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*Journal homepage: <http://www.journalijar.com>***INTERNATIONAL JOURNAL
OF ADVANCED RESEARCH****RESEARCH ARTICLE****A descriptive quantitative computerized occlusal analysis system: T-scan****Dr. Kirti Somkuwar**MDS, PGDHM, BDS Department of Prosthodontics Rishiraj College of Dental Sciences and Research Centre,
Bhopal M.P.**Manuscript Info****Manuscript History:**Received: 12 February 2015
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Published Online: April 2015***Corresponding Author****Dr. Kirti Somkuwar****Abstract**

Occlusion analysis and simulation occlusion of a patient remained the day dream of the dental profession. It constituted a great difficulty to analyze the problems arising from occlusal origins due to the complex nature of the human occlusal system. The search for the most atraumatic dental occlusion is growing demand especially in the fields of restorative and reconstructive dentistry. T-scan provides both qualitative and quantitative assessment of occlusion. Instead of the former messy qualitative carbon marks and it is presented in a video (movie) format. The system has got many advantages as being simple to operate, dynamic viewing of occlusion, timed analysis of force during various positions of teeth contact and the possibility of permanent documentation and monitoring of the occlusal condition after carrying on the various treatment protocols. The T-Scan not only presents a valuable method for clinical evaluation and understanding of the occlusal problems but also it offers an important tool for teaching purpose. The purpose of this review paper is to provide an overview of system over it's utility in advance treatment modalities

*Copy Right, IJAR, 2015., All rights reserved***INTRODUCTION**

Occlusal contacts are made when mandibular teeth come into contact with maxillary teeth. Near contacts are those areas that range from a contact to a gap of 0.5 mm between the occluding surfaces, while noncontacts are those areas wherein there is a 0.5-2 mm separation of the teeth.^[1] Among the several occlusal concepts existent, the more accepted one is the bilateral balanced occlusion introduced by Bonwill^[2] and studied by other known authors^[3]. Basis extension, flange area, cusp height, width of occlusal table, and the loss of periodontal sensibility are aspects that promote a reduction of the masticatory efficiency in dentures wearers. In fact the occlusal pattern seems to have a great influence on the increasing of balance between the prosthesis^[4]. Balancing ramps may promote denture balance through the smooth sliding between the prosthesis^[5]. Besides the excellent esthetics due to the anterior overjet, it is possible to have more stability during the food bolus interposition than in the classical balanced bilateral occlusion pattern^[9]. Occlusal contact marking indicators are used to determine the specific areas of this occlusal contacts.^[1] These indicators are made of special materials that on occlusal contact transfer color from the indicator to the occlusal contact area.^[2] It is assumed that a color mark represents a contact and that the transfer is accurate. An "occlusal interference" is any tooth contact that inhibits the remaining occluding surfaces from achieving stable and harmonious contacts.^[1] Any occlusal interference as small as 15 microns can trigger an untoward response and hence must be eliminated. Occlusal interferences can induce tooth pain or mobility, although data does not indicate that they are the cause of chronic jaw dysfunction problems.^[1]

The true occlusal contact time by definition implies that a time of 0 s elapses between the first and the last occlusal contact,^[6] i.e., all the occluding surfaces should meet at the same instant during the mandibular closure. Occlusal therapy aims at achieving this simultaneous occlusal contact relationship. T-scan occlusal analysis system provides one option to assess occlusal forces (Chapman and Kirsch, 1990). The T-Scan system is a computerized dental device which can quantitatively analyze occlusal contacts (position, strength, and frequency of occlusal contacts). This review will throw light upon T-scan technology in detail, its functional aspect and multi-disciplinary approach to deliver better services to patient

The occlusion indicators can be broadly divided as qualitative and quantitative indicators, (table 1). The principal difference being that the quantitative indicators are capable of measuring tooth contact events -:

Table 1 classification of occlusal indicator

Quantitative indicators
• T-Scan occlusal analysis system
• Virtual dental patient
Qualitative indicators
• Articulating paper
• Articulating silk
• Articulating film
• Metallic shim stock film
• High spot indicator

Selection of the Qualitative Indicators

- Thickness - The disadvantage of a thick occlusal registration strip, i.e., the one that the patient can perceive between the teeth is that it can indicate the tooth contact between the opposing teeth, even when no contact exists when the thickness of the registration strip is greater than the space between the teeth. Moreover, excessive thickness can induce a proprioceptive response that in turn can cause the jaw to be deflected.
- Plastic deformation - Occlusal registration strips that have plastic deformation will stretch before they tear, thereby enabling the dentist to tug at the strip and to evaluate the occlusal contact.

