Chapter

Role of Computer Technology in Changing Smile

Swapnil B. Shankargouda, Preena Sidhu and Sonica Miyyapuram

Abstract

In the ever changing complex society, where success has become a mantra for both young and old, facial appearance that includes smile, plays a pivotal role. Among many attractive components in a person's face, smile reflects the persona of an individual. In the present day next gen age, science in unison with technology and techniques which are rapidly getting ingrained into day to day dental practice, has changed the perception of healthy smile by more effective and less invasive approach. In this scenario, the onus lies on the dentist to give that perfectionist touch to a customised smile using computer aided software and hardware apparatus, and to avail the best state of the art material, equipment and techniques. Hence, it is imperative for us to understand and inculcate the role of modern cutting edge computer-aided technologies used in designing and changing the smile of an individual.

Keywords: dental technology, smile designing, digital impressions, digital radiography, CAD/CAM technology, smile makeover

1. Introduction

Technology plays a significant role in most areas of life and the dental field is not any exception. Patients and doctors have each benefited from the advancements and inventions in dentistry which supply trendy solutions to ancient dental issues that may be performed in an exceedingly economical and effective manner. The health of the mouth and body will improve with every new technology. Remember, good health starts within the mouth. As best said by Darwin, it seems that we have a tendency to all smile within the same language. Today, smile is definitely the foremost recognized expression that necessitates a natural study pattern that is pleasing to others. So, our responsibility as smile designers and dental specialists is to face this new challenge and acquire the abilities to spot and design numerous smile patterns, integrated by diagnostic, clinical and laboratory procedures. So, let us find out how technology can help us achieve this challenge. Dentists are incorporating the following high-tech tools into their practices.

2. Extra oral video camera

It permits having a close record of the patient's face while moving and talking. It will record the patient in numerous moods and gestures. It is an audiovisual record of the patient's ideas, preferences, expectations and complaints as well as the dentist's suggestions and explanations of various treatment options. Totally, different smiles and profiles are often applied to the patient's face, and therefore, the patient is often given the chance to settle on the simplest smile style [1].

3. Intraoral video camera

More or less, an intraoral camera is a little camcorder that takes a radiographic X-ray of the outside of the gum or tooth. The intraoral camera is nothing more than a larger than average pen and in spite of the fact that the use of the camera changes depending upon the model-type, this picture taking gadget is normally furnished with an disposable plastic sleeve for each new patient. While at the same time seeing a screen, the dental specialist tenderly moves the camera into the patient's mouth with the goal that pictures can be taken from an assortment of points.

First utilized in the mid 1990s, the intraoral camera is yet a moderately new bit of dental gear. Not very far in the past, just a bunch of practitioners inside the dental network utilized this little camera to take photos of the teeth and gums. Today, utilization of the intraoral camera is far reaching. For those dental practitioners who do utilize this gadget, the intraoral camera has been, and keeps on being, incredibly convenient both in diagnosing dental conditions, for example, tooth decay and fractured teeth and in instructing the patient. Most intraoral cameras are no greater than the size of a thumbnail, yet give unparalleled analytic capabilities. Intra oral examination of each point with the littlest subtleties can be seen as close as 2 mm from the tooth. With it we can diagnose certain conditions and plan treatment alternatives significantly more precisely than with representations, mirrors and radiographs [1].

4. Computer or voice activated data

Utilizing voice enacted innovation; dental specialists can report their discoveries by talking into the amplifier that are connected to a PC which has been "prepared" to perceive a restricted vocabulary. The PC at that point stores the data and even illustrations (identified with grin), so different methods can be examined with the patient.

5. Digital radiography

X-rays were discovered in 1895. Since then film has been the first medium for capturing, displaying, and storing pictures. Digital radiography is the latest advancement in dental imaging. RADIO-VISIOGRAPHY, the primary direct digital imaging system was invented by Dr. Frances Mouyens. It was manufactured by Trophy Radiologie (Vincennes, France) in 1984 and later described within the US dental literature in 1989. Compared to ancient X-rays, digital radiography may be a filmless technique that uses up to 90% less radiation. It additionally provides prime quality, digitally encoded data that may be adjusted electronically to alter contrast density or to amplify specific areas. By using digital radiography, buccolingual width of the jaws as well as the location of anatomic features such as the mandibular canal and the maxillary sinus can be determined which is useful while placing an implant in the esthetic position. Now-a-days manufacturers promote digital radiography system and video camera in one unit, i.e., single hand piece which can be convenient to be used [2].

