Midline Fractures in Single Maxillary Complete Acrylic vs Flexible Dentures

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Abstract

Background: Patients using single maxillary denture against their natural mandibular teeth face the problem of midline fracture in their routine acrylic dentures. Various techniques have failed over the years to address the problem. In this study, flexible denture material (Lucitone) with injection moulding system has been used and evaluated for midline fracture in these patients. **Methods:** A total of 58 patients in the age group of 38 to 80 years, who had experienced midline fracture in their acrylic maxillary dentures were selected. They were provided with new dentures using flexible denture material. Various parameters, namely, mastication, phonetics, esthetics and comfort level were evaluated.

Result: Only two cases reported slight crack in the palatal region of the maxillary dentures after 18 months of use. Mastication and phonetics were found to be improved with flexible dentures.

Conclusion: The flexible denture is a promising material for preventing midline fractures in a single maxillary denture. It is well tolerated by the patients as compared to the methyl meth-acrylate dentures.

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Key Words : Midline fracture; Single denture; Flexible denture

Introduction

The fracture of complete dentures constitutes a challenge and remains an unresolved problem. A midline fracture of single maxillary complete denture base especially in patients who have retained their natural mandibular teeth is an inevitable problem (Fig.1) [1]. Several factors have been attributed for the midline fracture including flexural fatigue resulting from cyclic deformation and those which exacerbate the deformation of the base or alter its stress distribution [2,3].

There have been continuous efforts to improve the poly methyl methacrylate towards the enhancement of strength, better dimensional stability, better abrasion resistance and the achievement of radiopacity [4,5]. Lucitone FRS (Fig.2) is a flexible and monomer-free thermoplastic dental polymer with low flexural modulus [6]. Few reports are available on therapeutic efficacy of flexible dentures in overcoming midline fractures. We undertook a study to evaluate clinical and therapeutic efficacy of super polyamide resin (Lucitone FRS) injection moulded complete maxillary dentures in patients who retained their natural mandibular teeth. The objective of the study was to compare midline fracture, retention, stability, mastication, esthetics, phonetics and comfort level in flexible maxillary dentures vis a vis conventional dentures on a subjective scale.

Material and Methods

A total of 58 patients in the age group of 38 to 80 years, with a mean age of 65 years, were included. The age and sex distribution of cases is given in Table 1 and Chart 1. All the selected cases had complete edentulous maxilla against mandibular natural teeth. All of them were provided with upper complete dentures and few cases of partially edentulous mandible were provided with lower partial dentures also for balanced occlusion. The dentures were fabricated with Lucitone FRS (Flexible resin) using injection moulding system. Following inclusion and exclusion criteria were adopted.

Inclusion criteria

- Adequately controlled systemic diseases like diabetes and osteoporosis or disease free status of patients.
- Acceptance of the flexidenture by the selected patients.

Exclusion criteria

- Patients with poor control of systemic diseases like haematological, cardiovascular and renal disorders, autoimmune/endocrinological disorders.
- Patients with habits like bruxism, habitual eccentric movements etc. which would compromise the results.
- Patients who have undergone chemo/radiotherapy.

Mandibular arch anomalies were corrected by selective grinding / restorations / flexible partial dentures. Standard clinical procedures with regards to impression making and maxillo-mandibular jaw relation records were followed. Shape,

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size and colour of the teeth were selected keeping in mind the age, sex, face symmetry, arch size, skin colour and most importantly colour, shape and size of the opposing mandibular natural teeth. If the cuspal form of the lower teeth were retained, anatomical teeth were selected which were arranged with good interdigitation with cusp tip to fossa relation. A substantial overjet was maintained while arranging the teeth. The overjet was gained by labio-incisal surfaces of the lower natural teeth and palatoincisor surfaces of the upper incisors [7-9]. Mechanical undercuts (diatorics) were made in the centre of each tooth before teeth arrangement so that the melted fluid polyamide flows into the undercuts and retains the tooth in the denture [10].

Trial was made in patient's mouth and a clinical check was done for stability, retention, esthetics, phonetics and occlusion. Patient's consent was obtained and minor changes, if required were made before retri al on the same appointment.

Table 1
Sex distribution

	Frequency	Percent	Valid percent	Cumulative percent
Females	17	29.3	29.3	29.3
Males	41	70.7	70.7	100.0
Total	58	100.0	100.0

Chart 1 : Age distribution of the study subjects

Fig. 1 : Mid line fracture in maxillary denture

In this procedure, injection cast technique was used and the sprue designing was highly technique sensitive (Figs. 4,5). For complete maxillary dentures, sufficient width sprue was attached to the posterior border of the denture with an extension over the palate area to allow adequate flow of the material throughout the palate area. For partial dentures and mandibular complete dentures, the sprue was attached to both lingual extensions as well as in the midline. Once the investment of the lower half of the flask was set, we embedded the upper half of the flask [10-12].

