

Application of neutral zone impression technique in mandibular completely edentulous: a systematic review



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Abstract

Objective: To identify scientific evidence relating to the application of neutral zone impression techniques for the manufacturing of complete denture in patients with various conditions.

Methods: An initial search was conducted from PubMed database, Wiley Online Library, and Google Scholar to evaluate articles published in dental journals from January 2015 to December 2017 about the application of neutral zone impression techniques in complete edentulous patients with various conditions. Manual search of published full-text articles and related reviews were performed afterwards. The initial results of this search resulted in 297 articles, with only 13 studies meeting the inclusion criteria.

Results: The selected studies were based on inclusion criteria with 47 patients as subjects with conditions related to neuromuscular disorders (3 articles), residual ridge resorption (RRR, 8 articles) and

another conditions (2 articles). Only 9 studies used a green stick impression compound, 2 studies used tissue conditioner, 1 study used silicone rubber impression material, and 1 study used alginate. The techniques used were swallowing and phonetic techniques in 8 articles, swallowing technique in 4 articles, and phonetic techniques in 1 article.

Conclusion: The success of a prosthesis depends on the proper position of the artificial tooth in the neutral zone. A variety of conditions requiring a stable and retentive mandibular complete dentures require proper neutral zone impression. Swallowing and phonetic movement instructions during the impression procedure were most often performed to record the neutral zone. Various impression materials can be used, but the impression compound was most common.

Keywords: Completely edentulous, Mandibular, Nuromuscular, Neutral zone, Residual ridge resorption

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Introduction

Denture that meet the requirements of comfort, efficiency, and good aesthetics are stable and retentive dentures. To achieve maximum stability, the denture should be made in such a way as to be in harmony with the normal neuromuscular system. The placement of the denture in an area called a neutral zone has shown favourable results.

The neutral zone concept suggests that the artificial teeth must occupy a position so that the force exerted on the denture by the tongue is just as much as the force exerted by the cheeks and lips.¹ Neutral zone impression technique is a treatment of choice in patients with atrophic mandible, partial glossectomy, mandibular resections which have led to an unfavourable denture bearing area, motor nerve damage to the tongue disease, trauma or burns, a stroke, scleroderma, or conditions arising from other natural causes such as prominent mental groove.^{2,3}

The important things noticed for the success of the neutral zone impression are the materials and the techniques that are used. Various materials such as impression compound, tissue conditioner, impression waxes, impression plaster, polyether,

and hard relining materials have been used for recording the neutral zone and each material has its inherent advantages and disadvantages.^{4,5} Over the years, a variety of materials have been used to record the neutral zone such as impression compound, impression plaster, waxes, tissue conditioners, and polyether. The impression compound material is of high viscosity, so performing oral functions such as blowing, sucking, and pursing of the lips cannot be dexterously performed. Impression plaster is chaotic and carries a risk of the patient swallowing fragments of plaster while performing functional movements. Uniform softening of the complete wax rims is critical for recording full functional movements, and if not done properly, can result in an inaccurate recording of the neutral zone. Tissue conditioners do not possess sufficient body; hence, it becomes laborious to use them even when they are supported by wire loops. Polyether impression material sets via an irreversible chemical reaction, making it difficult to perform any modification in the set material and reuse it.⁴

Generally, there are two kinds of movement that can be used of the neutral zone impression

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to get the most stable position, i.e. swallowing and phonetic. Swallowing is used as the principle modelling function in the traditional ‘modelling compound-swallowing impression technique’, for obtaining the neutral zone. Speech is another important part of the routine oral activities. It is utilized as the principle modelling function in a technique called piezography. Piezography records the mandibular denture space by means of pressure developed during oral functions, mainly speech. This technique customizes the contours of the lingual surface and precludes overextension. The term ‘phonetic neutral zone technique’ will be used in the present study.⁶ This literature review aims to identify scientific evidence relating to the application of neutral zone impression techniques for the manufacture of complete denture in patients with various conditions.

Methods

The systematic reviews was written based on PRISMA guidelines (Preferred Reporting Items for Systematic reviews and Meta-Analyzes).⁷ PRISMA is a set of evidence-based minimum items to be reported in systematic review and meta-analysis. The PICO question (population, intervention, comparison, outcome) in this systematic review is how the impression procedure of mandibular complete edentulous patients with various conditions to obtain stable and retentive dentures.