6. Direct digital imaging

Various components are required for direct computerized picture generation. These parts incorporate a X-ray beam source, an electronic sensor, an advanced interface card, a PC with a analog to digital converter (ADC), a screen, monitor, and a printer. Normally, frameworks are PC based with a 486 or higher processor, 640 kb inside memory furnished with a SVGA illustrations card, and a high-goals screen (1024 × 768 pixels). Direct advanced sensors are either a charge-coupled device (CCD) or complementary metal oxide semiconductor active pixel sensor (CMOS-APS). At the point when an X-ray beam collaborates with the screen material, light photons are produced, identified, and put away by CCD. Direct sensor CCD clusters catch the picture specifically. CMOS sensors have a few points of interest including structure joining, low power prerequisites, manufacturability, and minimal effort.

6.1 Advantages of CCDs

1. Decrease in exposure.
2. No processing chemicals required.
3. Real-time and instant images generated and shown.
4. Improvement in image.
5. Patient education.
6. Convenient storage capacity.

6.2 Disadvantages of CCDs

1. Sensor thickness and rigidity are more.
2. Goals are decreased.
3. Initial framework cost is more.
4. Life expectancy of sensor is unknown.
5. Control of infection is difficult.

6.3 DICOM standard

It is an acronym for digital imaging and communications in medicine. Medical radiologists found that many of their imaging systems could not communicate with each other. Most manufacturers had their own proprietary software and file types that were not compatible with those of other manufacturers. Now dentistry is beginning to recognize the DICOM 3.0 standard which is helpful for insurance companies in maintaining records and assessing claim estimation. (e.g., dental record, voice activated charting) [2].

6.4 DentaScan

A specialized type of CT or “CAT” scan which is performed on a conventional CT scanner. It is produced and licensed by General Electric (GE) and is performed only on "state-of-the-art" GE CT machines. It produces a highly detailed cross-sectional image of maxilla or mandible, which is then analyzed to evaluate dental implant sites.

6.4.1 Features

1. Axial or helical CT data is reformatted to display four images per screen for the mandible and maxilla.

2. Oblique images permit visual inspection of cortical bone and alveolar nerve for optimal implant placement.

3. Multiple (5 or 9) panorex images demonstrate pathology when needed, along with the nerve canal.

4. Oblique and panorex reformations are cross-referenced to each other and to the original CT images.

5. User selectable distance between oblique reformations (from 1 to 10 mm).

6.4.2 Advantages

1. Allows high resolution (1 mm) computerized images.

2. Allows precise measurements of the potential dental implant sites.

3. Access the mineralization or density of the involved bone site.

4. Produces a very low dose of X-ray exposure with negligible adverse effects.

7. WAND local anesthesia system-computer controlled device

A newly described maxillary nerve block injection which was first reported during development of a computer controlled local anesthetic delivery (CCLAD) system.

7.1 Components of WAND

1. Local anesthesia cartridge.

2. Microtubing.

3. Disposable handle.

4. Leur-lock needle.

5. Foot control.

WAND is activated by foot control. On activation, automatic delivery of solution at precise pressure and volume ratios takes place. Steady and continuous rate of flow is maintained. Solution can be deposited even if resiliency is encountered, resulting in effective and comfortable injection [3].

8. Comfort control syringe

It is an electronic, pre-set local delivery system of local anesthesia that administers the local anesthetic agent in a slower, more controlled and more reliable way than a conventional manual injection. The comfort control syringe has a two-stage system of delivery of local anesthetic system. The infusion starts at a moderate rate to limit the inconvenience related with quick infusion. Following 10 s, comfort control syringe naturally increases the infusion rate for the system that has been chosen [3].

9. Electronic dental anesthesia (EDA)

9.1 Indications

1. Patients with needle phobia.
2. When local anesthesia is ineffective.
3. Patient allergic to local anesthesia.

9.2 Contraindications

1. Patients with cardiac pacemakers.
2. Patients with neurological disorders.
3. Pregnant female patients.
4. Patients having dental phobias.

