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Research Article

Evaluating The Chewing Efficiency Of Complete Dentures Using Bilateral Balanced Occlusion And Lingualized Occlusion: A Comparative Study

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ABSTRACT

Background -Dentistry plays one of the major role in the battlefield of medical sciences. It covers the major part of the human body which deals with the complex orofacial structures and associated complex stomatognathic system. The complex stomatognathic system has to be maintained in every pathological or abnormal condition like partial to complete edentulism. The maintainance of the stomatognathic system is significantly dependent on the branch of dentistry that deals with the part or complete replacement of lost or missing functional and complex structures known as prosthodontics. The occlusion serves the basic function of the complete denture prosthesis as one of the central goal of complete denture therapy is restoring occlusion. The occlusal scheme is still the topic of debate (that which occlusal scheme is best suited for the complete denture prosthesis), as no occlusal scheme has proved best in all cases. It is revealed that the choice of occlusal scheme used in complete denture prosthesis is primarily to the practitioners personal preference and experiences that varies from patient to patient.

Aim -The purpose of this study was to evaluate the chewing efficiency of two different occlusal schemes i.e. conventional bilateral balanced occlusion and bilateral balanced lingualized occlusion in complete denture patients.

Method- 20 edentulous patients aged between 40 - 70 years with a mean age value of 55 years attending among the out-patient department of Patna Dental College and Hospital Patna, were selected for the present study. A thorough screening of general and systemic health is carried out and found free of all major systemic diseases. After the selection of the patients it was decided that all the 20 patients were provided complete denture with conventional bilateral balanced occlusion and after 45 days of post insertion of the newly fabricated complete dentures, the patients were recalled and asked for the subjective qualities of the complete denture.

Result -Confirming better chewing ability by BBLO than CBBO.

Conclusion- The result of the present study concludes that the complete dentures with BBLO performed significantly better chewing ability than CBBO Since in the present study, all the test were carried out with same set of complete dentures by modifying CBBO to BBLO upon the same patient, which had not been taken into account by any of the previous studies. All the previous studies had used two different set of complete dentures with two different patients. Thus, this is a remarkable milestone in the present study providing a definite authenticity of the study.

Introduction

The prevalence of edentulism in India was reported to be 16.3% in 2014[1], this percentage of population is a result of decreased fertility and increased life expectancy[2] due to the development in medical science providing better health facilities.

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So, for treating these populations, the major goal of prosthodontics is to rehabilitate the missing oral structures with the efficient and comfortable prosthesis which could be easily acceptable by the patient. As prosthodontics is the pioneer branch of dentistry and among all we wish to discuss about the complete denture prosthesis, the oldest treatment modality among the various treatment available in prosthodontics these days. About the complete denture prosthesis, it travelled a long journey which commences about in the year 1809 and continues till now and after 200 years of completion of complete denture prosthesis which start from the denture carved from the wooden blocks by the technicians with their hands to the time of CAD-CAM, carving of the acrylic blocks to minimize the errors that occurs during the process of complete denture fabrication. On emphasing complete denture prosthesis, the most important factors responsible for the success of the treatment is occlusion, retention, stability, phonation and esthetics. These factors are independent to each other but among all the occlusion /occlusal scheme is directly or indirectly affect the other factors. The occlusion serves the basic function of the complete denture prosthesis as one of the central goal of complete denture therapy is restoring occlusion.[3] The occlusal scheme is still the topic of debate (that which occlusal scheme is best suited for the complete denture prosthesis), as no occlusal scheme has proved best in all cases.[4] It is revealed that the choice of occlusal scheme used in complete denture prosthesis is primarily to the practitioners personal preference and experiences[4], that varies from patient to patient.

The studies till date suggests that among various occlusal scheme, the lingualized occlusion is most accepted by the patient and complies better chewing efficiency than the conventional bilateral balanced occlusion which gives better stability, comfort and esthetics to the patient[4]. But in practice, the conventional bilateral balanced occlusion is still holds the major share, and becomes the trend of the occlusal scheme used in complete denture prosthesis. The low prevalence rate of lingualized occlusion is assumed to be the result of a lack of conclusive comparative studies[4] and also due to its technique sensitivity. However, the historical background reveals that the lingualized occlusion evolved from the bilateral balanced occlusion, therefore the lingualized occlusion in addition to the fundamental advantages derived from bilateral balanced occlusion may also exhibit lingualized occlusion derived advantages resulting from the elimination of the buccal contacts of posterior artificial teeth. The improved results from lingualized occlusion may be due to the lingualized occlusal forces which is commonly believed to be a lingualized occlusion mechanical property, it is just shifting the occlusal forces from buccal to lingual, and makes the denture more stable without changing the position of the tooth on the residual alveolar ridge[5].