Dewaxing was done by putting the flask in boiling water for 4 to 6 minutes to soften the wax. The bolts were loosened on the flask to remove the metal flask brackets and flask was opened. Boiling out procedure was completed and the wax was discarded. The flask was flushed with clean boiling water. The stone around the sprue was beveled with a knife. Flask margin were checked to ensure that both flask halves fit together with intimate metal contact. A thin coat of Al-Cote separating agent was applied to the model and was allowed to dry completely. Diatorics (mechanical retention to the teeth) were checked. Enough tooth material was removed to enhance retention [11,13].

Dentsply Silicone Spray ® was sprayed on a Lucitone FRS cartridge. Using heat resistant gloves, the cartridge was inserted into the cartridge sleeve with the nozzle of the cartridge facing inwards. Injection insert was positioned on the bolt side of the flask and the opened flask was placed directly in a pre-heated oven maintained at 70-80°C. Furnace timer was set for 17 minutes. After heating the flask assembly was placed in front of the Success Injection System. Cartridge sleeve and cartridge assembly were removed from the furnace, keeping the cartridge assembly horizontal while transporting it to the flask assembly on top of the flask so that the nozzle of the cartridge fitted into the opening of the injection insert. The narrow piston head was properly aligned with the cartridge sleeve. The piston was engaged by depressing the activation switch (Fig.3).

After one minute of injection, the flask assembly was removed from the system and the cartridge assembly was disengaged from the flask assembly immediately. Finally, the used cartridge was removed using the knock out base and knock out rod and the cartridge sleeve was returned to the furnace. The flask assembly was cooled for five minutes

Fig.2 : Success flexible denture injection system

before de-flasking after which the denture was retrieved (Fig.4). The sprues were removed with a cut off disk.

Lucitone FRS was finished and polished using normal procedures for acrylic. Intra oral occlusal balancing was done before giving the denture to the patients. Patients were instructed to follow general instructions as they were following for their previous normal acrylic denture.

The presence of midline fracture in the study subject was evaluated objectively at the time interval of 3, 6, 9, 12 and 24 months after insertion of maxillary single denture. The patients were also evaluated for retention, stability, mastication, esthetics, phonetics and comfort level subjectively with the help of questionnaire (Annex-A) which they endorsed on a scale inclusive of parameters - excellent, good, satisfactory and poor at intervals 3, 6, 12 and 24 months in comparison with their experience with old dentures. The subjective data was analyzed by a non parametric test (Friedman's test) for drawing conclusion.

Results

All subject included in study were using upper conventional maxillary dentures. They had reported midline fracture and therefore sought new dentures which ranged from 1 to 10 times. The mean duration prior to appearance of crack / fracture in conventional dentures was five months. Two (3.44%) patients with flexible dentures reported midline

fracture during the period of observation. Statistical significance ($p < 0.05$) was reported for esthetic parameter. The patients reported gradual fading of denture base colour over a period of 12-24 months. Dislodgement of teeth from denture base was found to be progressive in 3 to 24 months ranging from 3.4% to 34.5% respectively in 38 subjects.

Comparison of flexible denture with conventional dentures on subjective scale revealed that 26 (44.8%) patients noticed retention and stability as good, while 23 (39.7%) found it satisfactory. Esthetics was good in 14 (24%) patients while 26 (44.8 %) reported it as satisfactory (Table 2). As far as phonetics was concerned, 24 (41.4%) patients showed satisfactory result with new flexible dentures, while three (5.2%) were not satisfied. 28 (48.3%) patients found the dentures satisfactory, while one (1.7%) was not satisfied (Table 2).

Discussion

Despite advances in dental materials, techniques, and equipment, fracture of poly methyl methacrylate resin denture remains a significant problem [2,5]. Darbar et al [5] have shown that the most common type of fracture is debonding / fracture of denture teeth (33%) in both complete and partial dentures followed by the midline fractures of complete dentures (29%) and other types (38%) of denture fracture. Patients who wear complete maxillary denture against mandibular natural teeth or with mandibular partial denture often face the problem of midline fracture in their maxillary dentures [7,8]. Several factors have been attributed to be the cause of midline fracture i.e. flexural fatigue resulting from cyclic deformation and factors that exacerbate the deformation of the base or alter its stress distribution may predispose the denture to fracture [1-3]. Other factors which form areas of stress concentration such as a large frenal notch [8], dentures with thin or under-extended flanges, poorly fitting dentures or a lack of adequate relief, dentures with a wedged or locked occlusion have been implicated. Poor clinical design, dentures which have been previously repaired [5], poor laboratory technique, use of porcelain teeth, increase in

Fig.3 : Success injection casting procedure

Fig. 4 : Flexible denture retrieved

stress concentration at the tooth/ denture base interface, heavy or uneven masticatory forces, unbalanced occlusion, patient related habits [6-9], diastema and maxillary tori are other common causes for midline fractures of upper dentures [13-14].

