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Evaluation of dental occlusion as an etiological factor in temporomandibular joint disorders: An observational study

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***Abstract*---**Introduction: Temporomandibular joint disorder (TMD) is a musculoskeletal disorder characterized by pain, limited mouth opening, joint sounds, mandibular deviation, and chewing disability. Premature contacts may lead to TMD. Role of dental occlusion as an etiological factor for TMD is still controversial. Aim of this study is to analyze the relationship between occlusion time and clinical symptoms of TMD using digital occlusion scan and analysis systems. Methodology: This observational study included patients of any gender, between 18-35yrs of age with TMD but otherwise healthy. Patients with periodontal disease, systemic inflammatory conditions, bruxism and tooth wear, patients undergoing treatment for TMD, orthognathic surgery and orthodontic therapy were excluded from the study. Occlusion and disocclusion time were the parameters assessed. The total sample size of this study was 30. Result: There is significant

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difference between study and test groups in occlusion and disocclusion time during centric occlusion, disocclusion time in protrusion, right and left lateral excursion. Conclusion: Occlusal interferences may affect the TMJ and can cause TMD.

***Keywords*---**dental occlusion, temporomandibular joint disorder, t-scan, occlusion scan, disocclusion, occlusion.

Introduction

Temporomandibular joint (TMJ) also known as cranio mandibular joint is part of the articulatory system which is formed by the TMJ, muscles of mastication and dentition. TMJ is made up of glenoid fossa of temporal bone, articular disc and mandibular condyle[1]. It is a ginglymodiarthrodial joint that is capable of both hinge and translatory movement. The uniqueness of TMJ is such that both joints are related to each other and function together[2].

As occlusion forms a part of the articulatory system, its role in dictating the function of the TMJ is obvious[3]. Normal occlusal and articular relationships between the jaws ensure that the produced forces in them are distributed evenly during mastication[4]. Any occlusal trauma caused by premature occlusal interactions and occlusal-articulating interferences, may lead to changes in the tooth-supporting structures (mucosa, periodontal tissues, and bone), as well as the masticatory muscles and the TMJ[5].

Disorders of the TMJ are broadly classified as myofascial, disc related and degenerative diseases. Temporomandibular joint disorders (TMDs), depending on the type and severity, are characterised by pain, limited mouth opening, joint noises, mandibular deviation, and masticatory inefficiency[6]. Parafunctional behaviours such as bruxism, clenching, and masticatory muscle tension are strongly linked to its symptoms. Since TMD is multifactorial and the role of dental occlusion as an etiological factor of TMD has been much debated over the decades[7]. Few authors agree that psychological and postural patterns play a role in the onset of TMD. Many researchers believe there is a clear link between TMD and malocclusion with a broad muscular discrepancy. The position of occlusion in TMD is a point of contention among dental researchers[8].

Appropriate treatment cannot begin before a correct diagnosis has been identified. Previously, the principle of occlusion was studied using articulating paper, shim stocks, occlusal waxes, and silicone impressions to examine the static relationship between teeth[9]. Traditional approaches have two major drawbacks: they are two-dimensional and do not measure the occlusal load or occlusal force. With the advent of digital systems that aid in analysing dental occlusions much more precisely, we may forge new understandings in this much controversial debate[9,10].

T scan is a digital occlusal analysis system that was developed by Maness et al in 1984[11]. It is convenient to use and provides an accurate quantification of occlusion. The system comprises a computer software and a special sensor that

can be attached to an operable hand piece[12]. This digital occlusal analysis system quantifies occlusion time, occlusal force and the distribution of forces on both sides of the mandible[13]. As evident, occlusion time is related with the premature contacts and occlusal instability which may be an etiological factor of TMD[14]. In this study, we aim to analyze the relationship between occlusion time and clinical symptoms of TMD using the T-Scan analysis system.

Methodology

The study was conducted at the Department of Oral and Maxillofacial Surgery and Occlusal Calibration Centre at Saveetha Dental College, SIMATS University. The approval of the study was given by the "Institutional Ethical committee, SIMATS Review Board". The study was conducted between November, 2020 to March, 2021 among patients reporting to the Out Patient Department of Oral and Maxillofacial Surgery.

