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ImplantScanBodiesandIntraoralScanners –ANarrative Review

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ABSTRACT
This review set out to find pertinent literature on intraoralscanbodies (ISB)andexplainhowthey fit intotheworkflowofdigitaldentistry.Thiscovered, among other things, scan body features and design, accuracy,scanbodymethodologies,andthefunction of ISBs in the computer-aided design and manufacture(CAD-CAM) process. The study concluded that intraoral scan bodies are essential to the digital process and have a significant impact on the precision and fit of implant prostheses.

I. INTRODUCTION

Around the world, digital technology has had a big gerimpactinmoredepartments.Digitaltechnology have also been applied to dentistry for a variety of usesandsectors,includingdiagnosis,implantplacement, and orthodontic aligners [1]. Dental implants have been used in recent years to replace lostteeth. Implant loading, abument installation, impression preparation for prosthesis,andimplantinsertionareallessentialprocesses[2].Thedevelopmentofdigitalscanningsystemsandimplantscanbodieshasmadetheprocessof fabricating implant retained prosthesis muchsimpler.Thedevelopmentofdigitalscanbodies,theiruse,andtheirsignificanceinthecreationof implant prostheses are outlined in this article.

IMPLANTSCANBODIES

Few innovations in dentistry over the last 20 years have had the same impact as the advent of the dental scanner. Bysubstituting a direct intraoral scanning method for an otherwise necessary step like a conventional impression, intraoral scanners allowedpractitionerstoforgoitaltogether[3].With the introduction of computer-aided design and computer aided manufactureprocessing (CAD-CAM),inearly2003,itbecamefeasibletofabricate implant-supported restorations using a digital workflow. Computer-aided data acquisition, data processing, and designing are the three components ofCAD-CAM[4].Makinganimpressionisthefirst prosthetic stage in the fabricationof implant prosthesisthatresultsinapassivefit.However, intraoral scanners are unquestionably useful tools thatsupportroutineclinicalprocedures[3].Withan optical imprint, all of the patient's dental arch data canbedirectlycaptured,transferredintoa3Dvirtual model, and sent over email as a Standard Tessellation Language (STL) file to the laboratory, this making the implant impression procedure simpler [5].

CONVENTIONALIMPRESSION

Prior to the development of digital scan bodies,dentalmodelsweremouldedusingdiestone plasterofParis,and impressionswerecreatedusing alginate, silicones, and polyether. Patients may experience some discomfort during these kinds of treatments; this is especially true for procedures involving the gag reflex[6]. Open tray impression andclosedtrayimpressionproceduresaretwoofthe impression techniques [7]. Additionally, doctors may find it challenging, particularly when dealing withtechnicallycompleximpressions,suchaswhen fabricating long span implant-supported reconstructions. In many situations, conventional impressions are challenging to correctly duplicate, particularly when there is a significant angle between the implants [6, 7].

Accordingtoearlierresearch,thedimension alaccuracyofpolyetherimpressionmaterialand polyvinylsiloxanefortransferprocessesinparallel and angulated implants is comparable [8].

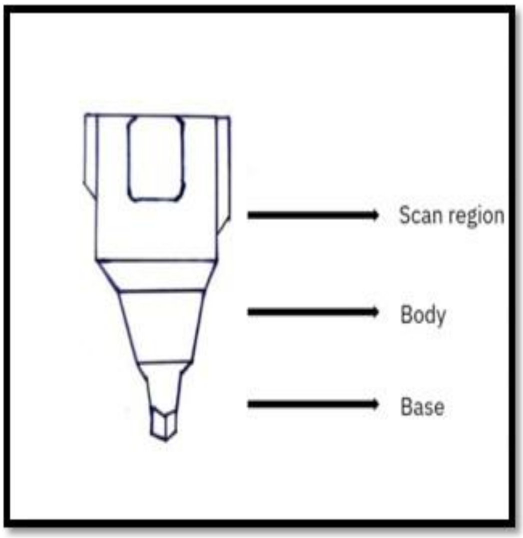
IMPLANTSCANBODYCOMPONENTS

Implantscanbodiescome inawide range ofsizes andforms.The scanregion,body,andbase arethethreeseparatepartsofanintraoralscanbody (ISB).

