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RESEARCH ARTICLE

COMPARATIVE EVALUATION OF THE RETENTION OF MAXILLARY DENTURE IN MICROSTOMIA PATIENTS FABRICATED USING SECTIONAL TRAY WITH PIN AND SLEEVE ATTACHMENT WITH THAT OF A CONVENTIONAL SECTIONAL TRAY DESIGN: IN VIVO STUDY

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Abstract

Background and Aims: Taking an impression from patients of limited mouth opening has been a great clinical challenge. In this regard, studies on sectional trays are very few. The aim of this study was to evaluate & compare the clinical efficiency of impressions using an easily designable sectional tray to that of cumbersome design of conventional sectional tray.

Materials and Methods: Two customized sectional trays – one with the pin and sleeve attachment which is easy to make & the other one with acrylic bar and stud attachment which is conventional & difficult to fabricate. Twenty dentures, ten from each sectional tray were fabricated for each of the 10 patients having limited mouth opening. The effectiveness of the impression record was compared based on the retention of the final maxillary denture which was measured using a digital force gauge. The data obtained were analyzed using SPSS 20.0 software and independent t-test was applied.

Results: There was no significant effect on the retention of the completed maxillary denture retention fabricated using two different two designs of sectional trays.

Conclusion: Pin and sleeve sectional tray can be used with equal clinical efficacy as the other conventional designs of sectional trays.

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Introduction:-

Microstomia is defined as an abnormally small orifice.¹ A limited oral opening can be caused by surgical treatment of oro-facial cancers, head & neck radiation, reconstructive lip surgery, burns, trauma, micro-invasion of muscles of mastication, temporo-mandibular joint dysfunction syndrome & genetic disorders.²⁻⁷

Impression procedures, recording of maxillo-mandibular relationship & teeth arrangement are complicated by restricted access to the oral cavity. Prosthodontic management of an edentulous patient with limited mouth opening is quite a challenge as it is tedious to use conventional techniques for the denture fabrication.

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One of the basic & important procedure which is a key to the successful denture fabrication is the impression making in such patients, which needs utmost accuracy. Since wide opening is an essential pre-requisite for proper tray insertion & alignment, but this is not possible in microstomia patients which demands for the modifications of the conventional impression procedures.

Sectional impression trays have been fabricated using recesses,⁸ orthodontic screws,⁹ Lego blocks (Lego systems Inc., Enfield, CT),¹⁰ dowel plug holes and a screw joint for rigid connection,¹¹ and interlocking tray segments.¹²

This article aims to compare the retention of maxillary dentures fabricated using two different sectional tray designs for edentulous microstomia patients.

Materials And Methods:-

This study was conducted at the department of Prosthodontics, crown & Bridges, Government Dental College & Hospital, Srinagar, on 10 completely edentulous patients involving both the male and female patients exhibiting limited mouth opening.

Inclusion Criteria

1. Completely edentulous male & female patients aged 55-75 years.
2. Well formed maxillary ridges.
3. Patient's mouth opening less than 27mm vertically & less than 31 mm horizontally which is quite a practical challenge for the impression making using conventional technique.
4. No history of trauma.

Exclusion Criteria

1. Completely edentulous patients with wide mouth opening.
2. Patients with resorbed ridges.

For making the primary maxillary impressions, smallest available stock tray whose flanges were modified as required so that it could be inserted into the patients mouth without much discomfort. The preliminary impression of maxillary arch for each patient was made with alginate & the casts were obtained using Type – II dental plaster.

For each subject, two sectional tray designs for customization were fabricated using auto-polymerizing acrylic resin.

Group – I:

One of the tray designs included pin & sleeve in which one part of the tray was fabricated with pin as a handle & the other half of the tray contained the sleeve within the acrylic handle to fit the pin accurately for assembling the parts together as a single unit (Fig.1 and 2).



Fig 1:- Sectioned self-curing acrylic resin tray fabricated on the primary cast.



Fig 2:- One half of the tray containing pin in place of handle & the other half of the tray containing sleeve within an acrylic handle.

Group – II:

The second tray which is a complex design included an acrylic bar attached to one part of the tray & an acrylic stud on the other half for attachment to properly align the sections of the trays extra-orally (Fig.3 and 4).



Fig 3:- Sectioned self-curing acrylic resin tray fabricated on the primary cast.



Fig 4:- One half of the tray containing acrylic bar & the other half of the tray containing acrylic stud.

For each subject, the border moulding was done using low fusing impression compound and secondary impressions were made using light body poly vinyl siloxane. The excess material along the midline was trimmed with a sharp B.P. Blade at an angle for the better approximation of the other segment when assembled extra-orally to form a seam-less contact for better cast reproduction. The secondary casts were poured followed by the subsequent steps required for the fabrication of maxillary complete dentures.