Digital Analysis System

The digital occlusal analysis system used for this study was T-scan Novus. The sequence of closure from the first point of contact to maximum intercuspation is recorded by computerised occlusal analysis technology. These closure data can be used to analyse and interpret the time required for the teeth to reach complete intercuspation, whereas the force mapping data can be used to locate forceful occlusal contacts objectively. The parameters of occlusion time, occlusal force and the distribution of forces on both sides of the mandible is measured by the system in four mandibular positions viz. centric occlusion, right lateral excursion, left lateral excursion and protrusion.

Sample Selection

Prior to being included in the study, all participants were informed about it and gave their informed consent. The sample size of the study was 30 and comprised two groups with 15 in each group.
The inclusion criteria for sample selection to each group were as follows:
Study Group: Patients of any gender, between 18-35yrs diagnosed TMD but otherwise healthy.
Control Group: Healthy volunteers aged 18-35yrs with so symptoms of TMD

Data Collection

All the participants of this study were subjected to personal interview and clinical examination. The personal interview included gathering personal information as well as a detailed medical and dental history. During the clinical examination, the single clinician evaluated occlusion, muscle of mastication, and TMJ. Research Diagnostic Criteria for TMD (RDC/TMD) was the diagnostic criteria followed for diagnosing participants with TMD. The participants of both the groups were subsequently subjected to digital analysis of occlusion by the T-scan Novus system. The outcome assessed were occlusion time and disocclusion time all four mandibular positions viz. centric occlusion, right lateral excursion, left lateral excursion and protrusion. The data of the study parameters were collected and

tabulated in Excel Spreadsheet. The graphical representation was also collected for reference.

Statistical Analysis

The collected data were analysed with IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp. To find whether there was a statistically significant difference in occlusion and disocclusion time between study and control groups, unpaired t- test was used at the 5% critical level ($p \leq 0.05$).

Results

The objective of this study was to evaluate the role dental occlusion as an etiological factor of TMD using digital analysis of occlusion. The results from this study showed a significant difference between control and study groups in occlusion and disocclusion time during centric occlusion ($p<0.05$) (Fig3) (Table 1). With respect to occlusion time during protrusion, right and left lateral excursion, no statistically significant difference was found between study and control group ($p>0.05$) (Fig 4) (Fig 5) (Fig 6) (Table 1). But the disocclusion time between study and control group during protrusion, right and left lateral excursion showed statistically significant difference ($p<0.05$) (Fig 4) (Fig 5) (Fig 6) (Table 1).

Discussion

Juniper proposed that when the disc shifts, the condyle shifts as well, changing the relationship of the lower teeth to the upper teeth and resulting in premature contacts[15]. This concept of 'harmony' between the intercuspal position of teeth and the stable position of the condyles in the fossae underpins the theory of 'orthopaedic stability.' In the absence of this 'harmony,' the condyle on one or both sides has an unstable relationship with the disc and articular fossa[16]. When the elevator muscles contract, the condyle on the affected side moves superiorly in search of a more stable relationship with the disc and fossa. As a result of the condyle's upward displacement, there may be a decrease in occlusal contacts, with the possibility of new occlusal interferences forming and aggravating the condition. This progresses as a vicious cycle[17].

Engel introduced the biopsychosocial model to medicine in 1977. The model was based on general systems and was intended to provide a comprehensive framework for conceptualising all levels of organisation relevant to health and disease[18]. The entity "occlusion" is one of the levels of organisation in the musculoskeletal pain condition "TMD." Since then, there has been a paradigm shift in the treatment of "TMD" from the biomedical model, (especially occlusion) to a biopsychosocial model of disease[19]. The intensity of shift is such that from occlusion being considered as the primary etiological factor of TMD, it is now regarded by many to have no role at all. The debaters against occlusion being an etiological factor consider behavioural, psychological and neurological problems to be the determinant of TMD[10]. The controversy is unsettling over the decades because much of the debate is based on anecdotal rather than scientific evidence. Most occlusal studies to date have evaluated the static relationship of the teeth and the significance, or lack thereof, of occlusal factors in relation to TMDs[20].

