Computer Aided Navigation for Predictable Dental Implantology : A Review

Dr. Rahul Srivastava*, Dr. Bhuvan Jyoti, Dr. Sachin kushwaha***, Dr. Pankaj Kumar Priyadarshi******

*Reader, Department of Oral Medicine & Radiology, ** Dental Surgeon, Department of Dental Surgery, Ranchi Institute of Neuro-Psychiatry and Allied Sciences , *** Senior Lecturer,Department of Oral Medicine & Radiology,**** Senior Lecturer, Department of conservative and endodontics, Rama Dental College, Hospital & Research Centre Kanpur (U.P)

Abstract: A dental implant may be a surgical fixture that's placed into the jawbone and allowed to fuse with the bone over the over the range of a couple of months. The implant acts as a replacement for the foundation of a missing tooth. New efforts in computer-assisted clinical implant dentistry have created a novel way to deal with implant surgery. Neocis, a Precision HealthCare Robotics organization, has introduced a FDA-cleared automated navigational framework (robot) expected to aid both planning and surgery of dental implants. The YOMI® mechanical arm gives an upgraded dimension of exactness and control while utilizing haptic guidance and multisensory feedback to perform dental implant process. The Yomi® framework, which joins haptic mechanical innovation, incorporates programming that helps specialists with preoperative arranging and navigational direction of surgical instruments during implant surgery. This review highlights the principle mechanism of action of Neocis Guidance System (Yomi®), advantages, limitations and its amazing applications in the field of dental implant. [Shrivastava S Natl J Integr Res Med, 2019; 10(3):63-67]

Key Words: Neocis Guidance System (Yomi®), dental implant, robotics.

Author for correspondence: Dr Rahul Srivastava, Reader, Department of Oral Medicine & Radiology, Rama Dental College, Hospital & Research Centre Kanpur (U.P), Contact number: 09450326179; Email id: drrahul_osmf@yahoo.com

Introduction: Dental implants have turned into a broadly acknowledged treatment choice for supplanting missing teeth. Implants are poised for explosive growth in coming decade.[1] Dental implants don't require the decrease of contiguous teeth, and since close-by teeth are not changed to help the implant, solid teeth are left unblemished, improving long haul oral wellbeing. Individual implants additionally enable simpler access to brush and floss between teeth, improving oral cleanliness. As per the American Academy of Implant Dentistry, approximately 3 million individuals' get 5.5 million implants every year in the United States; this number is developing by an extra 500,000 additional patients each year.[2]In the vast majority of the occasions, the arrangement of implant isn't as precise as planned. Indeed, even a minor variety in contrast with perfect situation causes challenges in placement of final prosthesis. Disappointments emerge because of absence of thought of the super structure amid presurgical planning. In this way to set up sensible congruity between finding, prosthetic arranging and careful stages utilization of transfer device is basic. Such a transfer device is named as surgical guide template.[3]

At present, a new system of computer assisted surgical procedure has been created for oral implantology which incorporates pre and intra- operative methodology. The preoperative surgical procedure is to utilize three‑dimensional (3D) sees as gave to upgrade crude pictures acquired from the patient before surgery. The fundamental point of this system is to render an objective district and a pathway associated with relative organs from figured tomography (CT) information. It gives 3D introduction of surgical instrument position and trajectory showed on a screen in real time within patient's 3D imaging data.[4]

Robotics is the branch of technology that deals with the design, construction, operation, and application of robots as well as computer systems for their control, sensory feedback, and information processing. The term robotics was introduced by writer Isaac Asimov in his science fiction book, I Robot, published in 1950. Neosis, a company based in Miami, Florida has developed "Yomi®" a robotically assisted dental surgical system. It is computerized navigational system intended to provide assistance in both the planning (pre-operative) and the surgical (intra-operative) phases of dental implantation surgery.[3]

Robotics is the branch of technology that deals with the design, construction, operation, and application of robots as well as computer systems for their control, sensory feedback, and information processing. The term robotics was presented by essayist Isaac Asimov in his science fiction book, I Robot, published in 1950. Neosis, an organization situated in Miami, Florida has created "Yomi®" a robotically assisted dental

surgical system. It is electronic navigational framework expected to give help with both the planning (pre-operative) and the surgical (intra-operative) periods of dental implantation surgery.[3]