- Tensile strength - Thinner strips would tear before they served their purpose, but those having the property of plastic deformation will stretch prior to tearing.
- Marking ability - On occlusal contact, the coloring agent should bond to the tooth. The occlusal registration strip should be thin, plastic and non-smearing on the tooth surface. Articulating foils have the greatest marking sensitivity values, followed by the articulating paper. It has been found that the marking ability of all qualitative recording media is negatively affected by the presence of saliva, and hence, the teeth should be dried prior to the use of the registration strips.

History of T-Scan

In 1987, Tekscan developed *T-Scan*®, the first ever grid-based sensor technology specifically designed for occlusal analysis. Tekscan created this powerful diagnostic tool in response to the need of dentists seeking an accurate way to dynamically measure occlusion.

The T-Scan computerized occlusal analysis (Tekscan, Boston, USA) is an integral part of clinical functional analyses in prosthetic and restorative insertions. The T-Scan computerized system can quickly determine prematurities, high points, regions of excessive force and non-uniform force concentration. It can also calculate disocclusion time accurately. The evolution of pressure sensitive ink - Mylar encased sensor technology, was introduced with the T-Scan® I computerized occlusal analysis system by Maness et al in 1984. In 1987, Tekscan developed *T-Scan*®, the first ever grid-based sensor technology specifically designed for occlusal analysis. Till now the advancement is reached up to t-scan version -5 Occlusal foil indicators can determine only the position, number and relative force of occlusal contacts.

T –SCAN SYSTEM

T-Scan is a computerised occlusal force analysis device. It is composed of three parts. The patient bites of a thin (75 micron) sensor. The sensor is made up of columns and rows of pressure sensitive ink, trapped in a Mylar sandwich. The sensor is attached to a handle (figure1) .Which scans at thousandth of a second time intervals. The handle reads the data from the sensor and passes it to the computer software which presents the data in an easy to understand visual display



Figure1. Showing computer system attached to sensor handle

The T-Scan Sensor

- Two Mylar layers Dielectric Electronic Leads, With Pressure Sensitive Ink having 2200 sensing points Of Sensor thickness 100 microns. Re-used for approx -15-25 recordings (figure 2).

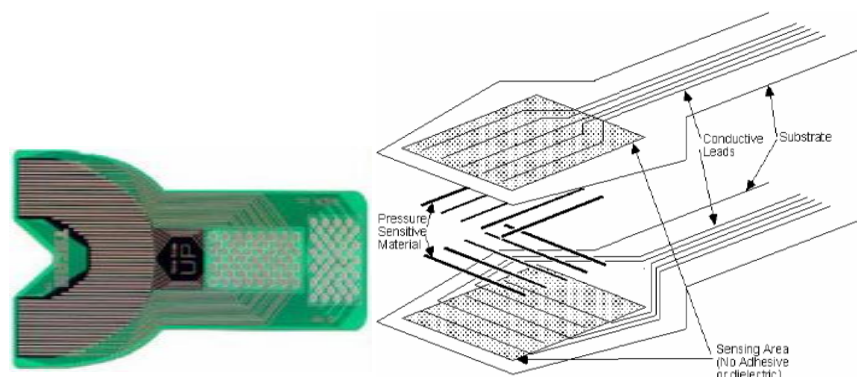


Figure 2 showing sensor and its layers

Recording technique - The recording handle with the sensor and arch support is placed between the maxillary central incisors of the patient [figure 3]. The recording is initiated by pressing the button on the recording handle. The patient is asked to close the mouth till complete intercuspation is reached, without making any excursive movements.



figure 3 .Showing patient recording

Data interpretation - The data recorded is shown as a force movie [figure 4],[figure 5] in which the center of force trajectory shows the history of the path of the center of the force from the beginning of the force movie recording to the current displayed frame. The trajectory movement indicates where the force summation is directed when more of the teeth of the patient sequentially come into contact [figure 4].

