ISSN: 2581-5989
PubMed - National Library of Medicine - ID: 101738774

International Journal of Dental Science and Innovative Research (IJDSIR)

IJDSIR : Dental Publication Service

Available Online at: www.ijdsir.com

Volume – 7, Issue – 3, May – 2024, Page No. : 163 - 168

An In-vivo comparative study for evaluating marking ability of qualitative occlusal indicators for occlusal contacts on different surfaces with and without interference

[1]Dr. Chandrasinh Rajput, Professor and PG Guide, Department of Prosthodontics, Crown & Bridge and Implantology, College of Dental Sciences and Research Centre, Bopal, Ahmedabad– 382115, Gujarat University

[2]Dr. Shruti Mehta, Professor, Head of Department and PG Guide, Department of Prosthodontics, Crown & Bridge and Implantology, College of Dental Sciences and Research Centre, Bopal, Ahmedabad– 382115, Gujarat University

[3]Dr. Hitendra Shah, Professor and PG Guide, Department of Prosthodontics, Crown & Bridge and Implantology, College of Dental Sciences and Research Centre, Bopal, Ahmedabad– 382115, Gujarat University

[4]Dr. Kavan Doshi, Post graduate student, Department of Prosthodontics, Crown & Bridge and Implantology, College of Dental Sciences and Research Centre, Bopal, Ahmedabad– 382115, Gujarat University

[5]Dr. Naman Brahmbhatt, Senior lecturer, Department of Prosthodontics, Crown & Bridge and Implantology, College of Dental Sciences and Research Centre, Bopal, Ahmedabad– 3821156, Gujarat University

[6]Dr. Nidhi Gupta, Reader, Department of Prosthodontics, Crown & Bridge and Implantology, College of Dental Sciences and Research Centre, Bopal, Ahmedabad– 382115, Gujarat University

Corresponding Author: Dr. Kavan Doshi, Post graduate student, Department of Prosthodontics, Crown & Bridge and Implantology, College of Dental Sciences and Research Centre, Bopal, Ahmedabad– 382115, Gujarat University

Citation of this Article: Dr. Chandrasinh Rajput, Dr. Shruti Mehta, Dr. Hitendra Shah, Dr. Kavan Doshi, Dr. Naman Brahmbhatt, Dr. Nidhi Gupta, "An In-vivo comparative study for evaluating marking ability of qualitative occlusal indicators for occlusal contacts on different surfaces with and without interference", IJDSIR- May – 2024, Volume –7, Issue - 3, P. No. 163 – 168.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Statement of problem; The accuracy of marking ability of qualitative occlusal indicators on different surfaces have been poorly studied.

Purpose: The purpose of this clinical study was to determine the marking ability of qualitative occlusal indicators on natural and artificial denture teeth.

Material and methods: 20 participants were included in this study undergoing prosthetic restoration treatment. Patients who fulfilled the inclusion criteria were allocated into 2 groups Natural teeth and Artificial denture teeth. Occlusal contacts with and without interference were registered applying maximum occlusal force with 2 different qualitative occlusal indicator material (100 microns articulating paper, 12 microns

articulating foil), Marked surface were photographed & Total surface area in pixel were measured using IC Measure 3 software.

Results; A paired t test was done to check the significant difference in marked surface area with and without interference between 2 groups. Findings showed that the markings of 100 microns paper and 12 microns foil with interferences showed highly statistically significant differences while 100 microns without interferences showed statistically significant results

Conclusions: The type of occlusal contact indicators has an effect on the false registration marks and on the size and number of the occlusal contacts as well. From the result's there is relationship between the thickness of the occlusal indicator and the form of the marks on the occlusal surface.

Keywords: Occlusal Indicator, Articulating Paper, Articulating Foil, Occlusal Contacts.

Introduction

Occlusion is considered as the static relationship between the incising or masticating surfaces of the maxillary or mandibular teeth or tooth analogues.[1] Understanding the patterns of teeth's static and dynamic contacts are required to achieve an accurate examination of occlusion in prosthodontic and restorative treatment and to further avoid occlusal discrepancy. For ideal occlusion, it is required to observe the simultaneous and homogeneous contact between the maxillary and mandibular teeth without any interferences or premature contacts. Premature occlusal contacts in prostheses or dental restorations may lead to devastating alterations in the craniomandibular system like occlusal discomfort, sensitivity of teeth, chewing difficulties, fatigue of the jaw, headache, facial pain, mouth opening difficulty, bruxism, TMJ disorders, MPDS and ear symptoms.[2] A serious risk can be triggered by a micron of occlusive interference. The patient is likely to stop biting from the new dental prosthesis or restoration side to avoid any pain or discomfort.