The present study covers the comparison of chewing efficiency between two occlusal scheme i.e. conventional bilateral balanced occlusion and bilateral balanced lingualized occlusion as an objective study and also the subjective analysis of retention, stability and general satisfaction using 100 mm visual analogue scale (VAS). Since the occlusion is the key of complete denture treatment, the chewing efficiency is the main goal of the occlusion. To evaluate the chewing efficiency of the complete denture with the different occlusal scheme, the various studies conducted on the subject by different techniques like sieving[4], calorimetric methods to EMG recording of muscles of mastications during chewing[3] we have selected the volunteers free of all systemic illness and jaw discrepancies.

Material and method

20 edentulous patients aged between 40 - 70 years with a mean age value of 55 years attending among the out-patient department of Patna Dental College and Hospital Patna, were selected for the present study.

A thorough screening of general and systemic health is carried out and found free of all major systemic diseases.

The exclusion criteria for the study were decided as follows:-

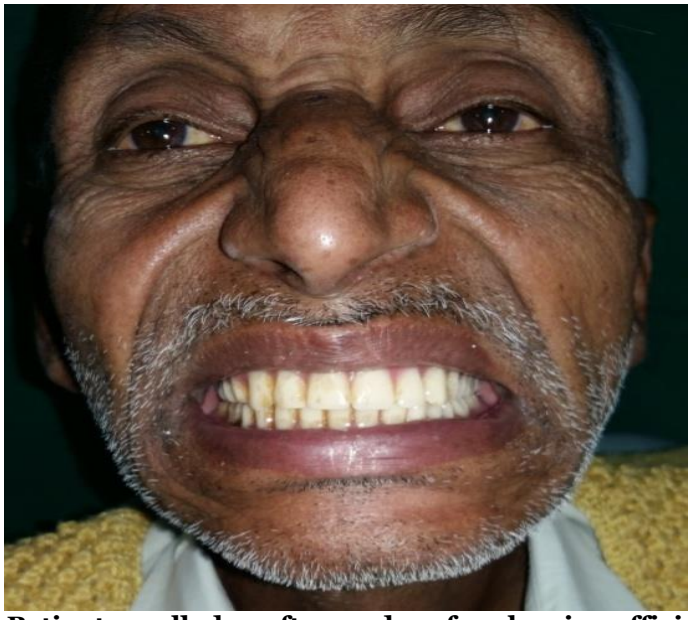
- Any systemic illness
- Any neurovascular diseases and psychological disorder
- Class II & Class III jaw relationships
- Severly resorbed residual alveolar ridges
- Flabby ridges

Residual alveolar ridges with severe undercuts and any exostosis, torri etc.

After the thorough screening of the patients on the basis of above criteria, the patients selected here were free of all systemic illness and with class I well formed residual alveolar ridges.

After the selection of the patients it was decided that all the 20 patients were provided complete denture with conventional bilateral balanced occlusion (photo-6) and after 45 days of post insertion of the newly fabricated complete dentures, the patients were recalled (photo-7) and asked for the subjective qualities of the complete denture like, Retention, stability, Phonetics and General satisfaction

Photo 1: Patient received C.D with CBBO



<u>Photo 2:</u> Patient recalled after 45 days for chewing efficiency test.

Results:

After the successful collection of the data from the patients the statistical analysis with unpaired t- test were done and tabulated separately for different types of test foods like raw peanuts, roasted peanuts, carrot slices. After the statistical analysis for the raw peanuts, the values obtained are given below in Table 1 & Graph 1, observed a significant difference showing BBLO gave better chewing ability than CBBO.

Table: 1

	Conventional Bilateral Balanced Occlusion		Bilateral Balanced lingualized Occlusion		Mean Difference	t-test value	p-value
	Mean	Std. Deviation	Mean	Std. Deviation			
Raw Peanuts	2.56	0.11	2.23	0.08	0.32	10.617	0.000
Unpaired t-test *** Significant difference**							

Again the roasted peanuts without shell the values obtained are given below in Table 2 & Graph 2 showing no significant difference was found in chewing ability with CBBO & BBLO.

