distance till the free gingival margin, and an immediate screw retained provisional restoration.

Procedure

The remaining root piece was extracted, using luxators, proximally, taking care, not to damage the labial bone.(Fig2) The socket was then thoroughly curetted and irrigated with sterile saline to ensure complete debridement. (Fig 3) Osteotomy was done through the palatal wall of the socket, and a 4.3*11mm implant was placed(Nobel Replace) 2mm palatal and 3mm apical to the free gingival margin. (Fig 4-6) This facilitates screw retained prosthesis. A torque of 45Ncm was achieved. Temporary abutment was placed on the implant.



Fig 1



Fig 2



Fig 5



Fig 3



Fig 6



Fig 4

The crown of the fractured tooth was intact, so it was decided to use the same as provisional restoration. (Fig 7-9) The crown was hollowed out to accommodate the temporary abutment and checked in the mouth for interference to ensure proper seating.(Fig10) Then, the shell thus formed was filled with light cured flowable resin and seated firmly.(Fig11) The access hole of the abutment was blocked to prevent the ingress of the resin. The resultant assembly was then cured. (Fig12) Once cured, the provisional was unscrewed to finish the subgingival area, resin was added, and desired contours achieved.(Fig13-15)



Fig 7

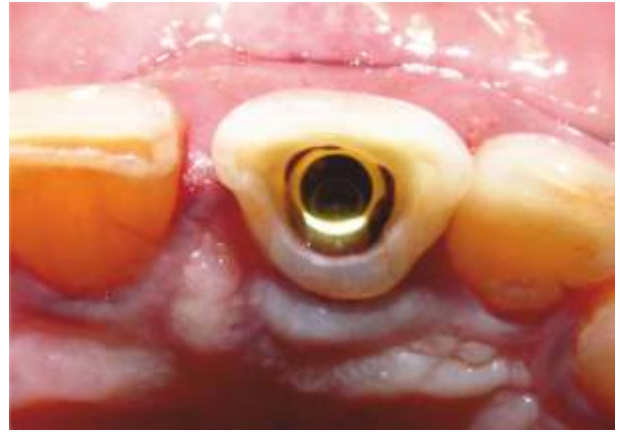


Fig 10



Fig 8

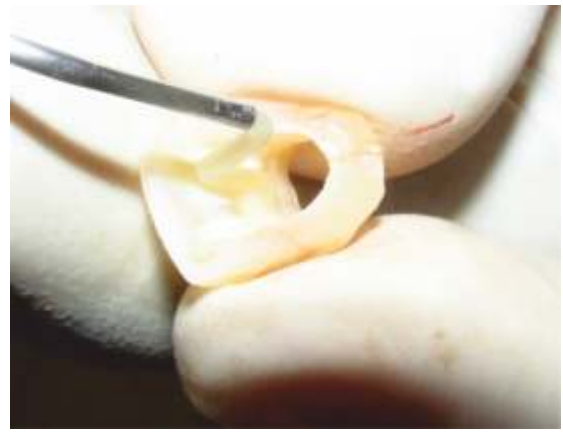


Fig 11



Fig 9



Fig 12



Fig 13



Fig 14



Fig 15

In the patient's mouth, a straight healing abutment was placed over the implant, and the jumping distance was filled with a bone graft (Mineross and Autogenous chips from the drills). Grafting was done right up to the free gingival margin (Fig16). The healing abutment was removed and the provisional screwed in place. Occlusion was subsequently adjusted.



Fig 16

Healing was uneventful, and the patient was assessed periodically. Nine months later, it was decided to go for final prosthesis, but the patient was reluctant as he was happy with the interim prosthesis, it being his natural tooth shell. (Fig 17-20) Fig 21 shows a 60 month follow up. Recession is seen with the adjacent central incisor. However, the tissues around the implant are absolutely stable.



Fig 17



Fig 18



Fig 19



Fig 20



Fig 21

Discussion

Treatment planning is the key for the success of any implant restoration. Thick tissue biotype causes less of a risk of buccal plate resorption, especially where the plate is intact following extraction. These cases present a better indication for immediate implant placement.^{2,3}

Key factors for a successful anterior implant restoration are:-

1. Presence of buccal bone
2. Primary stability
3. Implant size
4. Grafting the jumping distance
5. Tissue biotype

It is well documented that major changes occur post extraction upto 1 year.⁴ This resorption occurs in 2 overlapping phases. The bundle bone is replaced with woven bone resulting in reduction of crestal height. Second phase of resorption occurs from the outer surface of the buccal plate.⁵

Placement of implant in such a way that the screw emerges out through the cingulum facilitates a screw retained prosthesis. It also ensures that about 2-3mm space remains between the implant and the labial bone which can be grafted. Grafting this space limits the amount of buccal contour change of extraction site ridge and potentially enhances the thickness of the peri implant soft tissues coronal to the implant-abutment interface.⁶ Any resorbable graft can be used. The Grafting is done in 2 zones viz: 1- The bone zone, and 2- The soft tissue zone. Graft in the bone zone fills the space and prevents soft tissue collapse as the bundle bone resorbs. The graft in the soft tissue zone supports the soft tissue and probably helps increase its thickness and prevents collapse. The graft particles get resorbed, or are exfoliated

through the sulcus as the soft tissue heals. (Fig 20)