Search Strategy

An initial search was conducted from PubMed database, Wiley Online Library, and Google Scholar to evaluate article published in dental journals from January 2015 to December 2017 about application of neutral zone impression techniques in mandibular complete edentulous patients with various conditions. The keywords used were “neutral zone”, “mandibular” and “case report”. The initial results of this search was 297 articles, with only 13 studies that met the inclusion criteria.

Inclusion Criteria

The inclusion criteria in this systematic review include English language article; published between January 2015 to December 2017; has full-text; type of study are case report, original article, clinical report, pilot study, cohort study, and retrospective/prospective study; study was conducted on complete mandibular edentulous patients rehabilitated with complete denture; and that the studies included information about material and technique of neutral zone impression (swallowing or phonetics). The exclusion criteria were all studies which did not satisfy the above-mentioned criteria.

Selections of Study

Selection of study was done by using specific keywords. Then selected by looking at the title and reading the abstract. Next, downloaded the full-text of all appropriate articles and carefully identify them based on the eligibility criteria to be used for systematic review.

Extraction of Data

The compatible data with the eligibility criteria was collected manually from all selected articles, i.e. author’s name, year of publication, type of study, country, number and age of subject, related conditions experienced by the subject, recording techniques of neutral zone, and material impression used.

Results

Online database search obtained 297 articles include 15 from PubMed, 187 from Wiley, and 95 from Google Scholar. However, there are several similar articles based on selection of the title and abstract resulting in a total of 292 articles. There were 62 articles that didn’t have the full-text. Subsequent selection of articles based on eligibility criteria and obtained 13 articles accordingly.

From 13 selected studies: 9 case reports, 3 clinical reports and 1 prospective clinical study. The studies were mainly done in 2015 (6 cases), followed by 2017 (4 cases), and 2016 (3 cases); and in Asian, especially India (9 cases); Japan, Nepal, Saudi

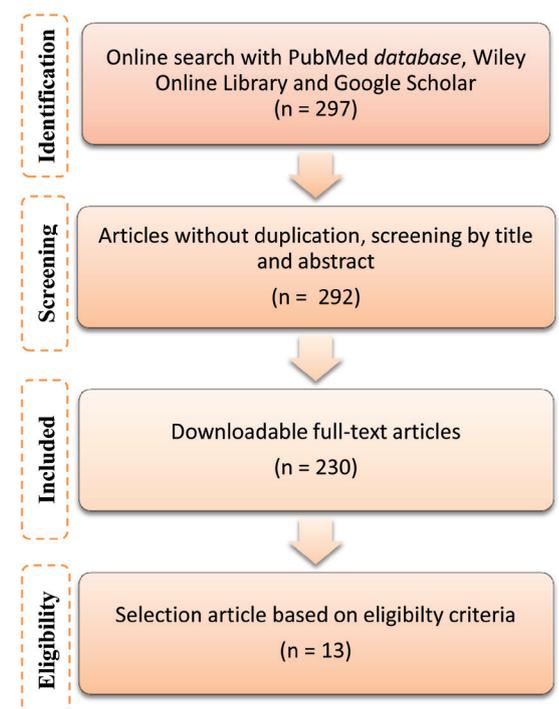


Figure 1 Article Selection Flow Chart

Table 1 Descriptions of studies comparison

Author and Year	Type of study	Geographic Region	Number of Patients	Age of Patients	Related condition	Recording of Neutral Zone Used	Impression Material
Shanker et al	Case Report	Asia (India)	1	70 y.o	RRR	The swallowing and phonetic technique	Hydrocolloid irreversible (Alginate)
Gaba et al	Case Report	Asia (India)	1	60 y.o	RRR	The swallowing and phonetic technique	Tissue conditioner
Mansuri et al	Case Report	Asia (Nepal)	1	80 y.o	RRR	The swallowing and phonetic technique	Impression compound
Rao et al	Case Report	Asia (India)	1	11 y.o	Type-1 Ectodermal Dysplasia	The swallowing technique	Low-fusing modelling compound (Impression compound + green stick)
Haralur	Case Report	Asia (Saudi Arabia)	1	65 y.o	Parkinson	The swallowing and phonetic technique	Impression compound
Maru et al	Clinical Report	Asia (India)	1	75 y.o	Bucket Handle Fracture	The swallowing and phonetic technique	Impression compound
Kumar et al	Case Report	Asia (India)	1	73 y.o	RRR	The swallowing and phonetic technique	Impression compound
Aeran et al	Case Report	Asia (India)	1	55 y.o	RRR	The swallowing and phonetic technique	Impression compound
Bushan et al	Clinical Report	Asia (India)	1	47 y.o	RRR	The swallowing and phonetic technique	Tissue conditioner
Pathak et al	Case Report	Asia (India)	1	62 y.o	Bell's Palsy	The swallowing and phonetic technique	Low-fusing modelling compound (Impression compound + green stick)
Saravanakumar et al	Case Report	Asia (India)	1	64 y.o	Neuromuscular incoordination	The swallowing technique	Low-fusing modelling compound (Impression compound + green stick)
Ohkubo et al	Clinical Report	Asia (Jepang)	1	82 y.o	RRR	The phonetic technique	Silicone rubber
Geerts	Prospective clinical study	South Africa	35	40-85 y.o	RRR	The swallowing technique	Impression compound

