

To Fabricate and Compare the Accuracy of Edentulous Primary Impression with Maxillary Adjustable Stock Metal Tray to Conventional Maxillary Stock Metal Tray

Shreepasad Wagle¹, Sulekha Gosavi², Siddharth Gosavi³, Komal Nalawade¹, Rozina Vishnani¹

ABSTRACT

Introduction: Stock metal trays are available in various sizes depending upon patient's jaw size, selection and keeping these trays is costly and time consuming to the operator. Objectives of the study were to fabricate an adjustable maxillary edentulous stock metal tray for maxillary arch impression and to compare the accuracy of an adjustable maxillary stock tray with that of conventional maxillary stock tray.

Material and Methods: an in-vitro comparative study was undertaken to access the accuracy of new adjustable tray with the conventional stock tray in school of dental sciences, KIMS, Karad. New adjustable maxillary stock tray was fabricated by using two big and two small stainless steel halves and adjustable screws to adjust width and length according to patient's arch. Ten impressions of ideal maxillary cast were recorded with impression compound by using conventional stock tray [group CST] and ten impressions by using an adjustable stock tray [group AST] and the results were analyzed by using unpaired t test.

Results Mean values measurements (in mm) of group CST reference points AB, CD, AC, BD and AD were 31, 48.9, 33.8, 31.7 and 49.6 respectively. Mean value measurements (in mm) of group AST reference points AB, CD, AC, BD and AD were 30.65, 48.9, 33.95, 31.9 and 49.25 respectively. There was apparent difference between conventional and an adjustable tray.

Conclusion There was statistical difference between impressions with conventional and adjustable stock tray. Adjustable maxillary stock tray can be used as a stock tray for primary impression in maxillary edentulous patient.

Keywords: Stock impression tray, adjustable impression tray, primary impression, edentulous impression, impression compound.

INTRODUCTION

Prosthodontists always desire to make accurate impression for successful prosthesis. To achieve accurate impressions dentists need to access the tissue to be recorded, selection of accurate stock tray and impression material are important.^{1,2} Tray is a device used to carry the impression material to the mouth, confine the material in opposition to the surface to be recorded, and control the impression material while it sets to form the impression. Accurate impression is depending upon accurate tray and good impression material. Many types of stock trays size 0 to 4 numbers are available for making primary impression. According to the size of patient's arch or jaw, particular size of tray is selected. Hence dentists need to have different size of trays, but sometimes stock trays are poorly shaped and are not according to size of jaw.^{3,4} This may leads to improper impression recording of patient's jaw. Some patient may require modification of the tray which increases chair side time. Stock trays that are available in market are perforated, non-perforated

and plastics trays. Plastic tray is not rigid and may distort during impression procedure.⁵ Selection of tray depends upon the impression material and operator's choice.

Since 50 years there in not much change in design of tray but different impressions materials has evolved.⁶ Metal stock trays are available in number 0 to 4 sizes according to the need of patient's jaw. All tray manufacturers fail to reduce the total number of trays. Multiple insertion of stock tray for selection in patient mouth is annoying and increase chair side time. So we felt the need of fabrication of an adjustable metal stock tray which will help dentist to adjust it according to the patient's arch size.

Hypothesis was that newly fabricated adjustable stock tray may not record primary impression as accuracy as impression with conventional stock tray. Hence, the aim of this original study was to fabricate an adjustable maxillary stock tray for impression of maxillary edentulous arch. This study was also access the accuracy of an adjustable maxillary stock with the conventional maxillary stock tray.

Objectives of the study were to fabricate an adjustable maxillary edentulous stock metal tray for maxillary arch impression and to compare the accuracy of an adjustable maxillary stock tray with that of conventional maxillary stock tray.

MATERIAL AND METHODS

It was an in-vitro comparative study conducted in school of dental science, KIMS DU Karad. The study was conducted by trained dental student under the supervision of expert dental surgeon in fully equipped dental school. After getting ethical clearance certificate from the Krishna institute of medical science deemed university Karad, study was conducted in the department of Prosthodontics of above mentioned university. To start with, fabrication of adjustable tray and to check its accuracy following materials were required.