All the efforts to overcome midline fracture in complete maxillary denture against natural mandibular teeth by improvising techniques and improving materials did not provide the requisite results [15]. Injection moulding technique was developed to overcome this problem [10]. Although this technology has been in use since 1954, it has become popular only recently. It was initially developed as a fluoropolymer (Teflon type

plastic) in 1962. Acetal was introduced in 1971. The material used in contemporary practice is a nylon based plastic - polyamide. It is stronger, more flexible than acrylic and thus can be used as a viable alternative [11,12]. In the present study, only two (3.44%) cases reported midline fracture which is suggestive of excellent therapeutic efficacy. All the patients included in the study were using methyl methacrylate maxillary complete dentures. Since we provided flexible maxillary dentures, the present study can be considered as a case control study. Parvizi et al [16] compared the dimensional accuracy between injection molded dentures base material versus poly methyl methacrylate. They were of opinion that injection moulded dentures base material is superior in accuracy. We have also observed the same in our study. In cases of severe undercuts this material has proved to be highly satisfactory.

In our study, statistically significant ($p < 0.05$) number of patients reported of poor esthetics. The patients reported gradual fading of denture base colour over a period of 12-24 months. Further research and improvement in the material is needed to overcome this drawback. Another major drawback observed was debonding of teeth from denture base. The polyamide denture base material has a unique property that it does not chemically bond with any of the acrylic resin / porcelain, so mechanical bonding is the only mode to

Annexure-A Questionnaire

Case no. Date :

Army no. Self / Relation/ Serving / Retired

Name : Age : Sex :

Address :

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Contact no :

Diagnosis:

How long you are wearing the upper maxillary denture:

How many dentures have you got made:

Reason for seeking new denture:

Whether your upper denture develops mid line fracture : Y/N

How frequently fracture appears :

What is your experience and observation with old as well new flexible denture on scale?

Excellent, good, satisfactory and poor as explained to you

Parameters	Old Denture				New Denture			
	3 months	6 months	12 months	18/24 months	3 months	6 months	12 months	18/24 months
Retention & stability								
Esthetics								
Phonetics								
Mastication								
Comfort level								

Table 2

Percentile of measured parameters in old and new dentures

Parameter	With Old Denture					With New Denture															
						3 months				6 months				12 months				24 months			
	E	G	P	S	E	G	P	S	E	G	P	S	E	G	P	S	E	G	P	S	
Mid line #	100%	Nil	Nil	Nil	3.44%																
Retention and stability	8.6	44.8	6.9	39.7	31.0	15.5	19.0	34.5	31.0	22.4	5.2	41.4	31.6	25.9	3.0	39.7	25.9	12.1	-	27.6	
Mastication	1.7	37.9	12.1	48.3	32.8	8.6	3.4	55.2	32.8	10.3	-	56.9	27.6	19.0	1.7	51.7	29.3	8.6	-	27.6	
Phonetics	5.2	36.2	17.2	41.4	34.5	10.3	8.6	46.6	31.0	12.1	-	56.9	25.9	15.5	3.4	55.0	29.3	8.6	-	27.6	
Esthetics	6.9	41.4	6.6	44.8	34.5	24.1	10.3	31.0	32.8	17.2	5.2	44.8	27.6	15.5	5.2	51.0	24.1	6.9	3.4	31.0	
Comfort level	1.7	29.3	25.9	43.1	32.8	6.9	3.4	56.9	37.9	5.2	1.7	55.0	34.0	13.8	-	51.4	29.4	3.4	-	328	

Parameter denoted as

Mid Line fracture in maxillary denture = MF; Retention and stability = R&S; Esthetics = E; Phonetics = P; Mastication = M; Comfort level while wearing denture = CL

Observation scale in decreasing order - E = Excellent - 4; G = Good - 3; S = Satisfactory - 2; P = Poor - 1

Fig. 5: Denture after 18 months use

use in the polyamide denture base material. Sufficient height of the selected teeth for this, should be there. Mechanical undercuts (diatorics) were made in the centre of each tooth so that melted fluid polyamide could flow into the undercuts so as to retain the tooth in the denture [11,12]. Patients with less vertical dimension and small crown length are unfit cases for flexible dentures. Modification in teeth design can be explored to overcome this problem. Another problem faced with the material was that no repair or relining is feasible. The flexible dentures were found kind to underlying soft tissues. There was no denture sore-mouth and the better comfort level was attributable to low modulus of elasticity [12,16]. Being a subjective analysis few patients were not able to comment on comfort level, phonetics etc and the same has not been included in the result. Our patients also reported better retention and stability in flexible dentures due to low modulus of elasticity of this material. We conclude that Lucitone flexible injection molded denture material is a promising alternative which requires a larger multi-centric trials with long term follow up to draw concrete conclusions.

Conflicts of Interest

This study has been funded by research grants from the Office of DGAFMS.

Intellectual Contribution of Authors

Study Concept : Col RK Dhiman

Drafting & Manuscript Revision : Col RK Dhiman, Lt Col SK Roy Chowdhury

Study Supervision : Col RK Dhiman

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