Immediate provisional coupled with grafting of jumping distance results in minimum change of ridge contour.⁷ Since the coronal part of the tooth was intact; it was decided to use the same in the form of a shell to hold the resin in place. As the patient was a medical practitioner, implant was in esthetic zone, it was possible to achieve primary stability, and the tissue biotype was thick, it was decided to provide immediate provisionalisation. They promote a peri implant soft tissue healing and minimize remodeling of the buccolingual ridge dimension.⁸ This is evident in the 60 month follow up photograph where the adjacent central incisor shows gingival recession, but not the implant. Post healing, the soft tissue and bone contours are maintained. When immediate provisional are given post grafting, it causes bulging of gingival margin. This compensates for the graft shrinkage on healing (Fig20).

Conclusion:

Immediate implant placement following tooth extraction has been found to be a viable and predictable solution to tooth loss. However, proper case selection and planning, and meticulous execution of surgical and prosthetic phases are very essential for long term success of immediate implants.

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Minimally Invasive Diastema Closure



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Introduction

Beauty lies in the eye of the beholder. Diastema or Gap between teeth is considered by many as lucky not only in India but even in France it is called as "dents du Bonheur", which literally translates to "lucky teeth".

But many patients consider it as an aesthetic complaint. Most commonly patients are concerned with Maxillary midline diastema. Maxillary midline diastema can be defined as a space greater than 0.5 mm between the proximal surfaces of the two central incisors.

Though diastema closure can be performed with different kinds of treatment, we have to keep patients' expectations (aesthetic, financial and time) in mind too.

A preferred treatment option is the use of porcelain veneers and these can be bonded to the facial surface of anterior teeth using bonding techniques.

Veneers were introduced into dentistry around 1938 by Charles Pincus. Ever since they have been used for various indications such as masking of discoloured teeth, closure of spaces, smile designing etc.

Gürel et al recently showed a 98.7% success rate of porcelain laminate veneers (PLVs) when the preparation depth is kept within the limits of enamel.

The purpose of this article is to share a case report

which shows how preparation can be kept intra-enamel by preparing the tooth through the aesthetic prevaluative temporaries.

Case report

A 28 year old male patient presented with chief complaint of spacing in his upper front teeth and desired to have his teeth cosmetically corrected. There was no relevant history contributory to the existing diastema and all other routine investigations were within normal limits. On intra oral examination patient was having midline diastema of 3mm. Overjet and overbite were normal. The patient presented with sound periodontal conditions and no decay present. On comparing size of central incisors with lateral incisors, it was found that proportion was mismatched because of smaller size of centrals. Treatment options given to patient were orthodontic closure of space and closure of space by porcelain veneers. The patient was getting married in a month's time and wanted to get a treatment which would be completed in a short duration. So we decided to go ahead with the treatment plan of space closure with porcelain veneers.

The procedure

1. First an alginate impression was taken and sent to the lab for a wax up. The wax up was then recorded with a putty index. (Fig 1,2,3,4)



Fig 1



Fig 2



Fig 3



Fig 4

2. The index was then loaded with Bisacryl material (Protemp 4 (3M) was used for this purpose. (Fig 5,6)



Fig 5



Fig 6

The temporary veneers were used for two purposes.

- a. To give an idea of the final look to the patient

This communication allows both clinician and patient to share their expectations, further eliminating patient dissatisfaction at the end of the procedure. Verbal communication alone is never enough.

- b. To prepare through the temporaries

Temporaries fabricated using the mock-up is very important when the Veneers are being designed to try and make the preparation as conservative as possible because the tooth preparation will be determined directly by the position and volume of the definitive restoration

3. The teeth were then prepared using depth cutting burs from shofu.

Precise depth orientation grooves can be achieved

with the specially designed depth cutting diamond points. These grooves are marked with a 0.5mm micro mechanical pencil for ease of identification. (Fig 7)

The rest of the preparation was completed using a brand new Mani TF 26 bur.



Fig 7

The veneer margins were then established using long, tapered medium grit diamond to prepare definitive chamfer 0.3–0.4 mm deep at the gingival margin. Tooth contacts (with lateral) were removed and the entire gingivo-proximal definitive chamfer margins were established. Finishing and polishing of the preparation was done using Soflex discs and Spirals (3M).

The preparation is minimum and restricted to enamel. (Fig 8)



Fig 8

4. Impression was recorded using heavy/light body (Polyvinyl siloxane impression) material using a Pentamix machine (3M) (Fig 9)



Fig 9

Patient was not desirous of a shade change. We did the shade selection using IPS natural die material shade guide. (Fig 10)



Fig 10

5. The bite was recorded with a stick bite technique. The stick bite is a quick and easy reference used for lab communication. It is a useful tool for the technician to have a visual reference to the esthetic plane or incisal edge position of the upper centrals.

To record this position, we air dried the lower anteriors and injected rigid bite registration paste (Orange bite A silicone material, Medicept) from canine to canine. While still soft, a wooden candy stick was inserted into it and the stick was leveled with the horizon.