Materials used for fabrication of an adjustable maxillary stock tray-

1. Stainless steel plates
2. Screw and threaded nuts

¹Intern, School of Dental Sciences, ²Professor, ³Reader, Department of Prosthodontics, Crown and Bridge, Karad, Maharashtra, India

Corresponding author: Ms. Shreepasad Wagle, Anand Nagar, Lashkarwadi, At post: Jalgaon, Tal: Dapoli, Dist: Ratnagiri, pin code: 415712, Maharashtra, India

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3. Micromotor and handpiece
4. Burs and mandrill, carborundum disc
5. Welding equipment

Material used for checking the accuracy of an adjustable maxillary stock tray-

1. An adjustable maxillary stock tray
2. Conventional maxillary stock tray number 3
3. Impression compound
4. Maxillary edentulous stone cast
5. Scale and modified divider
6. Hot water bath, scalpel, rubber bowl

Method

An adjustable stock impression tray was fabricated by using two halves of stainless steel plates. These stainless steel plates were shaped that of maxillary edentulous ridge and palate. These two plates were attached by adjustable screw at the center area of palate. Adjustable screw is consisting of middle shaft and two adjacent threads nuts. This helps to adjust the width of the arch. For the adjustment of length of the tray, two small plates were attached at distal end of the tray with slit and locking system. These small plates can be adjusted to increase the length (antero-posterior direction) of adjustable tray. Thus fabricated an adjustable maxillary stock metal tray can be adjusted from size 0 to size 4 as shown in front views and dorsal view of adjustable tray of size 0 and size 4 respectively (Figure-1:a,b).

To check the accuracy of an adjustable maxillary stock tray, an ideal edentulous cast was made from maxillary edentulous mold in dental stone. Four reference points were prepared on the ideal maxillary edentulous cast. Each reference point having dimensions 4mm length, 2mm width and 1.5 deep. These points were named as A, B, C and D (figure-2). Point A and point B are 17mm away from center of incisive papilla on left and right side on the crest of ridge at canine region respectively. Point C and point D are 43 mm away from center of incisive papilla on left side and right at maxillary tuberosity area respectively.

To access accuracy of adjustable maxillary stock tray with the conventional stock tray twenty impressions were made by using impression compound. Ten impressions of ideal maxillary cast were made by conventional stock tray and remaining ten impressions were made using adjustable maxillary stock tray with impression compound. Impression compound was softening in hot water bath at temperature of 55-60°C. Soften impression compound was loaded on the conventional stock tray number 3. Then tray was oriented and placed on maxillary cast. Slight pressure is applied so that impression compound flowed into the 4 reference points and sulcus of ideal maxillary cast. The tray was hold in position till the impression compound set. The impression was removed and evaluate whether it had recorded all the areas. Once the details were recorded appropriately, excess border was removed with scalpel and blade. Improper and defective impressions were discarded Total ten maxillary impressions were recorded with conventional stock tray [Group CST] (figure-3b).

An adjustable maxillary tray was adjusted laterally and antero-posteriorly by loosening the adjustable screws according to the ideal maxillary cast. Impressions with adjustable tray (figure-3a) were made using impression compound in same manner as mentioned above for conventional maxillary stock tray. Such 10

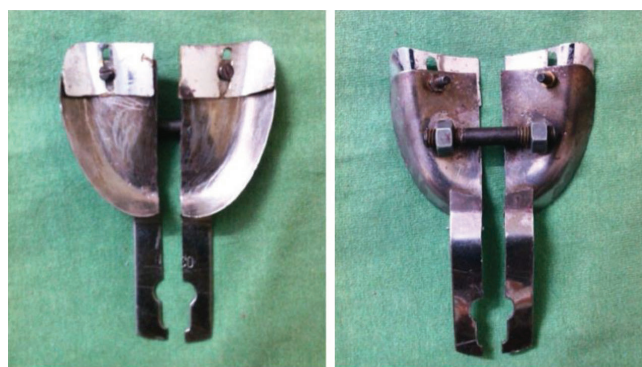


Figure-1: Showing open adjustable tray up to size 4, (a) superior view, (b) inferior view.