In this study, we analysed considered dental occlusion to be a dynamic one and quantitatively evaluated its role as an etiological factor in TMD. We found that there was a significant difference in occlusion and disocclusion time between the study and control group. We recognise the shortcomings of our study to be its study design and the lesser sample size. But nonetheless, the findings of this study does show that occlusion is one the etiologies of the multi-factorial TMD that should not be completely ignored.

Conclusion

We conclude that there is a significant difference between control and study groups in occlusion and disocclusion time during centric occlusion, disocclusion time during protrusion, right and left lateral excursion. Hence, we believe dental occlusion plays a significant role as an etiological or aggravating factor in TMD and should not be completely overlooked in the management of patients with TMD.

Conflict Of Interest
None

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Tables and Figures

Fig 1: T-scan Novus System

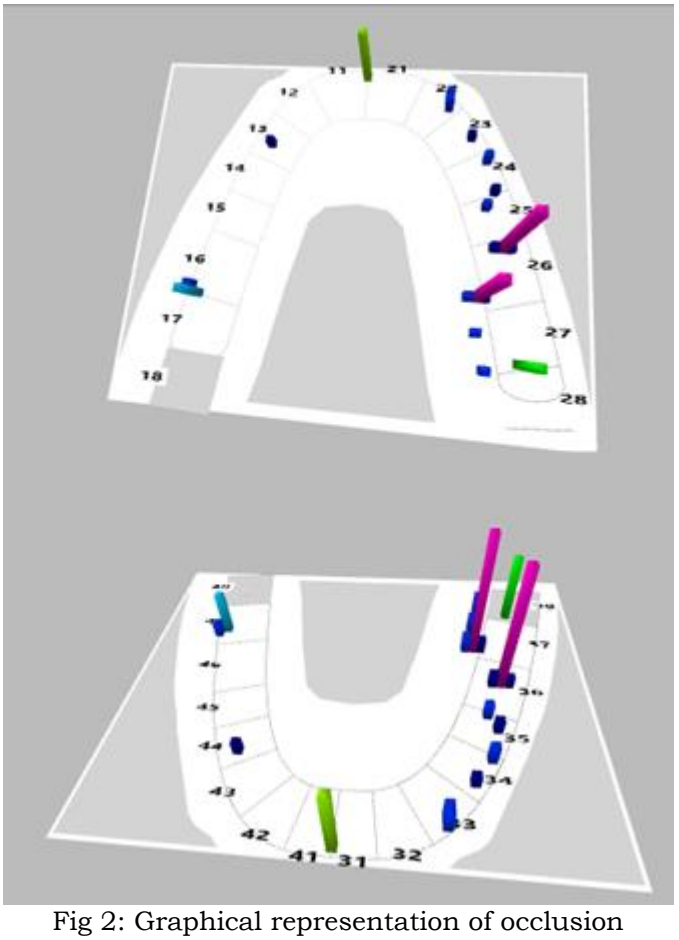

Fig 2: Graphical representation of occlusion

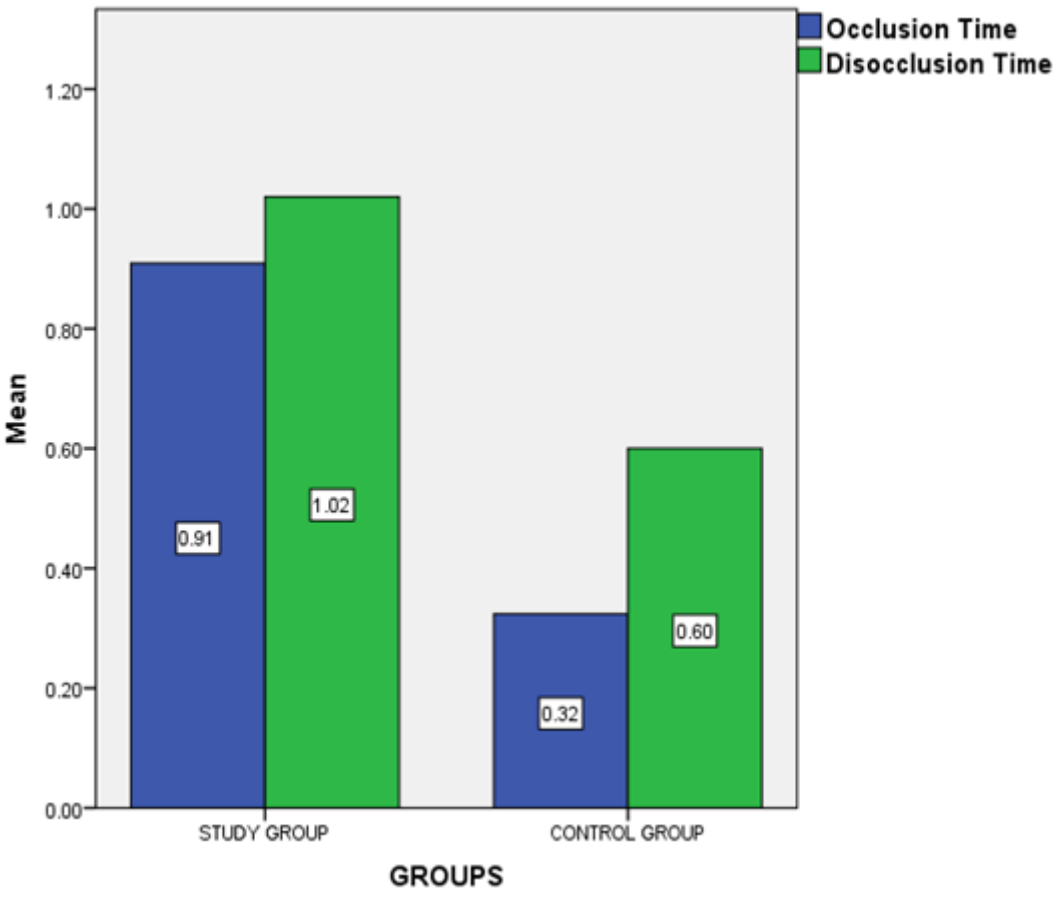

Fig 3: Bar chart showing occlusion and disocclusion time in study and control groups during centric occlusion