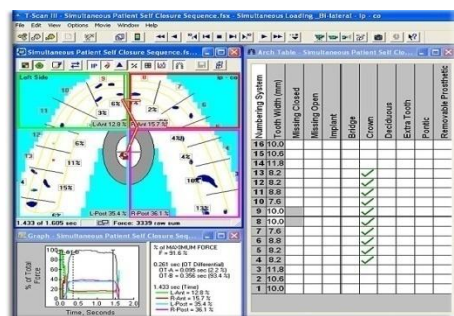


figure4. Showing Display data in window

Thus, by gaining information on the earliest occlusal contact, it can be adjusted and simultaneous occlusal contact can be established [figure 5],[figure 6]. The outcome of this occlusal therapy is that the patient can feel a more

widespread contact sensation at the end, the reason being that the establishment of true and measurable bilateral simultaneous occlusal contacts is achievable using the T-Scan.

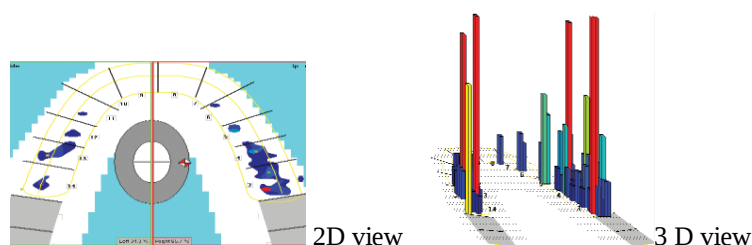


figure 5. Showing 2 dimension and 3 dimension view of occlusal contacts

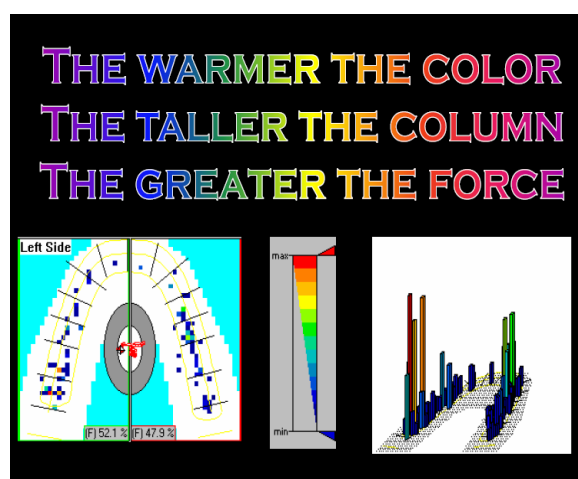


Figure 6. showing force distribution on individual teeth .

Application of T-SCAN

Application of T-scan is seen in : Fixed & Removable Prosthetics , Implant Prosthetics ,TMD Appliances, Occlusal Equilibration, Disclusion Time Reduction, Abfraction Management, Periodontal Management, Differential Diagnosis, Orthodontics, Locating Painful Teeth and Dental Case Finishing.

Case Finishing: From single unit fillings to full mouth rehabilitation it is important for patient comfort as well as restoration longevity to get a balanced occlusion with mutual anterior/posterior protection. As articulating paper does not measure force, balance, or timing, it is not a sophisticated enough media to rely on. T-Scan allows a clinician to case finish with accuracy and confidence.

Diagnostic Screening: Occlusal trauma is the cause of a large number of pathologies in the mouth. Abfractions, bone loss, exostosis, periodontal pocketing, as well as cusp breakages, restoration failure and excessive wear. Measuring the force and timing of a functional bite is essential for accurate diagnosis^[7]

Implantology: As implants do not flex in the periodontal socket. Controlling the force on restored implant prosthesis is difficult enough without working “blind” by not measuring it at all. The T-Scan shows in thousands of a second time intervals how force is applied to neighbouring teeth and implants.

Cosmetic Dentistry: Case finishing for cosmetic dentistry can be the difference between a successful case and a failure. Due to the precise nature of cosmetically driven patients, being having confidence that the restorations will be functional and veneers will not de-bond, is a tremendous asset.

Conclusion:

T-scan is available in various versions -T scan I , T scan II , T scan III , T scan IV, T scan V and latest is VI .The data is obtain from T-scan can be analysed in three ways

1. It shows the duration and relative magnitude of all tooth contacts
2. It identifies disproportional loading forces and transient impact forces acting on specific teeth and
3. It identifies active tooth contact occurring within the functional range of mandibular movement and the interaction between working and nonworking interferences.

Articulating paper mark size is non-descriptive of occlusal load, as many different sized marks can represent the same load, and equal sized marks do not represent similar loads. The T-Scan system has proved to be a reliable method for the analysis and evaluation of occlusal contact distribution in maximum intercuspation.^[8] Although its cost is very high but it is a valuable method for clinical evaluation and understanding of the occlusal problems but also it offered an important tool for teaching purposes

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