The retention of each denture was checked using a digital force gauge (Fig.5). The force values (in Newtons) displayed on the digital gauge at the moment of denture dislodgement were determined for each denture. The maximum force displayed on screen before dislodgement of the dentures in each group were obtained and tabulated for statistical analysis.



Fig 5:- Digital force gauge (Lutron FG – 5000A).

Results:-

The study compared two different tray designs for the fabrication of maxillary dentures fabricated for each patient with final retention as a comparative parameter. The dislodging forces required for each maxillary denture in each subject was recorded (in Newtons) and the collected data was tabulated with GROUP-1 representing the retentive values obtained for sectional tray with pin & sleeve attachment and GROUP-2 representing the retentive values obtained for sectional tray with complex design of bar & stud attachment.

The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and then exported to the data editor of SPSS version 20.0 (SPSS Inc., Chicago, Illinois, USA). A p-value of less than 0.05 was considered statistically significant.

Retentive values (in Newtons) obtained from each patient

S. no	GROUP – 1	GROUP – 2
1.	40.11	39.63
2.	44.41	41.17
3.	39.67	41.70
4.	46.81	44.21
5.	42.96	40.65
6.	33.77	35.27
7.	40.57	39.10
8.	38.23	38.17
9.	42.56	41.23
10.	41.98	39.77

Group statistics					
		N	Mean	Std. Deviation	Std. Error Mean
GROUP 1		10	41.11	3.578	1.131
		10	40.09	2.370	.750
GROUP 2					

The independent t-test revealed no significant statistical difference ($P > 0.05$) in the final retention of maxillary dentures between GROUP-1 and GROUP-2.

Discussion:-

In a patient with restricted opening, it is difficult to obtain the 'perfect' impression that captures all possible anatomic details. Priorities must be established according to the restorative & reconstructive needs of the individual patient. It is more difficult to insert the tray than to remove it from the mouth. When the tray is placed in the mouth, the operator usually stretches one corner, making the oral opening still smaller. During removal, the orbicularis oris can be stretched beyond the limit of the patient's normal function. In this situation, the muscle's sphincteric shape allows the operator additional maneuverability.¹⁶

Many authors have devised different impression tray designs for successfully recording impression in patients of limited mouth opening.

Mirfazaelian A described the use of an orthodontic expansion screw (2 guide pins and a screw) without the screw axis, to serve as a guide or key and keyway to fabricate a split custom tray. Preparation of a butt joint along the two pieces of a maxillary tray can enhance its stabilization during border correction and impression making.⁹

The expansion screw is placed vertically in the handle of the custom tray to accommodate the limited space. The length of the guide pins in the expansion screw can be reduced for easier insertion and removal if necessary.

Maxillary and mandibular trays require different locations for the key and keyway. For the maxillary tray, the holes must be located in the overlay piece and the guide pins are placed in the other half for better access. For the mandibular tray, guide pins are placed in the overlay piece and holes are located in the other half.

Dhanasomboon and Kiatsiriroj used dental stone which was poured directly to one half of the first sectional impression made. The second sectional impression, which was made, was later approximated with the first impression section and stone poured into the second half. Stock tray was modified by trimming the flange lengths.¹³

Yenisey et al. used sectional maxillary and mandibular trays for the completely edentulous patient with microstomia, caused by scleroderma. Preliminary impressions were made with a putty silicon impression material. For each special tray, a total of four metal snaps were attached. Two female parts were attached on the canine regions and two were attached on molar regions. Another block carrying male parts of the snaps was constructed. In the mandibular tray, only one block was adequate for the stability of the right and left parts. In the maxillary tray, two blocks were constructed and they were joined together to provide stability.¹⁴

Without surgical operation, it is very difficult to perform prosthodontic treatment for the patients with microstomia, especially when the mouth circumference length is less than 160mm².¹⁵ Because the smallest diameter of a fully retentive denture may be larger than the greatest diameter of the mouth opening, sectional or collapsible dentures are indicated.¹⁶⁻¹⁸

Conclusion:-

Limited mouth opening often complicates the prosthetic treatment of patient. The placement & removal of the loaded impression tray compromises the exact recording of the impressions. However, with the prudent designing & careful manipulation technique, many of the clinical difficulties, which can hamper successful fabrication of the prosthesis, can be overcome with good prognosis.

This study showed that the sectional tray with pin & sleeve attachment is a better alternative to the complex designed sectional tray with acrylic bar & stud attachment as a custom tray in microstomia patients in terms of ease of fabrication, better handling, patient convenience and comparable retention.

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