A picture of the same which also records the patients eyes was taken and sent to the lab along with other records. (Fig 11)



Fig 11

Day of bonding -

A split dam technique (Nicotine sheet, Hygenic (Coltene) clamps) was used to isolate the centrals. (Fig 12)



Fig 12

A try in paste (Variolink aesthetic try in paste, Ivoclar) was used to check the veneers.

Intaglio surface of the veneers were then treated in the following manner

Etching: 20 seconds with IPS Ceramic Etching Gel
Conditioning: 60 seconds with Monobond Plus. It was dried and bonding agent was applied.

Preparation of tooth

The teeth were cleaned using pumice powder. Teeth were etched using phosphoric acid, followed by application of bonding agent. Veneer cement (Variolink veneer cement, Shade +1) was used for cementation. (Fig 13,14,15,16,17)



Fig 14



Fig 15



Fig 13



Fig 16



Fig 12

Conclusion

Different treatment modalities are available for Diastema closure. But tooth-size discrepancy has most favorable outcomes to restorative solutions. Even though orthodontic treatment is a viable option, most adults do not want to spend several years and multiple appointments to enhance their smiles.

Composite resin is easy to use, requires fewer appointments, is economic but offers less wear resistance and surface staining, which makes it inferior to dental porcelain.

So porcelain veneer is a good option to offer and easy to execute if done in a planned manner of dental materials and quality communication with the prosthetic technician contributes to a harmonious smile satisfying both patient and professionals.

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Diode Laser: An Effective Tool for Gingival Depigmentation



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Introduction

Attractive smile expresses a feeling of happiness, success, and also reflects self confidence. A beautiful smile is not only made by the color, shape and position of teeth but also by the gingival tissues.

Gingival hyperpigmentation is the increased pigmentation beyond the normally expected degree of the oral mucosa. Several physiologic and pathologic factors can cause hyperpigmentation. However, the most common cause is physiologic or ethnic hyperpigmentation. Physiologic hyperpigmentation is genetically determined and is clinically manifested as variable amounts of diffuse or multifocal melanin pigmentation in different ethnic groups.

Melanin, a brown pigment, is the most common natural pigment contributing to endogenous pigmentation of gingiva and is produced by melanocytes in the basal and supra-basal cell layer of the gingival epithelium. The gingiva is the most frequently pigmented tissue of the oral cavity.

Although gingival melanin pigmentation does not represent a pathological problem, patients with a gummy smile or excessive gingival display usually complain of a "black gum" and request cosmetic therapy.

Gingival depigmentation is a treatment to remove melanin hyperpigmentation of the gingiva and various methods have been used for this procedure with different degrees of success including gingivectomy,

gingivectomy with free gingival autografting, electrosurgery, Cryosurgery, chemotherapy with 90% phenol and 95% alcohol and abrasion with diamond bur. Moreover, some of these techniques are prone to side effects and complications. Recently lasers have been used to ablate cells containing and producing the melanin pigment. The commonly used lasers for gingival de-epithelization include semi-conductor diode, Er: YAG Nd: YAG laser, and CO2 laser.

CASE REPORT

A 21 year old female patient reported in the dental office with a chief complain of black gums, visible both in the upper and lower front region of jaws, while smiling. There was no remarkable medical and dental history or any oral destructive habit. Diffused melanin hyperpigmentation was found on the labial surface of both the maxillary and mandibular arches (fig.1, 2, 3).



Fig 1



Fig 2



Fig 4



Fig 3



Fig 5

An informed consent was obtained from the patient after explaining the procedure.

Laser used

The diode laser (Zolar Photon Plus) used in this has fibre optic delivery system with beam diameter of 400 μ m, 980nm wave length and was operated at a 0.5 W irradiation power in a continuous contact mode.

Procedure

Before applying the laser, the operating staff and the patient wore special laser-protective eye glasses corresponding to laser wavelength. Highly reflective instruments or instruments with mirrored surfaces were avoided.

After application of topical anaesthesia (lignocaine hydrochloride), laser ablation was started from the mucogingival junction working toward the free gingival margin, including the papillae in a continuous contact mode with overlapping circles and the fibre tip was continuously moved across the site to avoid heat accumulation at any site (fig.4, 5).

The area was wiped with gauze soaked in normal saline. The same procedure was repeated till no pigments remained. The entire surface of each maxillary and mandibular gingiva that required treatment was irradiated in a single session. The procedure was completed within half an hour (fig.6).



Fig 6

The lack of bleeding after laser treatment can be attributed to the property of lasers to coagulate blood vessels and thereby assist in providing a relatively dry surgical field. Laser is absorbed by pigments in the soft tissue, thus making it an excellent haemostatic agent. However the healing was slightly delayed. It can be theorized by the fact that the protein coagulum formed on the wound surface acts as a

biological wound dressing by sealing the ends of sensory nerves. The soft tissue diode causes minimum damage to the underlying bone. The laser wound is a sterile inflammatory reaction. A dressing is not needed when the gingiva and mucosa are treated with Laser. So there will be faster re-epithelialization.