A. **Scan region**: The top section is the main component that is used to digitally register the orientation and angulation of an implant. Usually, a flat zone is introduced to create an asymmetrical shape that helps with surface identificationusingCADsoftwareandindexing theISB.Thescanzonemaycontainoneormore scan zones, which could improve the accuracy of the digital scan[4].

B. **Body**: The central section of implant scan bodiesiscomposedofarangeofmaterials,such as titaniumalloy, polyetheretherketone (PEEK), aluminium alloy, and other resins. It stretches from the scan region to the base.

C. **Base**: Forming the matching interface between the implant and ISB is the purpose of the base, whichmayormaynotbecomposedofthesame material as the body[4,9].



PartsofIntraoralScanBodies(ISB) TYPES

OF IMPLANT SCAN BODIES

Different manufacturers have produced differenttypesofscanbodies,whichareinuse[10]. Inessence,theyaremadeofmonolithiccomponents or a mix of various materials[9].

Amongthemare:

i. Aluminumalloys
ii. Titaniumalloy
iii. PEEK,orpolyetheretherketone
iv. Variousresins

Biocompatible titanium multifunctional scan bodies have just been offered as a healing abutment.Inadditionto materialseparation,bodies are also widely divided according to designs provided by various manufacturers [10].

INTRAORALSCANNERS(IOS)

Real-time intraoral pictures can be visualized in three dimensions using intraoral scanners [11]. Dr.Duret presented the CAD-CAM concept in dentistry in Lyon, France in 1973, and Dr.MormannandMr.Brandestiniwentontofurther improve it. The first digital impression technology tobesoldcommerciallywasCEREC.Subsequently, numerousothersystemswereintroduced,including the3MLava,C.O.S.,CadentiTero,3ShapeTrios, and E4D systems [12]. Each system has its own uniquemethodforscanning[12,13].Thefollowing intraoral scanners are currently on the market: CEREC Omnicam, Cerecbluecam, Dentalwings, Dentsply-Sirona, Shape trios, Core-3D, IOS Fastscan2015, Medentika, and NT-trading, Lava COS. [11, 13].

Three basicpartsmakeupanyCAD-CAMsystems:

i. **Data acquisition:** This process gathers data and either directly or indirectly converts it into an optical or visual impression.
ii. **Data processing:** To create the final optical impression and get it ready for milling, several software packages will be utilized.
iii. **Data manufacturing:**which is a computerized milling system used in the restorations' final fabrication [12, 14].

There are two primary classifications for contact and non-contact scanners. Confocal microscopy, triangulation, interferometry, wavefrontsampling, structured light, laser, and video are among the techniques utilized by most non-contact scannersindentistrytoobtainrawdata[4].IOScan onlyrecordpartsofanobjectatatime,regardlessof the technology used [4].

PROCESS OF SCANNING AND RECONSTRUCTION OF PROSTHESIS:-

Stepsinvolved:-

1. Toreconstructavirtualsurface,apointcloud— a collection of data points—is obtained using intraoral scanners and analyzed.
2. Themesh,whichisacollectionofflatpolygons ortriangles,isreallyusedtorecreatethisvirtual surface.
3. Post-processing procedures are required to clean up the imperfect rebuilt mesh.
4. Using CAD software, the surface can be matched with the appropriate implant analog once it has been rebuilt.
5. Afterthat,anSTLfileisutilizedtoprintormill thecast,leavingroomfortheimplantanalogto be placed by hand.
6. After that, the analog is luted into position inside the cast utilizing unique guide grooves, vertical stops, or other keyways.
7. Prosthesis fabrication is accomplished either conventionallyordigitallyusingCAMsoftware [4, 2, 11].

ACCURACYANDTRUENESS

Accuracy:

The"closenessofagreementbetweena measuredquantityvalueandatruequantityvalueof ameasurement"isthedefinitionofaccuracyin metrics and engineering.