What is Neocis, Inc. ???: Neocis® is a privately owned business situated in Miami, Florida that is changing dental implant surgery with advanced robotics, with a dream of propelling social insurance through the most recent innovation. The organization's FDA cleared Neocis Guidance System, or Yomi®, is shown for use to give help with both the planning (pre-operative) and the surgical (intra-operative) phases of dental implantation surgery. The framework gives programming to preoperatively design dental implantation systems and gives navigational direction of the surgical instruments. Yomi® gives surgical direction using haptic automated innovation, programming, and multisensory feedback to help accomplish the correct position, angulation, and profundity to put the implant precisely as indicated by plan. Yomi® empowers a negligibly obtrusive flapless methodology, which has been demonstrated to prompt quicker surgical procedure, quicker recuperation, and less agony for the patient.[5]

What is Yomi® : Yomi® is changing implant dentistry as the world's first robot-assisted dental surgical system. Neocis created Yomi® to build exactness and aesthetics in dental implant strategies through visual and physical direction and a basic digital work process. Yomi® gives a phenomenal dimension of accuracy and control. Utilizing haptic guidance and multisensory feedback, Yomi® accomplishes the correct location, angulation and profundity to put the implant perfectly.[6]

Figure 1: Neocis Guidance System(Yomi®)

The Yomi® robotic arm gives an improved dimension of accuracy and control while utilizing haptic guidance and multisensory feedback to perform dental implant surgery. The robotic arm enables the specialist to accomplish the right area, angulation and profundity while putting dental implants through its sensors, delivering genuine and extraordinary guidance.[7] (Figure:1)

Yomi® gives direction all through surgical procedure, with the dental specialist holding control consistently. Without the limitations of cameras or physical aides, Yomi® gives help to the specialist or surgeon in the planning and position of the implants, with a phenomenal dimension of instrument accuracy and control. In the meantime, Yomi® takes into consideration intra-operative changes, enabling the specialist to hold control of the surgical plan.

Yomi® consolidates the specialist's clinical skill with the advantages of robotic surgery. Yomi's® real-time visual guidance and robotic haptic guidance empowers a negligibly obtrusive methodology, which can prompt quicker surgical procedure, quicker recuperation, and less pain for the patient.

Haptic guidance : Haptic guidance is the ability for a robotic system to physically guide a surgeon so they can perform surgery exactly as they planned preoperatively, relative to the patient's CT scan. Yomi's® haptic guidance gives physical prompts to the specialist so they move their hands into the right position where the implant was intended to be put. Once Yomi® guides the specialist to the planned orientation and location, the specialist performs penetrating and implant placement as usual, with Yomi® physically obliging the hand piece to the planned depth.[6]

How does it work?: The robot is really a direction framework for the dental specialist. It utilizes a portion of a similar innovation as a GPS framework. Once Yomi® gets a CT scan of the patient's head, the software designs the procedural periods of the surgical procedure. It utilizes the measurements of head and face to help direct the dental specialist's hand and instruments as they drill and insert the implant. This helps ensure that patient's surgeon gets the right profundity and location with the drill.

Rest assured, however, the dental specialist stays in charge, should they have to make any alterations. This makes the procedural plans dynamic and adaptable, leaving all control in the specialist's hands. The software enables the dental specialist to know precisely where his or

her apparatuses are in connection to the patient's face, including nerves and arteries. These features make Yomi® a precise instrument that can help convey brilliant oral care.[8]

Does Yomi® supplant dental specialist?: Yomi® does not supplant the dental specialist. Yomi® gives dental specialist accommodating help. The dental specialist clutches and coordinates the Yomi® instruments. Yomi® consolidates dental specialist's expertise with the advantages of robotic surgery.

Indications of Neocis Guidance System (Yomi®): Mostly edentulous patients who need dental implants as a major aspect of their treatment plan. The Neocis Guidance System (NGS) ("Yomi"®) is an computerized navigational system proposed to give help with both the planning (pre-employable) and the surgical (intra-usable) phases of dental implantation surgery. The system gives programming to preoperatively design dental implantation methodology and gives navigational direction of the surgical instruments.

Contraindicatio of Neocis Guidance System (Yomi®): The Neocis Guidance System is not intended for use with patients that have insufficient bone or teeth to retain a Splint rigidly throughout a surgical procedure.