Arabia and South Africa each 1 case. The number of subjects was 47, and 35 of whom were subjects of prospective clinical study by Geerts et. al in South Africa. Most of the subjects were elderly (≥ 60 years old) with residual ridge resorption (RRR) and there is one edentulous subject that was 11 years old with a condition related to type-1 ectodermal dysplasia.

Table 1 shows some of the conditions experienced by the edentulous subject: neuromuscular disorders 3 articles (neuromuscular incoordination, Bell's Palsy and Parkinson disease), RRR 8 articles, type-1 ectodermal dysplasia 1 article, and Bucket Handle Fracture 1 article. Neutral zone impression in edentulous subject to obtain stability of prosthesis by

Shanker et al.⁸ Gaba et al.³ Mansuri et al.² Haralur et al.⁹ Maru et al.¹⁰ Kumar et al.¹¹ Aeran et al.¹² Bushan et al.¹³ and Pathak et al.¹⁴ using swallowing and phonetic techniques. Whereas Rao et al.¹⁵ Savaranakumar et al.⁴ and Geerts.¹⁶ using swallowing techniques and Ohkubo et al.¹⁷ using phonetic techniques.

Subjects with RRR related conditions, neutral zone impression used hydrocolloid irreversible (alginate),⁸ tissue conditioner,^{3,13} impression compound^{2,11,12,16} and silicone rubber.¹⁷ Subjects with neuromuscular incoordination⁴ and Bell's Palsy¹⁴ related conditions used low-fusing modelling compound (impression compound with green

stick) and Parkinson's disease-related condition used impression compound.⁹ Whereas in the subject with type-1 ectodermal dysplasia related condition used low-fusing modelling compound (impression compound with green stick) impression material¹⁵ and Bucket Handle Fracture-related condition used impression compound.¹⁰

Discussion

Based on selected articles, various impression materials used to record neutral zone of fabricate mandibular complete denture include alginate (hydrocolloid irreversible), tissue conditioner, impression compound and mixed material of combination impression compound + green stick. However, impression compound is the most common impression material.

Alginate is a soft material that sets at the temperature of the oral cavity; can be easily accepted even by very weak patients with poor muscular coordination. It is inexpensive, but does not have the strength to resist muscular forces during moulding so it needs to be modified with occlusal pillars.⁸ Processes that affect the dimensional stability of alginate impression materials are the expansion of impression materials due to water absorption or imbibition properties, and shrinkage due to the nature of syneresis or evaporation of water.¹⁸ Tissue conditioners are mucostatic, odourless and tasteless, can be done addition when the first application is deemed less, long-setting time gives enough time to perform all functional movements, but it is expensive¹⁹ and do not possess adequate body; so it becomes laborious to use them even when they are supported by wire loops.⁴

Impression compound has the quickest setting time^{9,20} so it is advantageous to use in severe cases of Parkinsons disease,⁹ capability of reproducing fine details, easy handling, and having no significant dimensional changes subsequent to hardening. It has certain limitations such as its short manipulation time and the fact that it hardens quickly in the mouth and does not remain in a plastic stage while the functional movements of the vestibular and alveololingual sulcular tissues are completed.²⁰ The impression compound material is of high viscosity, so performing oral functions such as blowing, sucking, and pursing of the lips cannot be dexterously performed.⁴ Admix material was used for recording the neutral zone taking into consideration our patient's history of neuromuscular disorder (where the oral musculature could not perform its function fully) with it's a combination ratio of impression compound and green stick (low-fusing)

the impression compound results in a low viscosity material allowing for ease in manipulation of the oral musculature. The admix material allowed for better flow and an accurate impression.⁴ The philosophy was that a viscous admix of impression compound and tracing (green stick) compound removes any soft tissue folds and smoothes them over the mandibular bone. This reduces the potential discomfort arising from the atrophic sandwich i.e. the creased mucosa lying between the denture base and mandibular bone.