9.3 Mechanism of action

At low frequency (2 Hz) TENS produces increase in blood levels of serotonin and β endorphins. These possess analgesic actions which benefit to patient undergoing restorative, crown and bridge or periodontal procedures. EDA produce excellent soft tissue anesthesia and may be used when multiple palatal infiltrations are given. EDA can reverse effect of local anesthesia by maximizing vasodilation and muscle contraction [3].

9.3.1 Advantages

1. There is no need for needle.
2. There is no need for injection of drugs.
3. There is no residual anesthetic effect.
4. There is residual analgesic effect for hours.

9.3.2 Disadvantages

1. It is expensive due to high cost of the unit.
2. It is technique sensitive, so special training is necessary.

3. It has a learning curve.

4. Presence of intraoral electrodes forms the weak link in entire system.

10. Computer aided design/computer assisted milling technology

Computer aided design/CAM is an abbreviation for computer-aided design/computer-aided manufacturing. It has been utilized for a considerable length of time in the manufacturing business to deliver precise apparatuses, parts and autos, CAD/CAM innovation has been progressively inducted into dentistry in the course of recent years.

Computer aided design/CAM technologies and metal free zirconia materials are utilized by dental specialists and dental research facilities to give patients processed artistic crowns, facade, onlays, inlays and fixed partial dentures. As the materials and innovations accessible for CAD/CAM dentistry have improved throughout the years, so too have the rehabilitation efforts that patients can get from this type of advanced dentistry. The present CAD/CAM rehabilitation efforts are better-fitting, progressively solid and increasingly normal looking (multi-shaded and translucent, like regular teeth) than recently machined prosthesis.

10.1 In-office and dental laboratory CAD/CAM options

Dental CAD/CAM innovation is accessible for dental practices and dental labs, empowering dental practitioners and their staff (or a research facility expert) to structure rehabilitation efforts on a PC screen. The CAD/CAM PC shows a 3-D custom picture of the virtually built tooth or teeth acquired by carefully scanning the tooth/teeth preparations with an optical scanner. On the other hand, the 3-D images can be acquired by scanning a custom made model got from conventional impressions of the tooth/teeth arrangements.

The dental practitioner or dental lab professional at that point utilizes those 3-D pictures and CAD programming to draw and plan the prosthesis. The duration of time it takes for a dental specialist, in-office lab professional or lab expert to rehabilitate an oral structure differs, dependent on aptitude, experience, and difficulty level of the case and treatment rendered. A few cases could take minutes, while others could require a half-hour or a greater amount of configuration time to guarantee quality.

When the last rehabilitation step is planned, the crown, inlay, onlay, facade or fixed partial denture, is processed from a single rigid block of fired material in a processing chamber. The rehabilitation at that point can be altered with stains and coatings to make an increasingly regular look, before being casted in a casting furnace and after that completed and cleaned.

10.2 Benefits of CAD/CAM dentistry

Research suggests that today's milled CAD/CAM restorations are stronger than those milled from earlier materials. They also are less likely to fracture. One of the advantages of CAD/CAM technology is that, same day dentistry may be a treatment option for patients. CAD/CAM dental technologies such as CEREC in-office or the E4D dentist system can be used to make an inlay, onlay, crown or veneer restoration in a single appointment, while you wait.

10.3 Special considerations for CAD/CAM dentistry

Computer aided design/computer assisted manufacturing is not a replacement for the preciseness and ability of a dental specialist or dental rehabilitation expert.

Dental specialists must be precise in preparing the tooth; both the dental specialist and dental laboratory technician must be precise when making the impression digitally and planning the prosthesis.

Similarly, the precision and ability with which they plan a prosthesis is vital, especially since the internal and marginal fit is important to avoid future tooth deterioration [4].

11. Digital shade selection guides

Shade selection is a procedure which provides patients an aesthetic restoration that harmoniously blends to the patient's existing dentition. Different shade guides are available in the market: Vita Classic, Vita System 3D-Master, Chromascop and custom or specific chroma and value guides. Clinicians often end up with compromised restoration because they encounter difficulty in interpreting a multi-layered structure of varying thickness, opacities and optical surface characteristics.