Table: 2

	Conventional Bilateral Balanced Occlusion		Bilateral Balanced lingualized Occlusion		Mean Difference	t-test value	p-value
	Mean	Std. Deviation	Mean	Std. Deviation			
Roasted peanuts without shell	2.23	0.08	1.96	0.14	0.28	7.629	0.000
Unpaired t-test **# Non-significant difference**							

For the carrot slices the values obtained are as given below Table 3 & Graph, observe a significant difference showing BBLO performs better chewing ability than CBBO

Table: 3

	Conventional Bilateral Balanced Occlusion		Bilateral Balanced lingualized Occlusion		Mean Difference	t-test value	p-value
	Mean	Std. Deviation	Mean	Std. Deviation			
Carrots sample	2.13	0.07	1.91	0.29	0.22	3.275	0.002*
Unpaired t-test *** Significant difference**							

Discussion

From the beginning of denture fabrication i.e. for over 200 years back to recent era, the main goal of the replacing missing oral structure is to maintain/achieve occlusion. In the complete denture therapy, achieving the optimum occlusion is the main goal of such treatment[3]. Occlusion/occlusal scheme is one of the main factor to the success of the complete denture and that is why occlusion is also the topic of debate for more than 150 years.

After the long journey of the development of the occlusal schemes it gives us choice of various occlusal schemes like:-

- conventional bilateral balanced occlusion
- bilateral balanced lingualized occlusion
- Monoplane occlusion
- Linear occlusion

Out of the above occlusal schemes available now a days, this study comparing the chewing efficiency between the two occlusal schemes i.e. CBBO and BBLO as the objective study and for the retention, stability and for general satisfaction is comparing as subjective study.

The conventional bilateral balanced occlusal scheme has become trend in complete denture prosthesis, on the other hand the lingualized occlusion is basically evolved from the CBBO having some differences in its biomechanics[4].

The lingualized occlusion is often confused like placing the mandibular posterior teeth lingual to ridge crest, therefore, Ortman suggested the term lingual cusp contact occlusion[6]. However, in the year 1927, Sir Alfred Gysi of Switzerland introduced the concept of lingualized occlusion and in the year 1941 S.H. Payne had suggested its use[6].

The study of the chewing efficiency between the two occlusal scheme i.e. CBBO and BBLO is conducted for the last many years. The debated occlusal scheme i.e. conventional bilateral balanced occlusion and bilateral balanced lingualized occlusion differs in several important aspect like in conventional bilateral balanced occlusion, the mesio buccal cusps of maxillary first molar occludes in the mesio buccal groove of the mandibular 1st molar, also the mesio palatal cusps is in the contact with the central groove of the mandibular first molar, representing the maximum intercuspation position, where the buccal cusps of both maxillary and mandibular teeth are in contact whereas in the lingualized articulation the posterior teeth are set as only the mesio palatal cusps of the maxillary denture rest in the central groove of the first molar of the mandibular denture so that there is no buccal contact of the posterior teeth of the maxillary & mandibular denture. The biomechanics behind that concept is to reduce the lateral force on the denture and restricted maximally to vertical forces.

However, it is just shifting of the direction of the forces from buccal to lingual and makes the denture more stable without changing the position of the tooth on the ridge. Due to its modified features it becomes the more advantageous to the patient specially in case of resorbed ridges.

The study of the chewing efficiency between the two occlusal schemes ie CBBO & BBLO is conducted for the last many years.

The researches comparing the chewing efficiency by various means & methods, like sieving method, calorimetric method's to the EMG recording of the muscles of mastication during chewing. The subjective study about the retention stability and for the general satisfaction is commonly done by using of 100 mm VAS or different types of questions.

The various articles reffered in this study reveals that two different individuals were selected for two types of occlusal schemes, to ascertain the chewing efficiency.

However, in our opinion the results cannot be the absolute objective finding about the chewing efficiency between the debated occlusal schemes as two different individuals were selected for two different occlusal schemes.

Keeping this point in the mind, we decided to use a single complete denture in the particular volunteers with two different occlusal schemes after a suitable interval of times. After screening of the general health and the exclusion criteria, the patient received the complete denture with CBBO and after resolving the post insertion problems, recalled after 45 days for the chewing efficiency test. The test was performed first on CBBO and the same denture was converted into BBLO after completion of chewing efficiency test with CBBO.