Postoperative instructions

No periodontal dressing was placed and no antibiotics were prescribed. The patient was advised to avoid hot and spicy food for 24 hours. The patient was also advised not to traumatize the area while brushing during the healing period at least for a week. The patient was followed up for 3 subsequent visits—one after one week, one month and 3 months.

A white fibrin slough was seen after 24 hours. At 1 week, the treated gingiva showed fast epithelization with a healthy appearance, but immature healing.

At 1 month, complete healing with tissue maturation was observed and the gingiva exhibited normal appearance (fig7, 8, 9). Postoperative side effects such as gingival recession was not observed during the 3 months observation period.



Fig 8



Fig 9

The treated sites showed uneventful wound healing without any severe post-surgical problems. There was obvious change in the amount of the pigmented areas in the patient's gingiva before and immediately after the operation and during the post-operative visits. The patient was very happy with the results.

Conclusion

Though the initial results are highly encouraging, there is a chance of repigmentation.

The treatment with diode laser is simple, effective with minimal tissue loss. It is very comfortable for both the operator and the patient. Thus the use of diode laser is a safe and effective treatment modality that can provide optimal aesthetics and minimal discomfort for gingival hyperpigmentation.

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- 3 Efficacy of Various Depigmentation Techniques: A Comparative Evaluation with A case report...
- 4 Dorik Patel¹, Charu Agrawal², Shilpa Patil U.3, Pathik Dholakia⁴, Riddhi Chokshi⁵,

Multidisciplinary Management of Previously Failed Endodontic and Aesthetic Treatment of a Maxillary Central Incisor



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Dr. Harsh Haren Shah (India)

A well known Endodontist and a sought after trainer from Mumbai. He conducts lectures and workshops on various topics of Endodontics and is a key opinion leader for Coltene-Micromega, MetaBiomed, Bombay Dental & Surgical and Woodpecker. He is an accredited member and one of the Board of Directors of the Indian Academy of Aesthetic and Cosmetic Dentistry.

Introduction

Maxillary central incisors are the most aesthetically challenging teeth involved in dental treatment. The aesthetic requirement of patients often demands repetition of previously performed treatment. Patients in their teens are most often concerned about aesthetics. However, as dental practitioners, we treat and correct the underlying functional and structural problems of these patients.

Following is a case involving a young boy, whose central incisor had been treated earlier, but had to be repeated due to aesthetic and structural requirements.

Case report

A 20-year old boy reported to Crowns & Roots Dental Solutions with the chief complaint of unaesthetic upper anterior crown (Fig - 1) which was placed 8 years back. The patient did not complain of any

symptoms with the concerned tooth. On examination, a porcelain-fused-to-metal crown was seen on the maxillary right central which was short in height and did not match the shade of the adjacent teeth. The gingival levels were not symmetrical with the left central incisor. The labial margin of the crown was also short with signs of food lodgment.

On radiographic examination (Fig - 1), it was observed that the tooth was endodontically treated with a post in the coronal part of the canal. The endodontic treatment was not precise and the post was short in length.



Fig 1

The following treatment plan was formulated

- Sectioning and removal of the crown
- Removal of the post
- Repetition of the endodontic treatment
- Placement of a new post and core buildup
- Fabrication of an aesthetic crown

Treatment

The old crown was sectioned using a transmetal bur to make a cervicoincisal groove, and the crown was then removed (Fig - 2) without compromising the remaining tooth structure. It was observed that an active metal post was present in the tooth, which was removed with the help of direct ultrasonics in an anticlockwise direction. The access cavity was temporized with eugonol-free temporary cement.



Fig 4



Fig 2

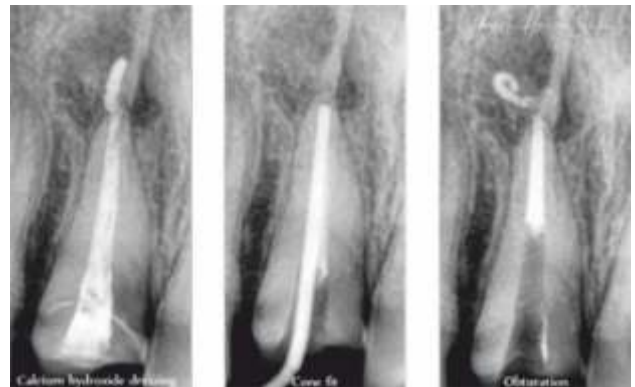


Fig 5

The gingivoplasty was next carried out using a scalpel for both the central incisors to provide satisfactory aesthetics (Fig -3). The right central incisor was then restored with a heat-cured acrylic crown (Fig -4) for a period of 6 weeks. Meanwhile, endodontic therapy was repeated (Fig -5) for 11 and intracanal medicament - calcium hydroxide was placed for 2 weeks.

Six weeks after the gingivoplasty, good soft tissue healing and excellent gingival contours (Fig -6) were observed and then prosthetic treatment was planned. Fiber post and composite core buildup were done and then the tooth preparation was modified (Fig - 7) as per the requirements for a lithium disilicate (E.Max) crown. The impressions were sent for the lab procedures and a trial was received after a few days.