There are limitations of shade guides as we fail to account for the variability found in natural teeth, e.g., fluorescence, opalescence, translucency, enamel thickness, and objectivity.

The effects of surface texture on light reflection are different. The characterizations must be recorded and duplicated in the final restorations. The use of technology with different devices in shade selection has eliminated subjectivity of choosing and the use of photography to communicate shades and characterizations has improved the selection process. The property of light source to influence color of objects is called "color rendition." There are special lights that are color corrected to emit light with a more uniform distribution of color that can be utilized [5].

11.1 Instrument shade selection

11.1.1 Colorimeters

It consists of a detector, signal conditioner and software with four photodiodes along with filters. It has an inability to maintain adequate sensitivity at low light levels. It is inferior to scanning devices like spectrophotometers [6]; for example, Chromascan (Sterngold, Connecticut).

11.1.2 Spectrophotometers

It mainly includes three specific components.

- A standard D65 light source.
- Means to direct the light source to an object and receive the reflected light from the object.
- A spectrometer that provides the most accurate color measurements by determining the intensity of the received light as a function of wavelength [6].

11.2 Shofu ShadeEye NCC

The ShadeEye NCC Dental Chroma Meter produces a total formula to coordinate the shade for a porcelain crown. It will accommodate a few shade guide systems, including its exclusive Vitapan 3D-Master, Chromascop, Biodent, etc. The base unit can create a printout, or can download it to a PC. On the PC, one can utilize the Shade Eye Viewer programming to record the whole patient's shade data which would then be able to be messaged to the laboratory alongside computerized photos of the teeth.

Shofu has 3 mm distance across hand held contact probe with focus at recipient and illuminator at periphery. To match standard observers collect light, color filters are used, which are transmitted to the docking unit, which analyze and present the shade in Vitapan classical designation Shofu ShadeEye NCC [6].

11.3 Vita Easyshade

It is a hand held spectrophotometer with a 5 mm contact test tip and a 20 kW halogen tungsten light D65.The base unit is associated with hand piece through monocoil fiber optic link. It has three spectrometers in the hand piece to quantify inside dissipated light and a PC handling unit to dissect the spectrometer information, decide a shade match to current Vita Classical and 3D shades and yield and show the outcomes [7].

11.4 Shadepilot

It takes into account absolutely exact assessment of spectral information, unaffected by light sources in the medical procedure or other encompassing light. It creates accuracy through correspondence and the highlights incorporate

1. Innovative: as it provides recommendation for enamel and dentin powders veneering.

2. Communicative: as it uses smart communication services for data transmission such as E-Mail, text notes and voice messaging.

3. Accurate: as it compares with the initial measurement of the natural tooth against the finished restoration.

4. Simple: professional assessment of the patient's shade can be done in less than 1 min.

5. Analytical: analysis and administration can be done on PC.

6. Free: there is no interference of ambient light and shades can be matched under all light conditions.

7. Mobile: can be used to measure the shade of the patient anywhere as there are no inconvenient cables attached.

8. Modern: as it uses latest technology to transfer images and data like USB, WLAN, etc.

9. Fast: as analysis of measured data can be done instantaneously.

10. Safe: as optimum measurements of the patient can be taken by angling at the patient.

11.5 Evaluation of the spectral image

11.5.1 Triple-zone measurement

You can request an analysis of the three zones—cervical, body and incisal. Select the zone yourself and analyze individually, accurately and routinely.

11.5.2 Single tone

The basic analysis by Shadepilot gives you an average tooth shade, allowing you to determine the precise area of analysis yourself.

11.5.3 Shade map

The proposed shade map consequently investigates each shade subtlety of the tooth for you. From this, it can determine important subtleties explicitly for the individual tooth layering.

11.5.4 Translucence

Shadepilot can furnish you in a noteworthy route with translucency data determined from the reflected light range.

11.5.5 Comparison

Assesses the pictures to look at the distinction in shading when treatment (tooth bleaching) or between the characteristic tooth and the crown.

11.5.6 Patient data bank

Stores and controls all your deliberate shades. This information, as a picture, alongside all other patient information is accessible for a longer period at whatever point required.