Advantages of Neocis Guidance System (Yomi®): Provides an unprecedented level of precision & control. Achieves the right location, angulation, and depth to place the implant perfectly. It provide clear visualization of the patient's surgical site which gives the preferred standpoint to change the strategy at any time so he can optimize the patient's anatomy. Exact implant placement can sometimes be more difficult with free-hand surgery. Robotic assistance increases surgical control for uncommon outcomes & patient experience. Allows for a less invasive dental implant surgery, making the treatment easy. Predictable Surgical Outcome.

Disadvantages of Neocis Guidance System (Yomi®): No judgment of the situation and hence unable to use any qualitative information. Continuous observing under the supervision of experienced dental specialist is required. These devices still stay over the top expensive and out of reach of the common man.

Adverse events of Neocis Guidance System (Yomi®): The following adverse events are possible: Improper preparation at implant site can result in damage to patient anatomy. Delays in surgery. Injury to client or patient because of unintended movement of the system. Electric shock to user or patient because of electric breakdown. Misuse or off label utilization of the system that leads to manual manipulation of the osteotomy, damage to patient anatomy, or hazard to the user.

Warnings: Neocis Inc has inadequate clinical and experimental information where upon to base any ends with respect to the viability of the Neocis Guidance System in applications other than the preparation of sites for putting dental implants. Adequate bone or teeth is important for holding the Splint inflexibly in the patient mouth. Any slipping of the Splint or movement relative to the rest of the mouth may lead to inaccurate preparation of the implant site.

The Neocis Guidance System is proposed just to be utilized after establishment capability by a prepared Neocis Inc. proficient. The device isn't to be utilized in an unfit way. All users must be appropriately prepared, following approved Neocis Inc. training materials prior to use.

All assembly, adjustment, alteration or fixes related with the Neocis guided system will just be performed by a trained Neocis Inc. agent.

Do not contact the patient and non-medical electrical equipment at the same time while working the device. The Neocis Guidance System isn't expected for use in a MR domain, and has not been assessed for use with RF producing devices, for example, diathermy, RFID and electromagnetic security systems (metal detectors and EAS systems).

Precautions: The Neocis Guidance System should just be utilized by dental specialists prepared in the placement of dental implants at facilities properly equipped for such procedures.

Prior to utilizing the Neocis Guidance System to guide drilling, check the respectability of the system by utilizing anatomical landmarks for verification. Contact the drill tip to a particular anatomical landmark and check that the representation on the screen matches.

The gadget is expected to be utilized with a solitary phase 120VAC 60 Hz Mains power source. Try not to endeavor to utilize the device with some other power source. Device isn't intended to ensure against entrance of solid foreign objects, or fluids. Device is just intended to be utilized on a hard, level, stable surface. When transporting and stowing the system, take care to abstain from putting unnecessary forces on the Guidance Arm and Patient Tracker subsystems. Ensure that the device is positioned in such a way, that the Device Power rope is accessible during normal operation.[9]

Neocis Guidance System (Yomi®) and Food and Drug Administration (FDA) clearance : MIAMI, Jan. 07, 2019 (GLOBE NEWSWIRE) -- Neocis, Inc., the leader and innovator in dental implant surgery using advanced robotics, announced a 510(k) clearance from the U.S. Food and Drug Administration (FDA) for additional dental materials to use with Yomi®. This clearance will expand workflow options to dental surgeons to achieve robot-assisted guidance. MIAMI, Jan. 07, 2019 (GLOBE NEWSWIRE) - Neocis, Inc., the pioneer and trend-setter in dental implant surgery utilizing advanced robotics , reported a 510(k) clearance from the U.S. Food and Drug Administration (FDA) for extra dental materials to use with Yomi®. This leeway will grow work process alternatives to dental specialists to accomplish robot- assisted guidance.

Yomi®, the sole FDA cleared robot- assisted dental surgery system, gives computerized navigation to aid both the planning (pre-operative) and the surgical (intra-operative) phases of dental implantation surgery.10 The framework offers physical direction through haptic robotic technology, which obliges the drill in position, introduction, and profundity. The assistive innovation gives the specialist complete control, in contrast to plastic surgical guides, takes into consideration clear perception of the surgical site.[11] MIAMI-Neocis Inc. company has completed the first sale of Yomi®, a robotic guidance system for dental implant procedures, to the South Florida Center for Periodontics and Implant Dentistry in Boca Raton, Fla. The system has been installed, and training has been completed for Dr. Jeffrey Ganeles, Dr. Fred Norkin, and Dr. Liliana Aranguren. Neocis Inc., a privately held company focused on improving health care through robotic assistance, manufactures and markets Yomi®, the first and only robot-assisted surgical platform for the dental industry.