Fig 3



Fig 6



Fig 7

The crown in the trial (Fig -8) seemed to be mesiodistally wider compared to the adjacent central incisor. It was then corrected with a slight composite buildup on the left central incisor, mesially (diastema closure) to maintain symmetry. After the composite buildup (Fig - 9), the crown was adjusted and sent for polishing and glazing.



Fig 8



Fig 9

At the next appointment, the crown was evaluated and was bonded using resin cement (Fig - 10). The outcome of the treatment provided very good aesthetics to the patient.



Fig 10

Conclusion

Providing aesthetic and functional rehabilitation to the patients, especially those in their teenage, is of utmost importance. The treatment plan sometimes needs to be modified for the patient as per individual needs. It is important to plan the treatment to accommodate not only aesthetic but functional requirements also, for a long-term success.

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Smile Transformation with Minimally Invasive Procedures



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A pleasant smile adds immense value to one's personality and goes a long way in improving one's self-esteem and confidence. With the introduction of newer composite resin materials and modern adhesive technology, we can transform our patient's smiles with minimally invasive methods.

Case Report

A 24-year old male patient came to our clinic with chief complaint of gaps between his front teeth and was unhappy with the shapes of his front teeth. He was going to get married in three months time and desired to improve overall appearance of his smile.

First Appointment: All the information was gathered so as to formulate a treatment plan, which involved:

1. Communication with patient: Patient was interviewed and asked for his expectations. He wanted larger teeth filling up the gaps and desired to have sharp/strong canines to depict a strong personality. Also due to time and economic constraints, he wanted minimalistic treatment.
2. Photographs:
 - Extra-oral full face view: front and lateral



- Smile views: front and lateral



- Intra-oral photographs: anterior aesthetic smile view, teeth in occlusion and with teeth parted.



3. Pre-operative video: It helps to see the visibility of incisal edges while the patient is talking.
4. Impressions were made for study models and were sent to laboratory to make a diagnostic wax-up and putty index made on it.

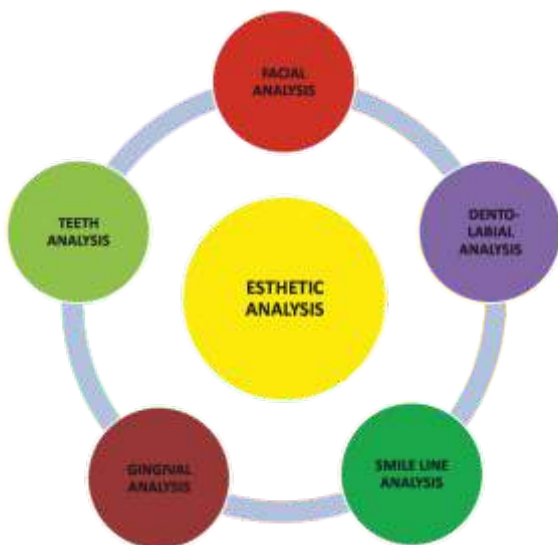




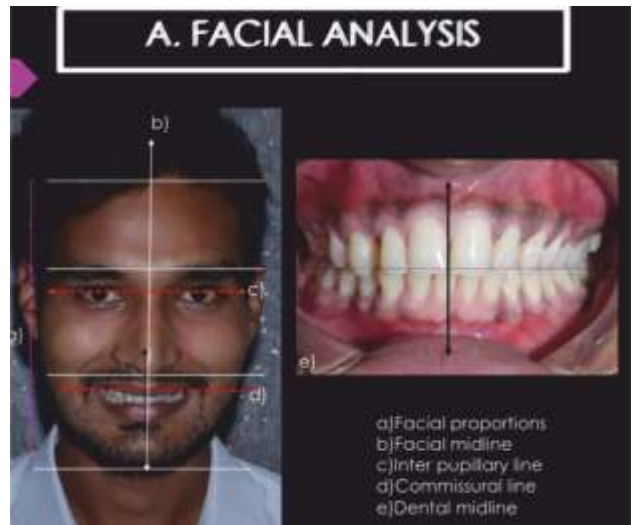
5. Scaling and oral prophylaxis was done and basic shade was recorded using the composite button technique.



Smile Analysis: With the help of the gathered information, detailed study and Smile analysis of the case was done which involved:



Facial Analysis:



A. Dentolabial Analysis:

- a. Incisal visibility: With lips parted or while smiling and talking the maxillary central incisors, the exposure or incisal visibility was 2mm approximately.



- b. Lip line: Patient had medium lip line, displaying mostly teeth and very little portion of marginal interdental papilla when smiling.



- B. Smile line analysis: Slight discrepancy in smile line was noted due to pronounced mesial angulation of incisors.



- C. Bilateral Symmetry:



- D. Gingival analysis:



- a. Slightly blunt interdental papilla and black triangular space was observed between maxillary central incisors apically.
- b. Flat/blunt interdental papilla between lateral incisors and canine bilaterally.