The occlusion indicators can be broadly divided as **Qualitative and Quantitative Indicators**: The principal difference being that the quantitative indicators are capable of measuring the tooth contact events.[3]

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

Fig.1: Showing classification of occlusal indicators

Qualitative and quantitative occlusal contact indicators are commonly used to assess these occlusal-articulating relations. Articulation paper is the most frequently used indicator due to its lower price and easy application. The size of the marks obtained by an articulation paper have been found to be indicative of load of the occlusal contacts in dental practice.[4]

The data in the available literature regarding the relationship between the thickness of the articulation paper and the area of the markings is rather contradictory.[5] According to some authors the size of the area of the marking shows how heavy the load with the small mark areas showing less load. Thicker occlusal contact indicators have been found to register marks that are greater in number and area than those thinner indicators can obtain.[6]

Aim of study

To compare the marking ability of the recorded contacts on a natural and artificial tooth surface obtained with articulating paper and foil of different sizes with and without interferences.

Material and methods

Total 20 participants were included in this study allocated from the OPD clinic of the Department of

prosthodontics of institute. Participants have undergone screening to check that they meet the inclusion criteria for the study listed below.

Inclusion Criteria

Each participant included in this study must have: -

- Class I Angle's Classification with normal occlusal relations
- Presence of existing anterior tooth contact
- Presence of healthy full complement of teeth.

Exclusion criteria

A potential participant was excluded if he/she has

- Presence of an anterior open occlusion
- Presence of a class 2 and class 3 malocclusion
- Presence of a deep overbite
- Presence of a TMD Symptomology
- Presence of an orthodontic appliances
- Absence of contacting Upper molar & premolar counterpart

Those deemed to be eligible were asked to give written informed consent for participation in the study and institutional ethical committee clearance was taken (CDSRC/IEC/20210102/02) .

Materials used

Material	Manufacturer
100 microns articulating paper	Bausch(Hainspitz, Germany)
12 microns articulating foil	Bausch(Hainspitz, Germany)
Blu-Bite radiopaque composite	Anabond Stedman pharma
Bonding agent	Fusion flo
Etchant	Smart etch
Curing light	Woodpecker

Equipment used

- Nikon D3500 DSLR Camera with macro lens
- Reflective stainless-steel mirror with polished surface
- IC Measure 3 software
- Mouth mirror
- Articulating paper holder
- Tweezers

The study comprised of total 80 samples that derived from 20 subjects of 2 groups.

Group 1 –Natural teeth

Group 2 - Artificial denture teeth

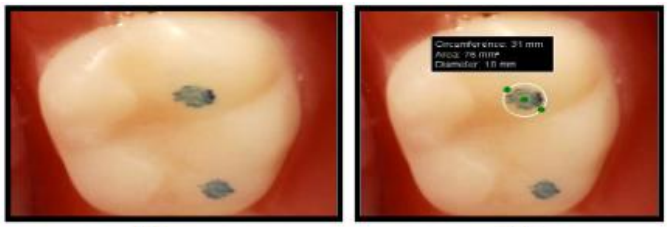
All the subjects were seated in dental chairs, with the Frankfort plane parallel to the ground. Before registration of contacts, the oral cavity of all the subjects were completely dried to increase the efficacy of qualitative occlusal indicators.

Then for group 1 subject (natural teeth), occlusal contacts were registered applying maximum occlusal force with 2 different qualitative occlusal indicator materials (100 microns articulating paper, 12 microns articulating foil) and contacts were registered. Marked surface were photographed with DSLR & Total surface area in pixel were measured using IC Measure 3 software (The Imaging Source, United States). Then after Occlusally Induced interference was made of 0.3 mm radius composite ball attached to Mesio-buccal surface of mandibular 1st molar and then marking of surface by occlusal indicators are taken. Following it, marked surfaces were photographed with DSLR & total surface area in pi0000xel was measured using IC Measure 3 software. For each subject, a new sheet of the occlusal indicators was used, and 10 repetitions were made for each one. Similar procedure was performed for subjects in group 2 (artificial denture teeth).

Data were collected from 80 samples and tabulated on Microsoft Excel. Statistical tests- Mean, standard deviation (SD), paired t-test, Confidence interval, were performed using SPSS software (IBM SPSS Statistical software version 23). Level of significance (P-value) was set at 0.05.

(a) (b)

Fig. 2: (a) 100 µ articulating paper (b) 40 µ articulating foils



(a) (B)

Fig. 3: Showing (A) marked surface contact area and (B) showing measurement of marked contact.

Results

Mean and standard deviation (SD) were calculated from recorded data are shown in Table 1 & 2. A paired t test was done to compare marked surfaces, recorded for both articulating paper and articulating foil in each patient with and without interferences (table 3). Results for the markings of 100 and 12 microns with interferences showed highly statistically significant differences while 100 microns without interferences showed statistically significant results.