11.5.7 Printing

Other than electronic viewing, this enables patient information to be printed off with all applicable investigation pictures and to pass on or document information [6].

12. Lasers

The dental laser utilizes a light emission instead of surgical blade to perform fragile gum surgical procedure and crown lengthening procedure/gingivectomy and gingivoplasty. Lasers give reduced inconvenience and at times, a suture free alternative for the treatment of tumors, mouth blisters, crown lengthening procedure, caries removal, correction of gummy smile, dental fillings, tongue tie correction and improvements of speech impediment, nerve recovery for damaged nerves and veins and scars. Lasers may likewise be utilized inside the treatment of certain dental conditions like disorders of sleep, certain cases of temporomandibular joint disorders and tooth sensitivity. This is a truly energizing space of advancement in dental technologies. Lasers utilize light-weight devices as their method of operation, bringing about an abbreviated and practically effortless mending period.

The advantages of this method are:

1. Hemorrhage control that provides a clean and dry operative field to provide a wonderful visibility of the operative field.

2. The operating time is decreased and thus reduces the postoperative swelling, scarring and pain [7].

13. Abrasive technology

Although abrasive technology does not replace the dental drill for filling teeth, it often provides an alternative. Working much like a precise miniature sandblaster, this instrument gently sprays away decayed tooth structure using a microscopically fine powder called alpha alumina, a nontoxic ingredient that is also used in whitening toothpastes. Because abrasive technology produces virtually no heat or vibration, it can usually be used without anesthetic injections. Abrasive technology frequently uncovers "veins of decay" that are hidden beneath the "stain pockets" of active tooth destruction that sometimes cannot even be detected by X-rays. It is utilized in any quadrant for any depth of decay while not damaging the healthy tooth structure. It is also useful during repairs of existing composite or porcelain restorations. Serving as an alternative to a traditional dental drill, an air-abrasion system is primarily used to treat small cavities, preserving healthy tooth structure without the use of a local anesthetic. These high tech tools open up a whole new world of possibilities and allow you to achieve the smile you have always wanted [8].

14. Digital impressions

With the advent of the digital impression system, the requirement for conventional dental impressions may in the long run be a relic of days gone by. Digital impressions utilize computerized innovation to make a dental prosthesis design on a PC, with no impression trays or dental impression material included.

On the contrary, digital impressions have omitted the uneasiness and discomfort regularly associated with dental impressions. When the tooth is prepared, it takes minutes for the dental practitioner to record the prepared tooth and make a virtual dental prosthesis directly on the PC screen. The final image of the virtual prosthesis is messaged to a laboratory technician to set up the shape, who thus sends it to a dental laboratory to fabricate/mill the final prosthesis. Digital impressions facilitates for the impressions to be sent to the dental lab straightforwardly, bringing about a shorter processing and fabrication time to create the dental prosthesis.

There are numerous advantages to utilizing the digital impressions system. Digital impressions commonly mean less choking/gagging, shorter dental appointments and a decreased tendency for error as related with conventional dental impressions. There is a decreased tendency for remaking the entire impression due to saliva or food debris contamination due to digital impressions as compared to conventional dental impressions and thus increasing the quality and efficacy with which the prosthesis is fabricated.

Not only does the exactness and accuracy of the digital impression addresses the dental issues related to conventional dental impression, it additionally reduces the work load for the dental practitioner, who might not need to reshape the dental crown once getting it from the dental lab.

There are a few disadvantages to the digital impression system. Most digital impression system have been intended to make permanent prosthesis, so utilizing them to partial and complete dentures is not feasible—for the time being. As digital impression systems are additionally an expensive unit to buy for any dental office, the expense might be passed on to the patients.

In any case, dental practitioners who do use a digital impression system are undoubtedly inspired by the innovation. Patients love the solace and comfort of it, as well. While numerous dental specialists are finding the upsides of this best in class dental innovation, it presently cannot seem to get on at most dental workplaces [9, 10].

15. Rapid prototyping

Rapid prototyping (RP)—alludes to programmed development of mechanical models from graphical PC information. Rapid prototyping is a kind of computer assisted milling/manufacturing (CAM) and is one of the parts of rapid and fast manufacturing of prosthesis.

