

# Comparison between the Neutral Zone and Admixed Impression Techniques in the Management of Atrophic Mandibular Ridges

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## ABSTRACT

**Objective:** To compare the stability and comfort level of dentures fabricated either by the Neutral Zone or by Admixed impression techniques in severely atrophic mandibles.

**Study Design:** Randomized Clinical Trial, Uni center, Single blinded, Two arm study

**Place and Duration of Study:** This study was conducted at the Prosthodontics department, Liaquat College of Medicine and Dentistry, Karachi from January 2021 to October 2021 for a period of 09 months.

**Materials and Methods:** A total of 84 edentulous patients with atrophic mandibular ridges were selected using non-probability consecutive sampling technique. Subjects were randomly assigned to one of two groups (Neutral Zone technique/Admixed) and observed at one month, three months and six months.

**Results:** Total mean score of level of comfort during impression was statistically significant for both the techniques ( $p < 0.001$ ). Regarding comparison of mean stability score after six months, mean of denture fit was observed with statistically significant difference for both the techniques ( $p = 0.041$ ).

**Conclusion:** : Dentures made by Neutral Zone technique showed slight superior levels of patient satisfaction and stability than dentures prepared by Admixed technique in all functional features (immovability, masticatory capability, retention, swallowing and speech) in addition to comfort and aesthetics.

**Key Words:** Atrophic mandibular ridge, Neutral zone technique, stability, Admixed impression technique

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## INTRODUCTION

The Glossary of Prosthodontics Terms defines “edentulism” as a condition of being edentulous (toothless); lacking of teeth or without natural teeth.<sup>[1]</sup> Although edentulism is not harmful but it requires restorative treatment as early as possible to improve the quality of life of an individual. The main objective of complete denture prosthesis for an edentate person is to give support functionally and aesthetically and the as replacements of the missing structures. However, the stability of the mandibular denture can be affected by the phenomenon called Residual Ridge Resorption<sup>[2]</sup>.

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In Pakistan the prevalence of being edentate (toothless) till 2003 was about 20% which was recorded by the FDI (Federation Dentaire International) Oral Health Atlas that emphasizes the extent of oral diseases globally<sup>[3]</sup>. As per the report of the National Institute of Dental and Craniofacial Research those people who had the minimum number of residual teeth were in the age group of 50-65 years<sup>[4]</sup>.

The concepts of both the conventional and the Neutral Zone techniques are equally considered in denture fabrication. As far as the concept of neutral zone is concerned, in this technique teeth are set in a region where displacing-forces of the tongue, the lips and cheeks are neutralized and stable<sup>[5]</sup>. Various materials have been recommended for recording neutral zone while fabricating the complete mandibular denture by neutral zone technique such as silicone, soft wax, modeling wax, impression compound, a polymer of dimethyl siloxane filled with calcium silicate, and tissue conditioners and resilient lining materials<sup>[6]</sup>. Numerous materials have been proposed to document the neutral zone e.g. plastic impression compound, polymer of dimethyl siloxane filled with calcium silicate, soft wax, silicone, conditioners for tissue and resilient lining materials<sup>[7]</sup>.

Removable complete denture (CD) treatment is the only therapeutic alternative for edentulous persons who do not have access to implant treatment. The concept of Neutral Zone technique in manufacturing complete dentures and its significance are well known, and numerous materials have been investigated to attain improved results in different populations. However, very little has been identified about stability, comfort and satisfaction as compared to conventionally fabricated dentures. The objective of this study was to compare the level of patients' comfort during impression and stability of complete denture in patients with atrophic mandibular ridges after one month, three months and six months post- insertion by using Neutral Zone and Admix Impression techniques.