Discussion

The result of this study shows that more occlusal contacts of smaller sizes are identified by articulating foil. With articulation paper marks that are registered are of lesser number and larger size marks. Our study correlates with study done by Ernst schelb[7] that revealed that the thickness of the marking materials, film material, and marking substance affected the size of mark. These relationships permit the dentist to select a material with optimal characteristics. The thickness of the articulating paper affects the recordings. A variety of in vivo and in vitro studies have shown that changes in thickness of the articulation paper result in staining areas of different sizes, numbers, and densities, even under conditions where the same forces or different forces are applied to the same restorations.[8-10] The load decreases.[11] The resulting marks of thicker paper are larger in size, and vice versa the marks obtained from the thinner paper have smaller size and bigger individual load. William Maness12 compared the performance of a new computerized occlusal analysis (T-Scan) system with that of Accufilm and Shim stock foil for the registration of tooth contacts on a laboratory model. Induced interceptive contacts were created on epoxy models in a mechanical closing device and the occlusal contacts were recorded for each registration method. Author stated that the traditional methods were similar to the computerized analysis but the T-Scan system provided additional differential diagnostic information in force and time modes for an improved occlusal analysis. Occlusal marking materials are proprietary and vary in thickness, type of ink, nature of backing, strength, and response to moisture. Millstein13 compared the markings from different occlusal marking systems in vitro. The author observed that papers, with different ink colours, even of the same thickness, gave varying patterns of contact markings. The intra class correlation coefficients suggested that the reliability of all but the thickest papers was low. The surface area of contact was variable according to the ink colour and type of backing. A 200 mm thick paper was found to have tooth contact areas which were less than those described with the use of a 40 mm sheet at one point. Saracoglu and Oapinar14 concluded from their study that repeated use of the same piece of occlusal marking paper or film results in a smaller number of markings. So, author advised that clinically the occlusal marking material should only be used once or twice and then it should be replaced.

100 microns	Without interferences (mm2)		With interferences (mm2)		P-Value
	Mean	SD	Mean	SD	
Natural teeth pt	73.70	6.91	81.10	8.50	0.0466
Artificial denture teeth pt	66.40	15.68	72.80	14.58	0.3571

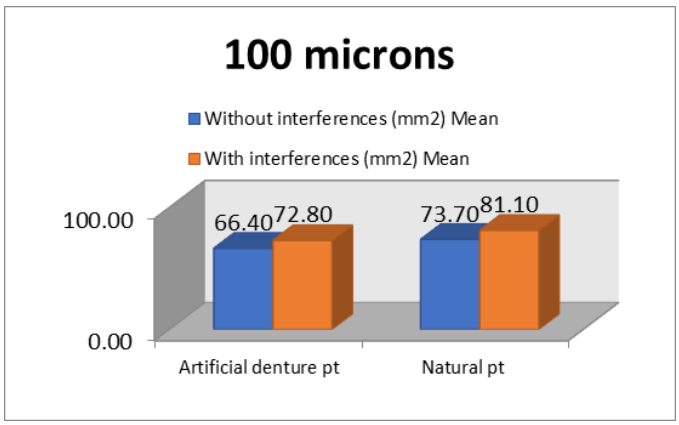
The formula force/size = load shows that the force is a constant value and when the marking area size increases. **Statistically significant at p<0.05 marked in yellow: *** Highly statistically significant at p<0.001 marked in green

Table 1: The mean (SD) values of marked areas of 100 microns articulating paper with and without interferences.

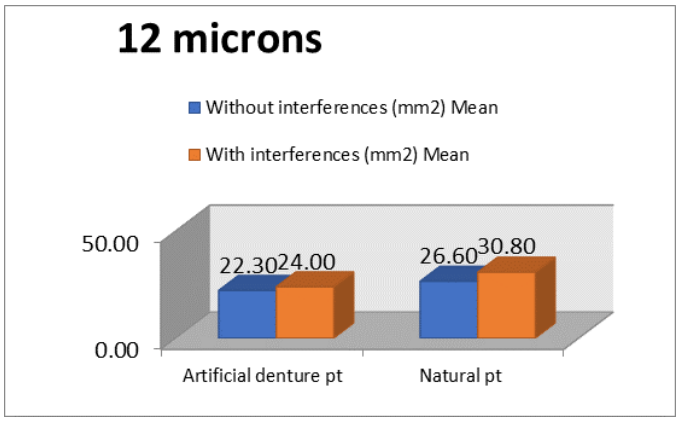
12 microns	Without interferences (mm2)		With interferences (mm2)		P-Value
	Mean	SD	Mean	SD	
Natural teeth pt	26.60	7.44	30.80	7.71	0.2310
Artificial denture teeth pt	22.30	3.74	24.00	7.27	0.5191

Statistically significant at p<0.05 marked in yellow: * Highly statistically significant at p<0.001 marked in green.