Figure-2: Showing points A, B, C, and D as described above.

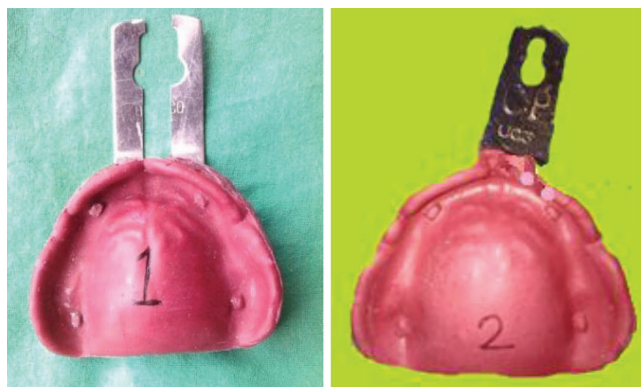


Figure-3: Showing impression made by using adjustable stock impression tray, and points A, B, C, D replicated on impression. (a) by adjustable stock tray, (b) by conventional stock tray.

maxillary impressions were recorded with an adjustable stock tray [Group AST].

All four reference points of maxillary cast correspond on maxillary impressions in group CST and group AST were measured. Distance between all four references points recorded on impression was measured like AB, CD, AC, BD, and AD with the modified divider and measuring scale. All the readings were noted in both groups.

STATISTICAL ANALYSIS

All the data were collected by the student researcher under the supervision of trained doctors. Analyses of all collected data done in Microsoft office excel 2007 and analyzed for descriptive and inferential statistic.

RESULT

Aim of study was to check the accuracy of newly fabricated an

adjustable metal maxillary stock tray. To assess the accuracy of new adjustable maxillary stock tray, twenty primary impressions with impression compound were recorded. These primary impressions were recorded by using maxillary conventional stock trays and adjustable tray. This study was divided into two groups, ten impressions were with conventional stock tray (group CST) and ten impressions were with an adjustable stock tray (group AST). Accuracy of new metal maxillary adjustable stock tray was access by measuring distance in mm between reference points AB, CD, AC, BD and AD in both groups of impression as shown in table-1.

Mean and standard deviation for each reference point AB, CD, AC, BD and AD were calculated for group CST and group AST as shown in table 2. Mean values of group CST were AB (31) CD (48.9) AC (33.8) BD (31.7) and AD (49.6) and mean of group AST were AB (30.65) CD (48.9) AC (33.95) BD (31.9) and AD (49.25). The standard deviation values of group CST and standard deviation of group AST are as shown in table-2.

Statistical significance using inferential statistic by using unpaired t test was used to calculate p value. The p value of reference points AB (0.0511) CD (>0.9999) AC (0.3061) BD (0.2878) and AD (0.1319) are as shown in table-3.

The result clearly shows that p value was > 0.05 that is insignificant at 95% confidence interval. Study suggested that there was no difference in accuracy of impressions with an adjustable maxillary stock tray and conventional maxillary stock tray. That means the impressions recorded with an adjustable maxillary stock tray were as accurate as conventional maxillary stock tray.

DISCUSSION

Since 50 years, there is no much change in stock trays design. Edentulous stock trays come in many sizes for both the maxillary and mandibular arches. Market is flooded with various shapes and sizes of stock trays in metal and plastic materials. Authors have worked on the modifications in shape, size and material used for fabrication of tray that has increased number of trays.^{6,7} For every patient operator has to carry all the autoclaved trays while making the impression.

In view of above mentioned problems an idea of fabricating an adjustable maxillary stock tray was clicked and split tray was fabricated by using two stainless steel plates. Two halves of it was attached with the adjustable screw which can extend the tray laterally for jaw width. Two small metal plates were added distally to extend the tray anteroposteriorly to adjust the length of the jaw. During fabrication of an adjustable tray we did not have any problem and fabrication cost was less.