## MATERIALS AND METHODS

A randomized, patient-blind, single center, parallel group with 1:1 allocation was carried out in Prosthodontics department, Liaquat College of Medicine & Dentistry, Gulistan-e-Johar, Karachi. Baseline measures were obtained then participants were randomized with a 1:1 distribution to one of two interventions with Neutral Zone and Admixed Techniques. The randomization schedule was generated through a block randomized by another investigator who was not involved in determining eligibility or in baseline, and in follow-up data collection. A full size trial required a total of 84 participants (42 in each group). The two groups were then followed up one month, three months and six months to observe any differences in outcome. Patients having ages ranging from 50-70 years were recruited for the study with complete edentulism, non-denture wearers or with ill-fitting complete dentures prosthesis, Atwood class V and VI and medically compromised patients who were contraindicated for surgical placement of implants to accommodate implant-supported prosthesis attending the Prosthodontics OPD for treatment.

Questionnaire along with Likert scale was used to evaluate the stability and level of comfort in patients experienced with the impression technique for atrophic mandibular ridge. Statistical analysis was performed using IBM SPSS statistical package 21 for Windows. Continuous variables were presented as Mean  $\pm$  SD. Categorical variables were shown as frequencies and percentages. The difference between 2 groups, according to continuous variables was determined by independent t-test. Categorical variables were compared using chi square test. A p-value of less than 0.05 was considered as statistically significant. Confounding factors were controlled by randomization and stratification in analysis.

A written informed consent was taken from all subjects after explaining the study purpose, procedure and outcome. The synopsis was then submitted to Ethical review committee of LCMD & Dar-ul-Sehat Hospital.

Patient's information and identification was kept confidential by using code numbers and security password for computer records.

## RESULTS

In this study mean age of the patients was (60.29  $\pm$  5.492) years for admixed impression technique while (58.29  $\pm$  5.82) years for neutral zone impression technique. Our results showed that regarding admix technique, 9(21.4%) patients in 51-55 years of age, 13(31.0%) patients in 56-60 years, 12(28.6%) patients in 61-65 years and 8(19.0%) in 66-70 years of age whereas in NZ impression technique, 14(33.3%) patients in 51-55 years of age, 11(26.2%) patients in 56-60 years, 12(28.6%) patients in 61-65 years and 5(11.9%) in 66-70 years of age. In this connection, only insignificant difference was found statistically in the age group of 51-55 years between both the techniques ( $p=0.584$ ). In respect of gender, impression of 16(38.1%) males and 26(61.9%) females were taken by using admixed technique whereas impression of 19(45.2%) males and 23(54.8%) females were taken using NZ technique ( $p>0.05$ ).

Regarding level of comfort during impression of both the techniques, total mean of difficulty in tongue movements (2.93  $\pm$  1.503) was reported with statistically significant difference between both the techniques ( $p=0.001$ ). A total mean of irritation during impression (1.50  $\pm$  0.768) was observed with statistically significant difference between both the techniques ( $p=0.046$ ). A total mean of difficulty to follow dentist instructions (2.05  $\pm$  1.379) was found with statistically significant difference between both the techniques ( $p<0.001$ ). A total mean of duration of procedure (3.10  $\pm$  1.542) was reported with statistically significant difference between both the techniques ( $p<0.001$ ). As far as total mean score (9.57  $\pm$  3.91) about level of comfort during impression for both the techniques are concerned statistically significant difference was found between both the techniques ( $p<0.001$ ), as shown in and Table I.

Regarding comparison of mean Stability score after six months between Ad-mixed and NZ zone impression techniques, a mean of fitting of the denture for both the techniques (4.73  $\pm$  0.588) was observed with statistically significant difference between both the techniques ( $p=0.041$ ). Moreover, total mean of chewing efficacy was observed as (4.86  $\pm$  0.518) with statistically insignificant difference between both the techniques ( $p=1.000$ ). The mean of Food impaction over the denture as (4.86  $\pm$  0.352), with statistically insignificant difference between both the techniques ( $p=0.217$ ), was also observed whereas insignificant differences were observed against swallowing ( $p=0.634$ ) and speech ( $p=0.156$ ) for both the techniques, as shown in Table 2.