Amid the late 1980s, the incubation of rapid prototyping system offered new potential outcomes for demonstrating additional oral and maxillofacial deformities. Principally used for the aeronautical and automobile industry to reduce the time required for planning and development of delicate and intricate model parts, it works on the standard of depositing material in layers or cuts to develop a model instead of shaping a model from a strong block of material. Thus, fabricating an accurate prosthesis by replicating all the inner geometry,as opposed to simply the external surface forms,compared to conventional dental prosthesis fabrication.

15.1 Two primary strategies for rapid prototyping

1. Additive—broadly utilized.

2. Subtractive—less successful.

15.2 Commercially used in variety of ways like

1. Stereolithography.

2. Fused deposition modeling.

3. Inkjets.

4. Three-dimensional printing.

5. Selective laser sintering.

6. Laminated object manufacturing.

7. Laser engineered net shaping.

15.3 Stereolithography

Stereolithography was the most essential foremost prototyping innovation to be created during the 1980's and is the procedure that is most commonly used to produce stereolithographic anatomic (SLA) models for medical procedure. The CAD model of the part to be made is cut into a progression of two-dimensional cuts. This information is utilized to control a beam of laser that draws each cut of the model on the outside of a tank of sap.

The photosensitive resin is immediately restored to a solid where the beam of laser strikes. At the beginning of the process, underneath the surface of the liquid resin, a "slice" of thickness of one 0.25 mm platform is positioned over it. On the completion of the first layer, it descends to cover the top of the model with resin to give way for the next layer to be formed. Thus, the model is built from the base up as the platform descends [11, 12].

15.3.1 Building of model

Local polymerization of the liquid is stimulated when the laser beam is drawn onto the surface of the resin. The object borders are solidified at first followed by the internal parts on coming in contact with the laser beam. On polymerization of the layer, the elevated platform moves down to a pre-defined distance of 0.1–0.5 mm layer thickness, with the model submerged in the resin liquid bath. The resin is leveled out as the surface is smoothened by the sweeper. Thus, a new layer of liquid is spread over the hardened layer followed by continuation of the drawing, thus building the model layer by layer.

During the building process, supporting structures (supports) during the process of production must be provided in order to prevent the sagging of the overhanging and isolated part. Finishing of the completed objects is done by draining the excess liquid resin, followed by removal of the supports and curing of the surfaces of the objects using ultraviolet floodlights. Production of a model may last up to 1 day, depending upon the data set resolution, model complexity and the total number of slices.

15.3.2 Advantages

1. Ability to make right prostheses, which helps the restorative outcome and shortens the usable time.

2. No roam for human error.

3. There is no limit on designing of complex mathematic designs.

4. Accurate and symmetrical.

5. Biocompatibility.

Throughout the last 23 years, the CEREC framework has advanced into a predictable method for reestablishing undesirable or disfigured teeth, mistreatment computer-aided design/computer assisted manufacture (CAD/CAM) technology. This CAD/CAM unit, which can manufacture onlays, inlays, 7/8 crowns, ¾ crowns and dental veneers, can allow the professional to restore the tooth with a permanent indirect restoration within one appointment.

The portable mobile unit comprises of three parts: a little camera, a video display screen and a three-dimensional shaping rotation machine.

The CAD/CAM CEREC system has evolved from the:

- CEREC-1, which fictitious solely marginally fitting single and twin surface ceramic inlays.
- CEREC-2, which showed advances in computing, upgraded code and distended type of grinding technique.
- CEREC-3, that may style well-fitting inlays, onlays, crowns, veneers, etc., in an exceedingly single visit.

The CEREC-3 technique involves:

1. Mouth preparation.
2. Powdering.
3. Scanning.

15.3.3 Advantages of the CEREC system

1. It is a single appointment procedure.
2. Impression is not required.
3. There is reduced marginal gap.
4. Glorious sprucing characteristics.
5. There is improved esthetics.
6. Necessity for minimal tooth reduction.
7. Allows to achieve higher dental medicine health.
8. Strength of the tooth is enhanced due to secured restorations.
9. Preparation, fabrication, cementation and sprucing is generally accomplished in 1–1½ hours.