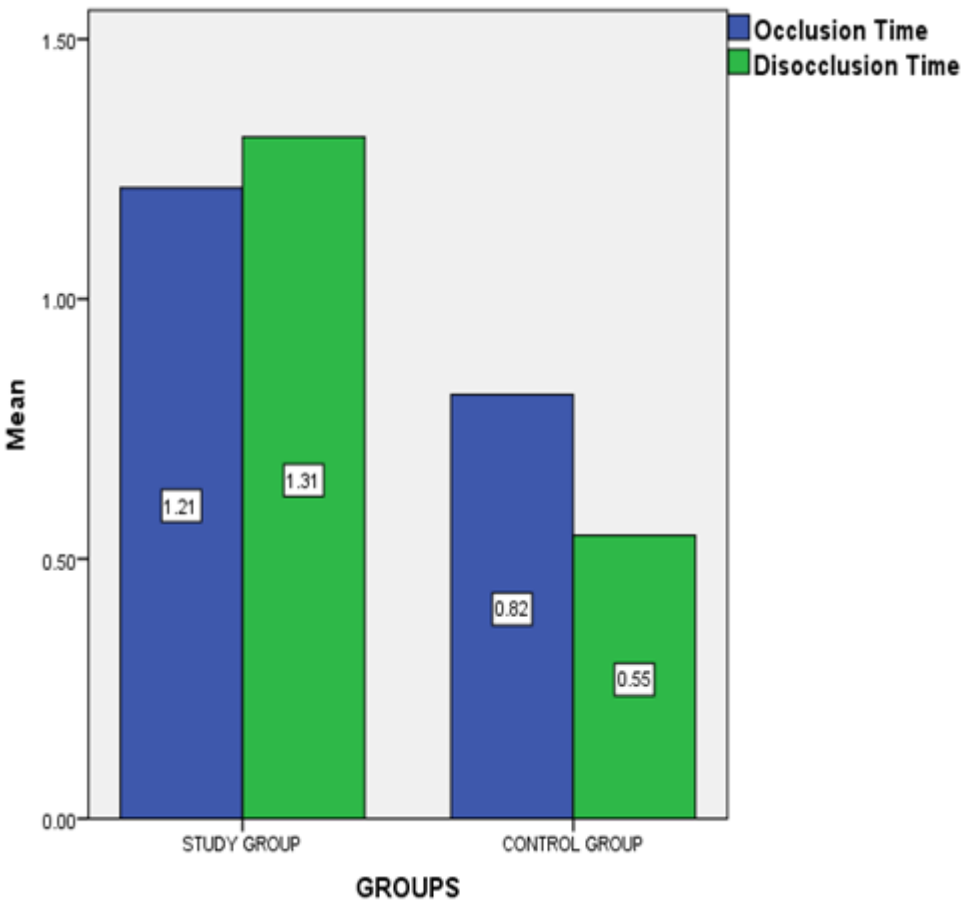

Fig 4: Bar chart showing occlusion and disocclusion time in study and control groups during right lateral excursion