- E. Teeth Analysis: Clinical findings



- a. Mesially inclined central incisors (divergent)
- b. Oblique/slanting incisal edges of maxillary central incisors
- c. Relatively small and narrow lateral incisors bilaterally
- d. Mesially rotated maxillary right canine
- e. Space between maxillary right lateral incisor and canine: 4-4.5mm
- f. Space between maxillary left lateral incisor and canine: 1.5-2mm

Treatment options suggested to patient

1. Orthodontic treatment
2. No preparation composite restorations
3. Minimally invasive Ceramic veneers. Approximate time and cost and the pros and cons of these treatment options were mentioned. Due to time and economic constraints, patient opted for composite restorations.

Second Appointment:

6. ESTHETIC TRY-IN/ESTHETIC TEST DRIVE: Galip Gurel has given the technique of Aesthetic Pre-evaluative Temporaries (APT). With the help of APTs, which duplicate the neatly prepared wax-ups exactly, the final

outcome can be visualised by both patient and dentist in terms of form, shape, length and even color. This involves intra-oral transfer of mock up using silicone index loaded with Bis-acryl composite (luxatemp) material.



Photographs were taken
-at 12 o'clock position to evaluate the position of incisal edges



-Smile views: front and lateral



Discussion with patient: Patient's opinion regarding smile preview was taken. He found the maxillary central incisors longer than he desired and showed interest only in closing the lateral spaces (the ones between lateral incisors and canines) After detailed discussion with the patient and taking into consideration patient's age, desires and existing intra-oral condition, the treatment plan was devised.

FINAL TREATMENT PLAN:

1. Direct Composite restorations were planned on maxillary right and left lateral incisors and canines for:
 - Closure of spaces (diastemas)
 - Improvement in shape and anatomy
2. Aesthetic contouring of distal incisal edges of maxillary central incisors to make them look straighter.

Third Appointment: Infiltration local anesthesia was administered. Isolation with rubber dam was done along with floss ties. A coarse soflec disc was used to roughen surface and remove aprismatic enamel.

Total etch adhesive technique was used to do composite restorations on lateral incisors and canines of maxillary right and left sides with the help of putty index made with reference to the mock up. Layering was completed using A3 Body shade and A3 Enamel shades of Filtek Supreme Z350 composite of 3M. Final cure was done under glycerine to remove the oxygen inhibited layer. Rubber dam was removed and primary anatomy was marked with pencil. Finishing was done to create illusion of proportionate teeth by modifying the transitional line angles. Aesthetic contouring of incisal edges of central incisors was done to give them a more straight look. Occlusal interferences were removed followed by pre-polishing and polishing. Bilaterally symmetry was achieved and spaces were closed to get the desired outcome and smile that the patient was looking for.



Palatal shell using A3 Enamel shade on putty index



Layering completed using A3 body shade and A3 enamel shade on maxillary left lateral incisor



Coarse sofex disc used to roughen surface and remove aprismatic enamel



Final cure under glycerine to remove oxygen inhibited layer



Maxillary left lateral incisor-Etch with 37% Phosphoric acid



Same protocol for maxillary left canine and maxillary right lateral incisor and canine



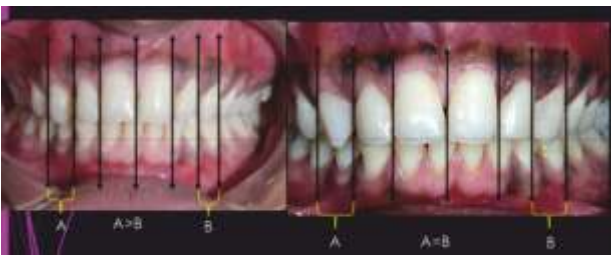
Application of fifth generation bonding agent



Pencil marks for primary anatomy simulating transitional line angles



Immediate post-operative



Bilateral symmetry achieved

Pre-op and Post-op anterior aesthetic views, right and left lateral views and facial views





Conclusion

- x The above case encompasses the use of direct composites for an array of clinical indications like diastema closures, improvement in tooth shape and form.
- x Additive / Minimally invasive technique (No preparation)
- x Smile preview helped us exactly understand what patient wanted in his new smile.
- x Patient's desires and expectations met, resulting in HAPPY PATIENT and gratifying experience for us.

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Smile Enhancement with no Preparation or Minimal Teeth Preparation and Lithium Disilicate Veneers - A Case Report



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An Aesthetic Dentist, treating patients globally. She completed her Masters in Composite from Japan. She is awarded as Winner in Aesthetic Practice of the year (Famdent Awards) and Female Dental Photographer (Dental Diva Awards). She is an accredited member of IAACD. She has been a speaker for IDA, Famdent and DRDCA International 2020. She conducted webinars nationally and internationally on aesthetics.

The minimally invasive treatment has always been the choice of treatment for the patients. Many of the dental procedures are now been implemented with innovations to make them almost non-invasive.

Presenting a case of a 25 year old female, who desired to close the gap in her front teeth. She also had history of orthodontic treatment done for more than 2 years, and she realised that after the active and passive phase of her orthodontic treatment her initial complains were unattended, and now wanted an alternative approach to close the spaces with minimal damage to the teeth.