The newest inclusion of the CEREC system is that the CEREC 3D, that provides a flexible, comparatively easy technique for fabricating esthetic restorations chair side while not involving a dental laboratory. The newest system, CEREC 3D (Sirona, Charlotte, NC), has distended on the ideas of PC imaging by utilizing three-dimensional viewing capabilities [11, 12].

15.3.4 Technique: fabrication using an optical impression

This impression can be accomplished in a single visit, eliminating the need for an elastomeric impression, an interim restoration, and payment of a laboratory fee.

The restoration is designed and carved from a solid block of porcelain or composite. These blocks are available in an assortment of shades that can be custom-stained and glazed. After the optical impression is made, restorations are designed on the computer using one of two modes, correlation or dental database. Correlation utilizes a preoperative optical impression of a wax-up of the unprepared tooth, while dental database utilizes the software's virtual library of tooth morphology to create the anatomy and contours of the restoration. The prepared tooth is captured in a single optical impression, along with as many of the adjacent teeth as possible. Multiple optical impressions are possible for quadrant dentistry. From this impression, a "Virtual model" is created on the screen. To create proper occlusion more accurately, both modes can utilize an additional optical impression of a bite registration and create an antagonist tooth model.

15.3.5 Features

The 3D feature of the software allows the model to rotate 360° in every plane to create a virtual die. An alignment tool is visible on the screen to help reorient the image after rotation. The software also displays a view window on the screen that makes arrow icons available and allows the operator to view the preparation and subsequent restoration from six predefined views: occlusal, cervical, mesial, distal, buccal, and lingual. After creating a virtual die, the next step is to outline the margin line on the die. In CEREC 3D, the margins are created automatically by the software, reducing the chance of operator error. The software makes this a user-friendly process through an automatic margin finder. The ability to view the die from any angle allows the dentist to correct the outline more accurately. Once the dentist is satisfied with the margin line, the software will design the restoration and place it on the die for viewing. The contact tightness should be evaluated and adjusted by clicking on the contact button, which is also displayed in the window. The purple line represents the height of contour, while the red, yellow, green, and blue areas all identify different degree of contact tightness [12].

16. Nanotechnology

Nanotechnology is a field of the amalgamation of applied science with technology. The word nano originated from the Greek word "dwarf." In 1959, Richard Feynman, a Nobel Prize winning physicist, was the first to elaborate the concept of nanotechnology in a lecture titled, "There's plenty of room at the bottom." From that point forward, nanotechnology has discovered use in a multitude of uses including dental analysis, material and therapeutics. It is not going to be long, when nanodentistry will prevail with regards to keeping up close ideal oral wellbeing through the guide of nanorobotics, nanomaterials, and biotechnology.

An expert in the field of nanotechnology, Prof. Keric E Dexler, was the first to term nanotechnology, which is the manipulation of matter on the atomic and molecular levels [13].

16.1 Current applications of nanodentistry

1. Endodontic nanocomposites, e.g., 3 M™ ESPE™ Filtek™ Supreme Plus.

2. Prosthetic nanocomposite denture teeth.

3. Periodontal plasma laser application.

4. Prosthetic nanoimpression materials.

5. Restorative nanofilled bonding agents, e.g., G-Bond.

6. Prosthetic dental implants.

7. Restorative nanofilled light-curing glass ionomer.

16.2 New treatment opportunities in nanodentistry may include

1. Major tooth repair.

2. Tooth renaturalization.

3. Hypersensitivity cure.

4. Orthodontic nanorobots.

5. Dental durability and cosmetics.

6. Nanorobotic dentifrice (dentifrobots).

7. Tooth repositioning.

8. Durability and appearance.

9. Inducing anesthesia.

10. Local drug delivery.

11. Molecular monitoring.

17. Digital smile designing [DSD]

DSD is another new innovation in the field of esthetic dentistry that has been acquainted with the universe of restorative dentistry lately. DSD programs are utilized for objective esthetic examination and virtual treatment planning by altering photos and additionally scanning models of patients jaws. Most of the smile designing softwares explicit for dental practice appear to disregard facial style parameters and focus on esthetic and dentogingival concepts.