Trueness:

The "closeness of agreement between the expectation of a test result or a measurement result andatruevalue"ishowtruenessistypicallydefined in terms of bias.

All clinical applications of prosthesis require accuracy; whether using implants or natural teeth, an IOS must be able to detect an accurate impression. The ideal IOS must be able to reconstruct the scanned object's surface and reproduce it as faithfully as possible. It must also possess high trueness and precision, providing results that are reliable and repeatable when scanning the same objects [13, 14, 15].

FACTORS IMPACTING INTRAORAL SCANNINGACCURACY

1. Scanbodydesign

Theshape,bevel,andsurfaceroughnessof scan bodies are geometric factors that have a significant influence on scan accuracy. Higher precision may be attributed to the orientation of the bevels, especially when the implant is positioned lingually, according to previous research [15, 16,].

2. Scanbodyheight

An 8mm coded healing abutment was found to cause a greater angular deviation than a 3mm coded healing abutment in earlier research [17].

3. Scanbodymaterials

When compared to the PEEK scan body, the titanium implant scan body yielded noticeably better truenessin the obtained scan data[10].

4. Bodyfit

The accuracy of a scan can be affected by platformdeviationanditsfit,whichiscontrolledby parameters such as mucosal alignment [15].

5. Implantpositionandangulation

The implant abutment analog angulation and its location on the final implant cast were revealedtobesignificantdriversofthetruenessand precision. The implant scan body feature's lingual orientation obtained the best trueness and precision scores whencomparedtothe otherorientation[18].

6. Operatorskill

Thereisongoingdebateoverhowoperator skill affects scan accuracy. Divergent perspectives from the research emphasize the necessity of a sophisticatedcomprehensionoftheparticularfacets of operator competence that could influence scan results [15].

7. Measurementtechniquesandscanningaids

Numerous measuring techniques and scanning instruments improve the precision of intraoral scans. Adding more surface points to the circle-based technique may produce either bigger differences in deviations or fewer variations if outliersarepresentiftheselectedpointsinthepoint-based technique do not contain outliers [19].

8. Oralconditions

Additionally, it's critical to recognize that oral variables,saliva,and moisture are examples of clinical situations that may contribute extra complications not fully reflected in invitro settings [15].

II. DISCUSSION

Inordertoreplicateanimplant'slocationin a digital model created using an intraoral scanner, scan bodies are precise attachments that are often screwed to the coronal portion of the implant [20]. Implant-supported prostheses can been created using intraoral scanners [21]. Reduced storage needs, quick access to 3D diagnostic data, and simple digital data transfer for professional and patient communication are just a few benefits of developingdigitalmodels[22].EachISBisdecoded by software using a compatible implant library or catalog, which associates digital analog with a specificpositionandangulation.Scannabletransfer abutments are necessary to digitalize the relative virtual position of the implant [23].The accuracy of the IOS test was influenced by the implant's placement, angulation, bevel feature, and implant scan body shape in the dental arch [18]. Measurement methods had a major impact on measured deviations as well, with point-based methods producing smaller deviations [19].The dentistand technicians ignorance is one of the disadvantages. Even though the apparatus is complicated, newer models are easier to use, but even with these changes, proficiency and training are still required. Compared to traditional impression techniques, digital impressions will be less expensive (12). The dental team's efficiency is greatly increased and work flow is streamlined by intraoral scanners and implant scan bodies, which digitally provide an accurate physical model [24].

III. CONCLUSION:-

The following conclusions were reached afterthis review's findings were takenintoaccount. Implantscanbodies(ISBs)areintricatedevicesthat vary greatly in terms of functions and appearance. Data collection, ISB surface matching, and virtual surfacereconstructionareallstepsinthedigitization process of ISB. Compared to traditional impressions, implant scan bodies and digital imaging offer various advantages. They can aid laboratory technicians and dentists alike by facilitating increased precision in implant-retained prostheses. The necessity for continuous research and clinical validation is emphasized by the several kindsofintraoralscanbodies,thedynamicnatureof oral circumstances, and the changing scanning technology environment.

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