Clinical Evaluation

- Diastema in relation to all the maxillary anterior teeth.
- Missing maxillary right lateral incisor (12).
- Composite residue (ortho appliance debonding) was seen on 11,13,21,23.
- Coronally placed gingival zenith in relation to 12 and 21.

After the examination the following treatment plan was proposed.

Treatment plan

Smile correction included:

- Laser assisted frenectomy and gingival zenith correction.
- Implant supported restoration in 12.
- No preparation ceramic laminates with 11, 13, 21, 22 and 23.

Patient preferred for an option without implant due to financial reasons.

The final treatment protocol decided was placement of a bridge with respect to missing tooth 12.

The preoperative profile pictures were recorded to assess the present conditions (Fig A1), at the same time the maxillary arch retracted views and in occlusion views were recorded (Fig A2,A3,A4 and



Fig A1: Profile views

A5,A6,A7) The 12o'clock view and a moderate smile view(to assess the usual display of her teeth)were also recorded (Fig. A8, A9). These photographs revealed the left over composite on the buccal surface of maxillary anteriors after previous orthodontic treatment.



Fig A2: Front profile picture of the patient showing anterior teeth diastema and composite residue on 11, 13,21and 23 of previous orthodontic treatment.



Fig A3: Right lateral profile view showing missing maxillary right lateral incisor.



Fig A4: Left lateral profile view.



Fig A5: Front profile picture of the patient showing anterior teeth diastema and composite residue on 11, 13, 21 and 23 of previous orthodontic treatment



Fig A6: Right lateral profile view



Fig A7: Left lateral profile view.



Fig A8: Occlusal view



Fig A9: Moderate smile view

This was followed by shade selection and the impressions of maxillary and mandibular arches using poly ether impression material (3M ESPE, Monophase). The working models were prepared in stone plaster and wax-up was done according to the planned treatment. (Fig A10, A11)



Fig A10: Shade selection



Fig A11: Wax-up model for trial run.

The procedure of Laser assisted gingival zenith correction was done using Picasso 2.5W laser (Fig 12). The putty index was made (3M ESPE soft putty) (Fig.13) and same was transferred intraorally using Bis acryl material (3 M Protemp 4) (Fig B1, B2, B3)



Fig A12: Shows the Laser assisted frenectomy and gingival zenith correction.

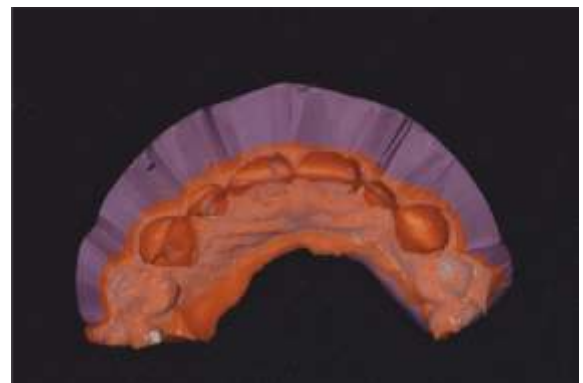


Fig A13: Putty index prepared for transfer of smile trial run intraorally.



Fig B1: Smile trial run - Front view



Fig B2: Smile trial run - Right lateral view



Fig B3: Smile trial run - Left lateral view



Fig B5 B: Completed tooth preparation

Fig B1, B2, B3 Shows front, right lateral and left lateral views for transferred putty index intraorally with Porotemp 4 -The trial run

As the patient opted for a non-implant procedure the teeth 11 and 13 were minimally prepared (using DIATECH Coltene, 856, 018, 8F red ring bur and 0.3 mm depth cut bur, blue ring) and 21, 22 and 23 were left unprepared. The enamel surface was smoothed using 3M soflex discs. An impression was made in polyether material and patient was relieved after providing the temporaries. (Fig B4, B5 A and B, B6)



Fig B6: Impression of prepared teeth is made in polyether impression material

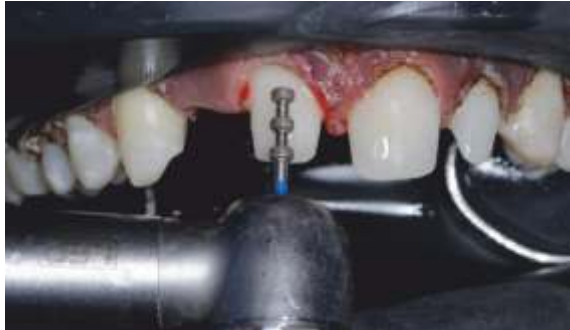


Fig B4: Preparing through the temporaries for the bridge on 11, 12, 13, using LI-DI-SI.



Fig B7: Smile of the patient with temporaries on.



Fig B5 A: Finishing the preparation using red soflex disc 3M, ESPE.

The wax mock -up was prepared on the model on preoperative conditions. The laser assisted gingival zenith corrections created the space cervical to temporaries, which was later restored using light cure composite (3M Z350 A2). (Fig B8, B9, B10)



Fig B8: Temporaries extended cervically with composite



Fig B9: Temporaries extended cervically with composite



Fig B10: Temporaries extended cervically with composite

Fig B8 - B10 shows the temporaries that have been extended cervically with composite to cover exposed margins after gingivoplasty.