The conversion of CBBO to BBLO was explained elaboratory by Brien R. Lang in 2004, he advocated the convertion of the occlusal scheme by the selective grinding of the cusp and deepening the groove/fossa with the help of carbide trimming and finishing burr no 7010[6,7] by gently grinding the lingual inclines of the maxillary facial/buccal cusps that demonstrate interference. Premature cross arch balancing contacts on the lingual inclines of the mandibular facial cusp was reduced to provide freedom of movement on the contra lateral working cusps. The selective occlusal reshaping procedure should be continued until a smooth, free gliding movement is observed[7].

The protrusive balance can be achieved by marking of the articulating paper which was kept on both sides on posterior teeth and patient was asked to protude/ forward his mandible from maximal inter cuspal position, the premature protrusive contact may appear between the lingual inclines of the maxillary facial cusps and the facial inclines of the mandibular facial cusp during the protrusive movement. Such contacts were eliminated by grinding the mandibular facial cusp keeping the posterior teeth bilaterally contacted in protrusive movement.

The post insertion adjustment was done according to the need and after 45 days interval of post insertion, the chewing efficiency was carried out.

The chewing efficiency test was conducted by the sieving method and it was first introduced by Gaudenz in 1901[8], the important factors regarding the authentication of the sieve system is the aperture size and its synchronocity.

The Sethi sieves of different sizes like 850mm,1mm,1.18mm,2.00mm and 2.36mm respectively as the manufacturer provides this range of the aperture size only.

In the year 2002, a comparative study were conducted for the chewing efficiency test with single sieve system and multiple sieves system, and proved multiple sieve system is more authentic[8].

The chewed food particles are then passed gradually on the sieves according to the aperture size as shown in photograph 3.

Photo 3: Chewed peanuts were poured onto the sieves

Keeping the amount and type of food and chewing stroke constant the size of the particles, determines the chewing efficiency that mean finer the particle size, higher will be the chewing efficiency and coarser the food particle less is the chewing efficiency.

So, the data were collected in the form of sieve size that which number of sieve were allowed total passing of food particles, the lesser aperture size sieve allows complete passing of food particle more chewing efficiency where as the greater aperture size sieve will less chewing efficiency. The above statement is authenticated or proved by the definition of the chewing/masticatory efficiency which is measured by determining an individuals capacity to grind or pulverized a test food[9].

The test was conducted on every alternate day for 5 days and 5 times in each day. The five days testing was performed to prevent the errors which can occur from the emotional, psychological, physiological and mental conditions of the patient. The several dates reduces the errors which can occurs due to the different situation and condition of the patient.

This is again repeated for the converted denture with bilaterally balanced lingualized occlusion. The three different test foods were chosen to reduce the errors which can occurs from the different consistency of the food materials.

Since all three types of natural test food, are the principal food and easily available and it is normally consumed[9] by the people of the region.

However, the raw carrot was amongst the most resistant foods presenting a high degree of accuracy in reliability test and the roasted peanuts decreases the concentration of oils in peanuts and consequently their agglutination[8].

The result of the present study concludes that the complete dentures with BBLO performed significantly better chewing ability than CBBO Since in the present study, all the test were carried out with same set of complete dentures by modifying CBBO to BBLO upon the same patient, which had not been taken into account by any of the previous studies. All the previous studies had used two different set of complete dentures with two different patients. Thus, this is a remarkable milestone in the present study providing a definite authenticity of the study.

Summary and Conclusion:

The evaluation of chewing efficiency was carried out by using three different types of natural test foods by the sieving method separately for the two occlusal schemes, first with the complete denture with bilateral balanced occlusion and then the same denture was converted into bilaterally balanced lingualized occlusion with selective grinding of the buccal cusp of posterior teeth and also modifying the central fossa of lower posterior teeth. After 45 days interval of post convertion, to acustomized with new occlusal schemes by the patient, the chewing efficiency was again carried out and the data was collected in terms of which occlusal schemes are more efficient in grinding the test foods more finer with given number of chewing strokes and can pass through the sieves with smaller aperture and the data thus collected were sent for statistical analysis. The subjective outcomes like retention, stability, and comfort was found higher in case of bilaterally balanced lingualized occlusion.

The result of the present study concludes that the complete dentures with BBLO performed significantly better chewing ability than CBBO Since in the present study, all the test were carried out with same set of complete dentures by modifying CBBO to BBLO upon the same patient, which had not been taken into account by any of the previous studies. All the previous studies had used two different set of complete dentures with two different patients. Thus, this is a remarkable milestone in the present study providing a definite authenticity of the study.

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