Table 2: The mean (SD) values of marked areas of 12 microns articulating foil with and without interferences.



Graph 1



Graph 2

	Paired Differences					T	df	Sig.(2 tailed)	corelation	significance
	Mean	Std. deviation	S.E. Mean	95%confidence interval						
				Lower	Upper					
100 µ articulating paper artificial without interferences	-6.4	4.6	1.28	-9.3	-3.5	-4.98	9	0.0010	0.9670	0.0000
12 µ articulating foil on artificial without interferences	-1.7	5.08	1.61	-5.33	1.93	-1.06	9	0.3170	0.7550	0.0120
100 µ articulating paper on natural with interferences	-7.4	4.3	1.36	-10.48	-4.32	-5.44	9	0.0000	0.8640	0.0010
12 µ articulating foil on natural with interferences	-4.2	1.81	0.57	-5.5	-2.9	-7.32	9	0.0000	0.9720	0.0000

Statistically significant at p<0.05 marked in yellow: * Highly Statistically significant at p<0.001 marked in green

Table 3: Comparison of marked surfaces with and without interference for 100 microns and 12 microns

Conclusion

Within the limitations of the study, following conclusions were drawn:

1. Occlusal indicators marking systems lack the ability to consistently identify contact areas and frequently do not give an accurate profile of the tooth contact.
2. The type of occlusal contact indicators has an effect on the false registration marks and on the size and number of the occlusal contacts as well.
3. There is relationship between the thickness of the occlusal indicator and the form of the marks on the occlusal surface, as size of qualitative indicator like articulating paper increases to 100 µ, there is increased in markings of surface area and vice versa as sized decreases.

References

1. Academy of Denture Prosthetics. Nomenclature Committee. Glossary of prosthodontic terms. Journal of Prosthetic Dentistry, CV Mosby; 1987.
2. Okeson JP (2008) Management of Temporomandibular Disorders and Occlusion. Springer, St. Louis.
3. Sharma A, Rahul GR, Poduval ST, Shetty K, Gupta B, Rajora V. History of materials used for recording static and dynamic occlusal contact marks: a

literature review. Journal of clinical and experimental dentistry. 2013 Feb;5(1):e48.

4. Bakke M (2006) Bite force and occlusion. Seminars in Orthodontics 12(2):120–126.
5. Koos B, Godt A, Schille C, Göz G (2010) Precision of an instrumentation-based method of analyzing occlusion and its resulting distribution of forces in the dental arch. J Orofac Orthop 71(6):403–410 40. Bakke M (2006)
6. Qadeer S, Kerstein R, Kim RJY, Huh J-B, Shin S-W (2012) Relationship between articulation paper mark size and percentage of force measured with computerized occlusal analysis. The Journal of Advanced Prosthodontics 4(1):7–12.
7. Schelb E, Kaiser DA, Brukl CE. Thickness and marking characteristics of occlusal registration strips. J Prosthet Dent. 1985;54(1): 122–126.
8. Brizuela-Velasco A, Álvarez-Arenal Á, Ellakuria-Echevarria J, del Río-Highsmith J, Santamaría-Arrieta G, Martín-Bianco N (2015) Infuence of articulating paper thickness on occlusal contacts registration: a preliminary Report. Int J Prosthodont 28(4):360–362.
9. Saad MN, Weiner G, Ehrenberg D, Weiner S (2008) Efects of load and indicator type upon occlusal contact markings. J Biomed Mater Res B Appl Biomater 85(1):18–22.
10. Carey JP, Craig M, Kerstein RB, Radke J (2007) Determining a relationship between applied occlusal load and articulating paper mark area. Open Dent J 1:1–7.
11. Qadeer S, Kerstein R, Kim RJY, Huh J-B, Shin S-W (2012) Relationship between articulation paper mark size and percentage of force measured with computerized occlusal analysis. The Journal of Advanced Prosthodontics 4(1):7–12.
12. Maness WL. Laboratory comparison of three occlusal registration methods for identification of induced interceptive contacts. The Journal of prosthetic dentistry. 1991 Apr 1;65(4):483-7.
13. Millstein P, Maya A. An evaluation of occlusal contact marking indicators. A descriptive and quantitative method. J Am Dent Assoc. 2001;132(9):1280–1286.
14. Saraçoğlu A, Özpinar B (2002) In vivo and in vitro evaluation of occlusal indicator sensitivity. J Prosthet Dent 88(5):522–526