After fabrication of an adjustable tray, accuracy of an impression with it needs to be verified. So, 20 impressions of an ideal maxillary cast were recorded with the impression compound by using conventional maxillary stock tray [group CST] and adjustable maxillary stock tray. Ten impressions were recorded for each group. The four points A, B, C and D on the ideal cast and which was transferred into impression were used as reference for measurements. This study clearly showed that an adjustable stock impression tray is as accurate as conventional stock tray and it can be used in making impression of edentulous arch with impression compound. Thus this study rejected the hypothesis.

Group CST	Measurement of reference points (mm)				
	AB	CD	AC	BD	AD
1.	31	49	34	32	50
2.	31.5	49	33	31	50
3.	30.5	48.5	34	31	49
4.	31	49	34	31	50
5.	31	49	34	32	50
6.	31	49	34	32	50
7.	31	49	34	32	49
8.	31	48.5	33	32	49
9.	31	49	34	32	49
10.	31	49	34	32	50

Table-1: Measurements of impressions taken by Conventional stock tray [CST] in millimeter.

Group AST	Measurement of reference points (mm)				
	AB	CD	AC	BD	AD
1.	31	48	34	32	49
2.	31	49	34	32	49
3.	31	49	34	32	50
4.	31	49	34	32	49
5.	30	49	34	32	50
6.	30.5	49	34	32	49
7.	30	49	34	31	49
8.	30	49	34.5	32	49.5
9.	31	49	34	32	49
10.	31	49	34	32	50

Table-2: Measurements of impressions taken by Adjustable stock tray [AST] in millimeter.

Points	X1 Mean value and standard deviation of Group CST	X2 Mean value and standard deviation of Group AST
AB	31.00 (0.235702)	30.65 (0.474342)
CD	48.90 (0.210819)	48.90 (0.316228)
AC	33.80 (0.421637)	33.95 (0.158114)
BD	31.70 (0.483046)	31.90 (0.316228)
AD	49.60 (0.516398)	49.25 (0.474342)

Table-3: Mean values and standard deviation of each measurement.

Points	X1*	X2**	T	p- value
AB	31.00	30.65	2.090	0.0511
CD	48.90	48.90	0.000	>0.9999
AC	33.80	33.95	1.053	0.3061
BD	31.70	31.90	1.095	0.2878
AD	49.60	49.25	1.578	0.1319

(Where X1* = mean value of measurements taken by Group CST and X2** = mean value of measurements taken by Group AST.)

Table-4: t value and P value of each point measurement by unpaired t test.

To solve this problem of repeated sterilization, disposable trays came in the market but it is not cost effective. An adjustable tray can be used for one patient and it can be cleaned and autoclaved. The dentists can invest in increasing the number of adjustable stock trays. The only really significant 'advance' (if one could call it that) in the past 50 years has been the plastic 'disposable' tray. Conventional stock impression trays are available in

various sizes from size 0 to size 4 or more. Some manufacturers provide it in different design modification too, but they fail to reduce the number. Dentist has to buy set of conventional stock impression trays. Also after selection of the tray, selected tray may require modifications like casting flanges for proper adaptation, building the posterior area by other materials like wax, resin, impression compound etc. As adjustable maxillary stock tray is having four different components, we can adjust width irrespective of anteroposterior length and vice versa. Tray will be selected in first attempt only. In conventional stock trays, dentist uses one set of trays from sizes 0 to 4 for only one patient. In adjustable tray we can use only one tray for one patient. Hence instead of using set of 5 trays for one patient we can use 5 adjustable trays for 5 different patients. Adjustable stock impression tray is 3 to 4 times cost effective than the set standard conventional stock impression tray.

CONCLUSION

Within the limit of the study, fabrication of an adjustable maxillary stock tray is an easy and cost affordable procedure. Statistical result shows that there is no difference between the impressions with adjustable stock metal tray and conventional stock impression tray. Therefore this adjustable stock tray can be used for making primary impressions of maxillary edentulous arch.

Further long term study is required to check an accuracy of adjustable maxillary stock tray in patient's mouth. Also accuracy of an adjustable tray can be verified by using different primary impression materials.

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