**Table No.1: Comparison of mean comfort level during impression between Admixed and NZ Impression technique**

Groups Characteristics	Neutral zone		Admixed		Total		t- test	
	Mean	SD	Mean	SD	Mean	SD	Statistic	P-value
Difficulty in tongue movements	3.45	1.10	2.40	1.66	2.93	1.50	3.38	0.001
Irritation during impression	1.67	0.95	1.33	0.47	1.50	0.76	2.02	0.046
Difficulty in following dentist instructions	2.57	1.51	1.52	0.99	2.05	1.37	3.74	<0.001
Duration of procedure	3.69	0.95	2.50	1.78	3.10	1.54	3.81	<0.001
Total Score	11.38	2.28	7.76	4.37	9.57	3.91	4.75	<0.001

**Table No.2: Comparison of mean Stability score after six months between Admixed and NZ impression technique**

Groups Characteristics	Neutral zone		Admix		Total		t- test	
	Mean	SD	Mean	SD	Mean	SD	Statistic	P-value
Fitting of the denture	4.60	0.73	4.81	0.39	4.70	0.59	-1.66	0.100
Chewing efficacy	4.86	0.64	4.86	0.35	4.86	0.51	0.00	1.000
Food Impaction	4.90	0.29	4.81	0.39	4.86	0.35	1.24	.217
Difficulty in Swallowing	4.52	0.50	4.62	0.49	4.57	0.49	-0.87	.384
Difficulty in Speech	4.64	0.48	4.67	0.47	4.65	0.47	-0.22	.821
Total score	23.40	2.04	23.71	1.56	23.5	1.81	-0.778	.439

## DISCUSSION

Over the severely resorbed mandibular ridges, it becomes difficult to make denture with good stability and retention. Therefore, dentures are fabricated with their outlines corresponding to the neutral zone in order to overcome the trouble. When a denture is contoured by using neutral zone technique it is essential to make sure that the forces applied by the surrounding musculature are functioning more efficiently in synchronization and provides benefit for balancing probable forces of oral and perioral musculature<sup>[8,9]</sup>. As far as our study is concerned, it was reported that dentures fabricated by using neutral zone impression technique were more retentive and showed more stability as compared to the admixed impression technique, whereas comfort level during impression was slightly higher in admix technique as compared to neutral zone.

Dentures that are fabricated by using neutral zone impression technique over severely resorbed mandibular ridge ensured that the forces imposed by the muscles assist in retention and enhances balancing of the denture rather than displacing during function. The dentures made by NZ impression technique also have additional benefits like decreased food impaction, superior esthetics because of facial support, appropriate positioning of the posterior teeth that permits adequate

tongue space. Clinicians have to recognize and trace the neuromuscular dynamics of the tissues of oral cavity and this must be applied in the manufacture of the ultimate prosthesis<sup>[10]</sup>. Our study findings were not consistent with the above mentioned study and showed that difficulty in swallowing and speech were less obvious in denture fabricated by using NZ technique with the significant difference between both the techniques whereas chewing efficacy was better and food impaction was more obvious in NZ technique with an insignificant difference between both the techniques after one month following insertion of denture.

It is necessary for the clinician to recognize the neuromuscular dynamics of the oral cavity tissues for the clinician and is useful in the fabrication of the balanced prosthesis that will be seated in a balanced area of the neutral zone region where the forces exerted by cheeks and tongue will balance out each other<sup>[11]</sup>. Our study also supported the above research that placement of teeth were more balanced at neutral zone because all the imposing forces by muscles of cheeks and tongue are in equilibrium at that position after 1 months. Therefore, chances of dislodgment of denture during mastication, speech, and swallowing become reduced.

Similarly, in above mentioned research, merging of two-impression techniques to acquire a complete denture prosthesis that evenly cover up the remaining

crest of ridge, thus raising the surface area of the denture that gets in touch with the residual ridge avoiding dislocation of denture base in both rest and functional position. Therefore, the immovability and retention of the mandibular complete denture prosthesis is enhanced along with higher patient satisfaction [12]. As far as our study is concerned, stability against the dislodging and masticatory forces was maximum in the prosthesis fabricated by using NZ technique as compared to Admixed.