Adobe Photoshop and Keynote were not specifically made for digital smile designing; be that as it may, these two softwares characterize, measure and adjust the most elevated number of dentofacial esthetic components. Photoshop and Keynote fulfill facial examination criteria; in this manner, they could be utilized for investigation of complex cases that require treatment other than restorations alone and where orthodontic or surgical intervention are to be considered. In spite of the fact that there are numerous digital smile designing software programs accessible explicitly for dental specialists, it is conceivable to utilize Photoshop and Keynote to make and show patients the proposed dental restorative treatment. Their significant downside is that a moderate to cutting edge level of preparation is required by the dental specialist so as to use the product capacities during the time spent for esthetic smile designing. A number of specialists have utilized Photoshop for DSD and decided the essential options to be utilized in the diagnosis. These incorporate editable teeth moulds, division of the observation grids, techniques of measurement, rules for the initial wax mock-up and permanent restoration prediction. The competency of Keynote in DSD has additionally been depicted in the literature. Like Photoshop, Keynote gives the capacity to characterize reference lines and line angles and acquire the required restoration.

Computer aided design/computer assisted machining companies, for example, Sirona have improved the esthetic highlights of the anterior teeth restoration in their software programming. Whenever assessed, CEREC SW 4.2 could build a 3-D computerized model of the patient's face to permit control of the considerable number of measurements of carefully planned esthetic rehabilitation procedures including functional analysis of the articulated models. DSD programs consolidate digital innovation to the smile designing procedures and can be utilized as digital tools for analysis, treatment plan evaluation, and correspondence with the patient and dental laboratory technician that can formulate a predictable dental treatment outcome. Be that as it may, not all the DSD programs accessible today give a similar competency to complete examination of the dentofacial esthetic components. Despite the fact that this is a standout amongst the most imperative components to be viewed as while picking a DSD program, different factors, for example, usability, case documentation capacity, cost, time proficiency, orderly advanced work process and association, and similarity of the program with CAD/CAM or other computerized softwares may likewise impact the dentists choice [14].

18. Conclusion

The knowledge and practice of yesteryears may not assist the dental specialist with achieving perfection later on. The ability of replacing a tooth esthetically and functionally is demanding and there is positively no excuse for error. Use of magnification/amplification using dental loupes will become a necessity to achieve better visibility and provide state of the art restorations which would not be possible as accurately with the naked eye.

A dental practitioner will be compelled to give better impressions of the prepared tooth to suit CAD/CAM designed prosthesis fabrication. Lengthy and technique sensitive laboratory procedures will be replaced by CAD/CAM methods and we should overhaul our knowledge and technological constraints by updating ourselves to suit the cutting edge innovation.

Imaging innovation will likewise experience incredible change. Volumetric radiographic technique will progress towards becoming in-office and will assist the clinician with diagnosing difficult temporo-mandibular disorders. Intuitive softwares like Simplant will simplify the diagnostic and surgical placement of the dental implants. The number and size of implants necessary to rehabilitate the edentulous space can be pictured well in advance prior to the implant surgery depending upon the computed tomography (CT) images taken in the in-office machine. Investigating and diagnosing the occlusal abnormalities using computed tomography images will no longer be a difficult task. Nanotechnology based dental materials and products will be a common affair, particularly for restorations and dental impressions. Dental specialists may observe caries-free teeth and bioengineered tooth substitutes in the near future. Therefore, dental specialists will never be able to ignore the fast yet ever changing technologies, which may disruptively affect the present system.

The future belongs to those who tell the best tales about the future; at the end of the day, just inventive masterminds will get a chance to contribute towards future expert needs. Dental specialists ought to wind up visionaries of an actually improved future like the (CEOs) of the information technology (IT) area who envision a land with astute iceboxes, thinking shoes, self-governing vehicles and online doctors.

Conflict of interest

None.

Author details

Swapnil B. Shankargouda[1]*, Preena Sidhu[2] and Sonica Miyyapuram[3]

1 Department of Prosthodontics and Crown and Bridge, KLE Academy of Higher Education and Research, VK Institute of Dental Sciences, Belgaum, Karnataka, India

2 Faculty of Dentistry, SEGi University, Kota Damansara, Malaysia

3 BDS, KLE VK Institute of Dental Sciences, Belgaum, Karnataka, India

*Address all correspondence to: swapnil.shankargouda@gmail.com

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