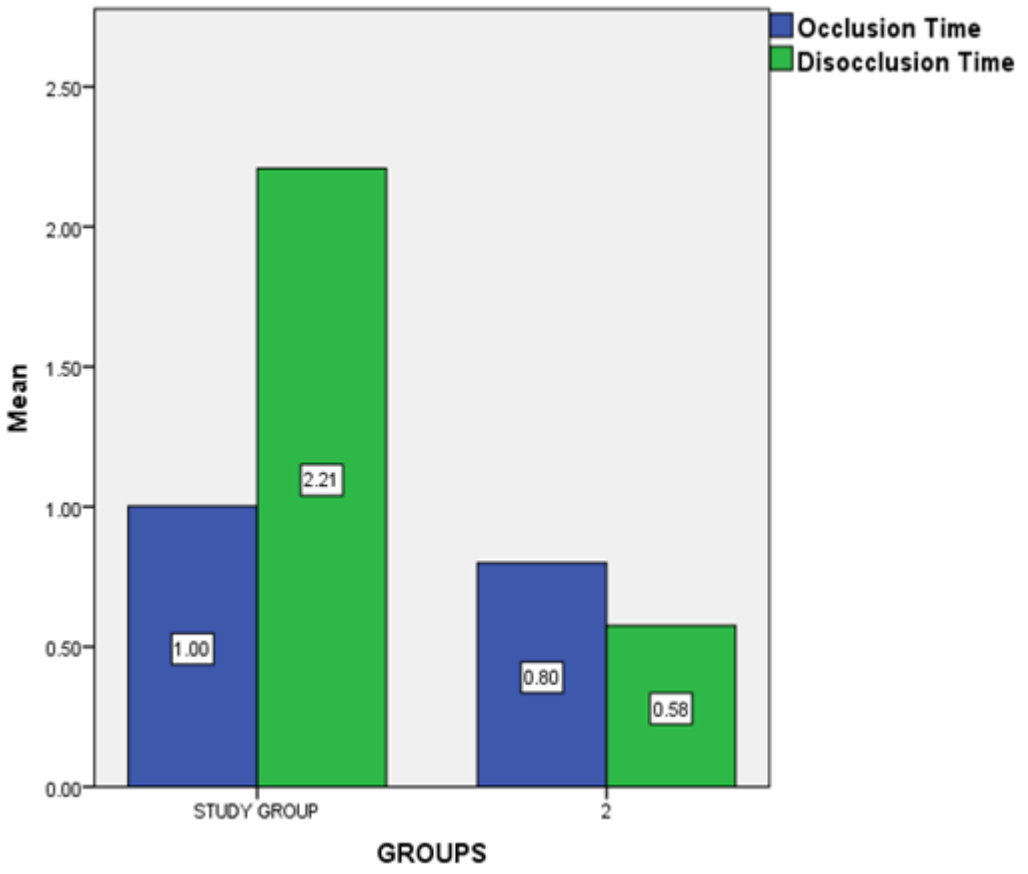

Fig 5: Bar chart showing occlusion and disocclusion time in study and control groups during left lateral excursion

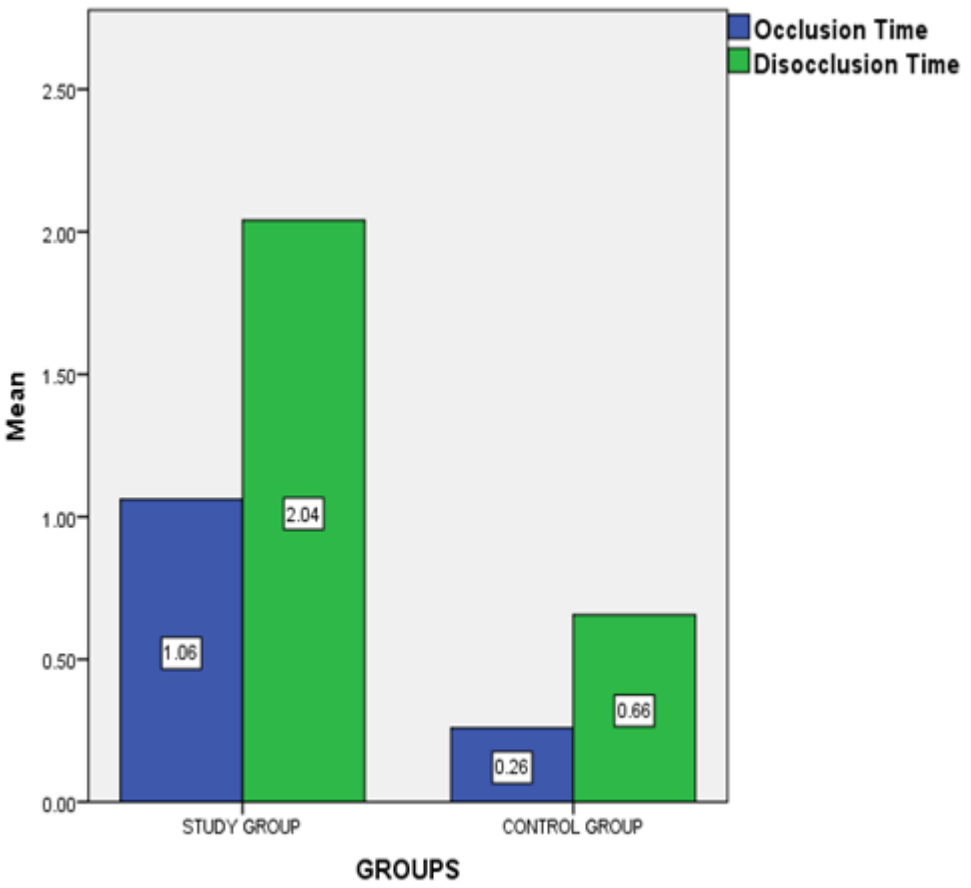

Fig 6: Bar chart showing occlusion and disocclusion time in study and control groups during protrusion

Table 1: Shows p value of occlusion and disocclusion time between study and control group at in all four mandibular movements

PARAMETERS	***p***
Centric Occlusion	
Occlusion Time	0.027
Disocclusion Time	0.004
Right lateral excursion	
Occlusion Time	0.260
Disocclusion Time	0.001
Left lateral excursion	
Occlusion Time	0.180
Disocclusion Time	0.00
Protrusion	
Occlusion Time	0.387
Disocclusion Time	0.011