Another clinician conducted a clinical trial that involved 52 participants [13]. Each participant received two sets of complete denture, one fabricated conventionally and the other fabricated by neutral zone impression technique (NZ) perception with a 1-month failure period. Participants indiscriminately selected 1 of 2 sealed opaque envelopes with 2 denture series, either conventional followed by NZ or NZ followed by conventional. Therefore, participants were unsighted for the dentures they carried. Patient gratification with each denture type was reviewed after 6 weeks of placement by an unsighted staff member by means of a 5-scale questionnaire designed for the most imperative purposeful features (esthetics, masticatory capability, retention, immovability, verbal communication, and comfort). Patient satisfaction scores were considerably superior with the NZ dentures as compared to the conventional dentures in all aspects;  $P=0.001$  for question 2 (judgment of denture look) and  $P<0.001$  for all other questions [13]. Our study is consistent with the above mentioned study in which complete dentures were fabricated by two different techniques such as neutral zone and admixed techniques. On comparison of both the techniques using a 5-scale questionnaire developed for the most important functional aspects (food impaction, masticatory ability, fitting of the denture, swallowing and speech after insertion), the outcomes were more pronounced with a significant difference in denture made by NZ technique than admix in masticatory ability, swallowing and speech while they were less pronounced with insignificant differences in food impaction and fitting of the denture. Similarly, Patient satisfaction scores regarding stability were significantly higher with the NZ dentures than with the admixed technique dentures with respect to swallowing ( $p=0.007$ ) and speech ( $p<0.001$ ) after one month. Chewing efficacy was significantly improved after three months whereas fitting of denture was also significantly improved after six months ( $p=0.041$ ) in dentures made by neutral zone technique.

Fahmy and Kharat presented a study that involved two groups of patients, one with dentures fabricated conventionally and the others with dentures that were fabricated through the neutral zone technique. Mastication, comfort level and verbal communication were compared in both the groups. Majority of the patients were pleased with those dentures that were

made by the NZ technique [14]. Our study is consistent with the above research revealed that stability scores were higher in dentures made by the NZ technique while comfort level during impression were higher to some extent in dentures made by the admixed technique.

A consideration of speech is of vital significance while fabricating complete dentures. Tongue plays an important function during speech. Rilandi and Sharry revealed that the dimensions of the tongue do not reduce with the increasing age such as widespread degeneration and weakness of all other tissues in older age. There is approximately 10% increase in the dimension of tongue in edentulous patients if they are not wearing complete dentures [15]. Zaigham also supported that neutral zone method presented adequate space for tongue [16]. Goyal and Greenstein shaped the palatal outlines of the maxillary dentures according to their function and evaluated verbal communication with conventional dentures. Their study illustrated that verbal communication was noticeably enhanced with functionally contoured dentures [17]. In our study, in neutral zone approach, the position and movements of tongue is specified because position of tongue is recorded through various functional movements. Therefore, dislodging forces by the tongue were minimized by this approach and improved the speech.

Therefore, it was demonstrated that NZ impression technique integrates the features previously present in the form of muscular structures, to control the vanished retentive features particularly in cases of resorbed ridges. This offers acceptance of outcomes as stability is concerned, despite compromised residual ridge condition. This technique merely explains the perception that synthetic teeth should not be positioned over the crest of ridge or buccal or lingual to it but somewhat it should be positioned as directed by the functional movement of cheeks, lips, and tongue that retain the denture in its position.

## CONCLUSION

Dentures made by NZ technique showed slight superior levels of patient satisfaction and stability than dentures prepared by Admixed technique in all functional features (immovability, masticatory capability, retention, swallowing and speech) in addition to comfort and aesthetics.

### Author's Contribution:

Concept & Design of Study:	Irum Munir Raja
Drafting:	Mervyn Hosein
Data Analysis:	Muhammad Athar Khan
Revisiting Critically:	Irum Munir Raja, Mervyn Hosein
Final Approval of version:	Irum Munir Raja

**Conflict of Interest:** The study has no conflict of interest to declare by any author.

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