The impressions were sent to the lab for preparing the LI-Di-SI laminates and veneers on 21, 22, 32 which were as thin to be compared with the eye contact lenses and the bridge for 11, 12 and 13. After receiving the prosthesis, it was first checked for its proper fit on the models and same was tried intraorally. (Fig C1 - C5)



Fig C1: LI-DI-SI ceramic art retrieved from the laboratory



Fig C2: LI-DI-SI ceramic art retrieved from the laboratory



Fig C3: LI-DI-SI ceramic art retrieved from the laboratory

Fig C1 - C3 shows LI-DI-SI ceramic art retrieved from the laboratory.



Fig C4: Captured Ceramic art glamour

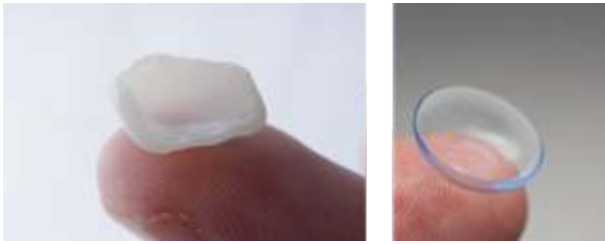


Fig C5: Thin LI-DI-Si prepress prosthesis resembling contact lens

After trial the teeth were isolated using rubber dam and proceeded for cementation as follows.

The ceramic art was made ready for cementation in following steps. (Fig C6 - C9)

- Etching the ceramic art using 5% Hydrofluoric acid for 20 seconds, (Vivadent Ivoclar, Ceramic etching gel.)
- Drying
- Applying silane coupling agent for 120 sec (Monobond Plus, Vivadent Ivoclar).
- Bonding with dual cure bonding agent (Clearfill SE, WIZDENT, KURRARE, JAPAN).



Fig C6: Etching the ceramic art



Fig C7: Drying the ceramic art



Fig C8: Applying coupling agent



Fig C9: Applying bonding agent

Fig C7 - C9 shows etching the ceramic art using 5% Hydrofluoric acid for 20 seconds, followed by drying and applying silane coupling agent for 120 sec. and bonding with dual cure bonding agent.

The steps followed for making the teeth ready for receiving the ceramic art are:

- The teeth will be ready two weeks after laser frenectomy
- Split dam isolation
- Etching with 35% phosphoric acid for 20secs
- Rinsing off the etching gel and drying- appreciate the frosty appearance of the enamel
- Bonding with dual cure bonding agent
- Cementation with dual cure adhesive cement of the LI-DI-SI bridge on 11, 12, 13 (Ivoclar Verioliink)
- The last layer is cured through the transparent gel (Liquid strip, Ivoclar) to remove the oxygen inhibition layer

(Fig C10 - C20)



Fig C10: Two-week post-op after laser frenectomy



Fig C14

Fig C11 - C15 split dam isolation followed by etching with 35% phosphoric acid, the frosty appearance, bonding with dual cure bonding agent and cementation with dual cure adhesive cement of the LI-DI-SI bridge on 11, 12, 13



Fig C15



Fig C11



Fig C16: Bonding and cementation of 21, 22, 23.



Fig C12



Fig C13



Fig C17: Bonding and cementation of 21, 22, 23.



Fig C18: Bonding and cementation of 21, 22, 23.



Fig C21: Final post-ops after removal of rubber dam

After the removal of excess cement, the case was observed for any high points. All the excursive movements were checked and stable occlusion was observed.



Fig C22: Final post-ops after removal of rubber dam



Fig C19: Application and curing through the KY Jelly to take care of the oxygen inhibition layer



Fig C23: Final post-ops after removal of rubber dam



Fig C20: Immediate post-op



Fig. C 24: Post - operative occlusal view - Frontal



Fig. C 25: Post - operative occlusal view
- Left lateral



Fig. 29: Pre-operative Twelve o'clock view.



Fig. C 26: Post - operative occlusal view
- Right lateral



Fig.30 Post-operative Twelve o'clock view.



Fig C 27: Pre-operative occlusal view



Fig. 31: Dental glamour



Fig 28: Post-operative occlusal view.



Fig. 32: Dental glamour



Fig. 33: Dental glamour



Fig 34: Dental glamour



Fig 35: Dental glamour

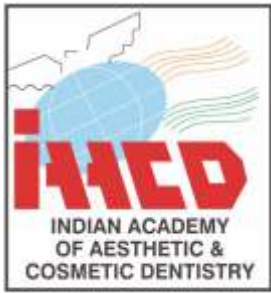


Fig 36: Dental glamour

Finally patient was happy to receive the smile she desired.

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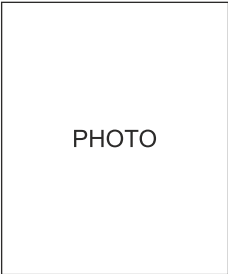
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*When used as directed on pack, for extrinsic stains only. Shade guide for illustration and demonstration purpose of the whitening effects only. Actual effects refer to VITA shade guide. Individual teeth whitening results may vary.