MIAMI-Neocis Inc. organization has finished the primary sale of Yomi®, an robotic guidance system for dental implant procedures, toward the South Florida Center for Periodontics and Implant Dentistry in Boca Raton, Fla. The system has been introduced, and training has been finished for Dr. Jeffrey Ganeles, Dr. Fred Norkin, and Dr. Liliana Aranguren. Neocis Inc., a privately held organization concentrated on improving medicinal services through robotic assistance, fabricates and advertises Yomi®, the solitary robot- assisted surgical platform for the dental business. Headquartered in Miami, Fla., Neocis is venture-backed, including funding from Mithril Capital Management and robotic surgery industry pioneer Fred Moll and commercially available through www.neocis.com.12

Conclusion: Dental technologists have assumed a fundamental job in the surgical planning phase of dental implants for a considerable length of time and are essentially winding up increasingly dug in their planning, surgical, and restorative functions. Yomi is another option in contrast to conventional careful methods. Yomi furnishes dental specialists with robotic guidance during surgery. The specialist is in control at all times. Yomi joins specialist's aptitude with the advantages of robotic surgery. Yomi enables specialist to rapidly make changes to surgical plan. Yomi Robot-Assisted Dental Surgery is cleared by the FDA in the United States as a modernized navigational system proposed to give help with both the planning (pre-operative) and the surgical (intra-operative) phases of dental implantation surgery. The system provides software to preoperatively plan dental implantation procedures and provides navigational guidance of the surgical instruments. However continued research and scientific studies are required to substantiate the claims of effectiveness of this technique.

References

1. Ganz SD. Presurgical planning with CT-derived fabrication of surgical guides. J Oral Maxillofac Surg. 2005;63:59–71.
2. Dental implants, Advanced Procedures, Caring Hands & Exceptional Results That Will Last A Lifetime. Available from: https://westchesteroralsurgery.com/procedu

re-benefits-of-dental-implants-step-by-step-understanding-of-the-dental-implan process/
3. Yeshwante B, Baig N, Tambake SS, Tambake R, Patil V, Rathod R. Mastering dental implant placement: a review. Journal of Applied Dental and Medical Sciences 2017;5:220-27.
4. Rawtiya M, Verma K, Sethi P, Loomba K. Application of robotics in dentistry. Indian J Dent Adv 2014;6:1700‑6.
5. Neocis Inc. Reaches First Commercial Milestone for Yomi® - The World's First Robot-Assisted Dental Surgical System. Available from: https:// www.globenewswire.com /news-release/2018/11/14/1651721/ 0/en/ Neocis-Inc-Reaches-First-Commercial-Milestone-for-Yomi-The-World-s-First-Robot-Assisted-Dental-Surgical-System.html
6. Yomi – Eeel the difference. Available from: https://www.neocis.com/technology/
7. Robot Assisted Dental Implants - Westchester Oral Surgery. Availble from: westchesteroralsurgery.com/robot-assisted-dental-implants-westchester-ny/
8. Edwards MD Implant dentistry and periodontics Availabel from: https://www.indyimplants.com/blog/2018/01/05/meet-yomi-dental-robot/
9. Neocis. Available from: https:// www.neocis.com/ indications-for-use/.
10. Neocis Inc. Announces FDA Clearance for First Robotic System for Dental Implant Procedures. Available from: https://www.businesswire.com/news/home/20170302005444/en/Neocis-Announces-FDA-Clearance-Robotic-System-Dental
11. Neocis Announces FDA 510(k) Clearance of Additional Dental Materials for Use with Yomi®. Available from: https://www.globenewswire.com/news-release/2019/01/07/1681453/0/en/Neocis-Announces-FDA-510-k-Clearance-of-Additional-Dental-Materials-for-Use-with-Yomi.html.
12. Neocis Inc. Announces First Sale of Yomi Robotic System for Dental Implant Procedures. Available from: https://www.businesswire.com/news/home/20170314005537/en/Neocis-Announces-Sale-Yomi-Robotic-System-Dental.

Conflict of interest: None

Funding: None

Cite this Article as: Srivastava R, Jyoti B, kushwaha C,Priyadarshi P. Computer Aided Navigation for Predictable Dental Implantology: A Review.Natl J Integr Res Med 2019; Vol.10(3): 63-67