Conclusion

The success of a prosthesis depends on the proper position of the artificial tooth in the neutral zone. A variety of conditions requiring a stable and retentive mandibular complete dentures require proper neutral zone impression. Swallowing and phonetic movement instructions during the impression procedure were most often performed to record the neutral zone. Various impression materials can be used, but most often the impression compound is chosen based on the quick setting time, capability of reproducing fine details, easy handling, and having no significant dimensional changes subsequent to hardening.

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Conflict of Interest

The authors report no conflict of interest.

References

1. Porwal A, Satpathy A, Jain P, et al. Association of neutral zone position with age, gender, and period of edentulism. *J Prosthodontics* 2016; 1-8.
2. Mansuri M, Bhandari A, Prajuli PK, et al. Rehabilitation of an edentulous mouth with severe mandibular ridge resorption using neutral zone impression technique: a case report. *Bangladesh J Medic Sci* 2014;13: 477-480.
3. Gaba N, Kuckreja MN, Kumar S, et al. Revisiting the forgotten-neutral zone: a case report. *Indian J Dent Sci* 2015;7: 1-3.
4. Saravanakumar P, Thangarajan ST, Mani U, et al. Improvised neutral zone technique in a completely edentulous patient with an atrophic mandibular ridge and neuromuscular incoordination: a clinical tip. *Cureus* 2017;9: 1-12.
5. Jum'ah AA, Nixon PJ. Neutral zone in complete dentures: systematic analysis of evidence and technique. *Smile Dent J* 2011;6: 1-3.
6. Ladha K, Gupta R, Gill S, et al. Patient satisfaction with complete dentures fabricated using two neutral zone techniques: a within-subject cross-over pilot study. *J Indian Prosth Soc* 2013: 1-8.

7. Liberati A, Altman DG, Tetzlaff J, et al. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration. *BMJ* 2009;339: 1-27.
8. Shanker SS, Umamaheswaran A, Nayar A. Biometric denture space - concept of neutral zone revisited using a hydrocolloid impression material. *J Clin & Diagnos Res* 2015;9: 10-12.
9. Haralur SB. Clinical strategies for complete denture rehabilitation in a patient with Parkinson disease and reduced neuromuscular control. *Hindawi Case Reports in Dent* 2015: 1-5.
10. Maru K, Vyas A, Dhiman Y, et al. Prosthodontic management of edentulous patient with bucket handle fracture: a clinical report. *Int J Scientific Study* 2015;3: 176-179.
11. Kumar R, Khan R. Neutral zone approach for complete denture fabrication: a case report. *Int J Health Sci & Res* 2016;6: 384-388.
12. Aeran H, Kumar V, Taneja C. Innovating the art of impression techniques in prosthodontic rehabilitation of atrophied mandibular ridges: a case report. *Int J Oral Health Dentist* 2016;2: 190-199.
13. Bushan P, Aras MA, Coutinho I, et al. Customized cheek plumper with friction lock attachment for a completely edentulous patient to enhance esthetics: a clinical report. *J Prostho* 2017: 1-5.
14. Pathak C, Pawah S, Sikri A. Lip and lower lid supporting prosthetic appliance: a unique approach of treating unilateral facial paralysis. *J Clin & Diagnostic Res* 2017;11: 9-11.
15. Rao L, Gounder R. Prosthetic rehabilitation of a patient with type-1 ectodermal dysplasia: a case report. *Journal of Dr. NTR University Health Sci* 2015;4: 124-127.
16. Ohkubo C, Shimpo H, Tokue A, et al. Complete denture fabrication using piezography and cad-cam: a clinical report. *J Prosthetic Dentist* 2017: 1-5.
17. Mailoa E, Dharmautama M, Rovani P. Effect of mixing methods of alginate impression material on linear dimensional stability of stone cast. *J Dentomaxillofac Sci* 2012;11: 142-148.
18. Kursoglu P, Ari N, Calikkocaoglu S. Using tissue conditioner material in neutral zone technique. *New York State Dent J* 2007;73: 40-42.
19. Yadav B, Jayna M, Harish Y, et al. Comparison of different final impression techniques for management of resorbed mandibular ridge: a case report. *Case Reports in Dentist* 2014: 1-6.
20. Manoj SS, Chitre V, Aras M. Management of compromised ridges: a case report. *J Indian Prosthodontic Soc* 2011;11: 125-129.



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