

A Survey on Edentulous Indian Population to Study the Accuracy of Available Edentulous Stock Trays

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ABSTRACT

Background: This study was based on the hypothesis that the commercially available stock trays are not sufficiently standardized. With this, a survey was conducted among the edentulous patients and certain measurements were obtained. The data obtained were correlated with the data obtained by measuring various commercially available stock trays. This had given us an insight to which existing trays are ideal and if not, which corrective measures are to be suggested.

Materials and Method: A total of 100 normal edentulous patients are evaluated to obtain the required measurements from the edentulous maxillary and mandibular ridges.

Result and Conclusion: Within the limitation of the study, from the result obtained, following conclusions were drawn. A. All maxillary edentulous trays – medium and large trays need to be made larger antero-posteriorly from the papilla to posterior palatal seal areas. B. All maxillary edentulous trays – medium and large trays need to be made wider in the inter-stenson's duct area. C. All maxillary edentulous trays - Palatal depth of medium and large trays must be increased to provide ideal space for impression materials except Essago-Germany and Jabbar- India. D. All maxillary edentulous trays - medium and large trays need to be made wider from one hamular notch to the other except GDC- Germany. E. All mandibular trays except large Essago- India trays, need to be made wider from one retromolar pad to the other. F. All mandibular trays except small Essago- India trays need to be made wider laterally near midpoint of the antero-posterior dimensions.

Keywords: Edentulous impression trays, Edentulous stock trays, Tray measurements, Arch measurements.

INTRODUCTION

The requirements of the primary impressions are that they should accurately record clinically relevant landmarks of the edentulous mouth without excessive tissue distortion. They should be

made in rigid stock trays which fit the form of the denture bearing area.

While selecting stock trays for preliminary impressions following criteria should be considered.

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- 5 mm of clearance with soft tissues
- Maxillary trays should extend slightly beyond vibrating line
- Mandibular trays should cover the retromolar pads
- Stock trays come in a variety of designs and sizes. Stock trays can be made of metal (not disposable) or plastic. The plastic trays are intended to be disposable. They have a cross-section characterized by a channel with two normally extending walls so that they will surround the ridge of which an impression is to be formed. The contours of these trays are not anatomical in the sense that they lie in close proximity to the gum area surrounding the ridge, but rather a tray is fabricated which fits within the patient's mouth and loosely surrounds the gum section. The tray is constructed to fit over the general structures of the dental anatomy and constructed in many lengths, widths and varying degree of curvature, and is used to transport and hold in place a substance, often referred to as impression material and which when hardened, creates an accurate negative image of the structures in the mouth.
- This study is based on the hypothesis that the commercially available stock trays are not sufficiently standardized. With this in mind we will be doing a survey among the edentulous patients and certain measurements will be obtained. The data obtained is correlated with the data obtained by measuring various commercially available stock trays. This will give us insight as to which existing trays are ideal and if not which corrective measures are to be suggested.

MATERIALS AND METHOD

Material used:

Vernier caliper, Metallic scale, Indelible pencil, Mouth mirror & probe, Inch tape, Divider and the commercially available dentulous trays GDC-Germany, Essago-

Germany, Jabbar-India, Ecodent-India, Khushboo-India

A total of 100 normal edentulous patients were evaluated to obtain the required measurements from the edentulous maxillary and mandibular ridges. While selecting the patients for the survey, patients with congenital and acquired maxillary & mandibular defects were excluded. This multicentric study was carried out in well renowned dental institutions in and around Bangalore. The trays were divided into small, medium and large based on the measurements obtained from the population. The measurements of edentulous arches were made by the following methods.

a) Maxillary arch (FIGURE -1)

- A midline was drawn over the maxillary ridge passing through the incisive papilla anteriorly and extending along the mid palatine raphe towards the posterior vibrating line of the palate. Distance from the incisive papilla to the posterior vibrating line along the mid line was measured. This line was named papilla-posterior palatal seal line (P-PPS)
- Another line called canine-papilla-canine line

(CPC) was drawn through the midpoint of the incisive papilla perpendicular to midline. The point at which this line bisects the ridge was called 'C' and the C to C distance was measured (C-C).

A mark was made on the ridge opposite to the stenson's duct papilla on either side. This distance was measured and was called "stenson's duct - stenson's duct" (SD-SD)

A thin rod was placed horizontally connecting points SD-SD and with the help of vernier caliper, vertical distance to a point on the mid palatal raphe was measured. This measurement was called palatal depth (PD) (FIGURE 2).

With the help of T burnisher hamular notch was located on either sides and points were located distal to tuberosity behind the ridge crest. The distance between these two points measured and

named as “hamular notch-hamular notch” (HN-HN). Distance from the already marked SD and HN was measured, (SD-HN) on either side.

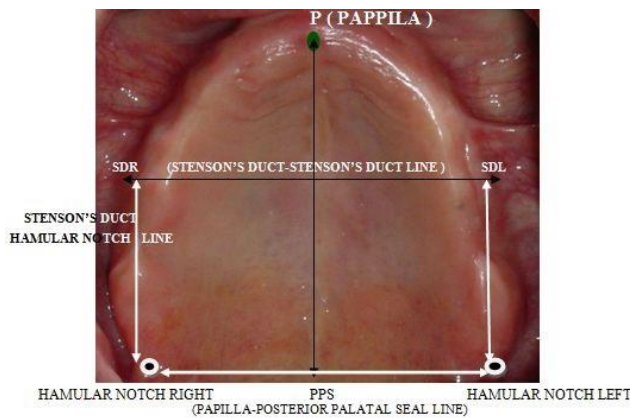
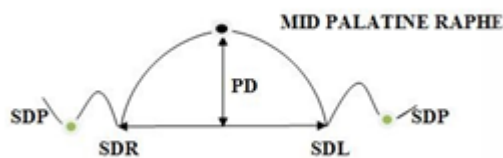


Fig 1: Measurement of maxillary arch



PD- PALATAL DEPTH

SDR-SDL – STENSON'S DUCT LINE

SDP – STENSON'S DUCT PAPILLA

Fig 2: Measurement of palatal depth of maxillary arch

Mandibular arch (FIGURE-3)

- A point was marked on the ridge crest along the midline corresponding to labial and lingual frenum. This point was named as MID-SAGITAL-POINT (MSP)
- On the posterior ends of retro molar pads on either side a point was made along the crest. These points were designated as retro molar pad right (RP-R) and retro molar pad left (RP-L). Distance RP (L)-RP(R) measured. Distances MSP-RP(R) and MSP-RP(L) were also measured. Using these values a triangle was drawn, MSP-RP(R)-RP(L). Midpoint of MSP-RP(L), A and midpoint of MSP-RP(R), B, located and distance A-B measured (FIGURE 4).

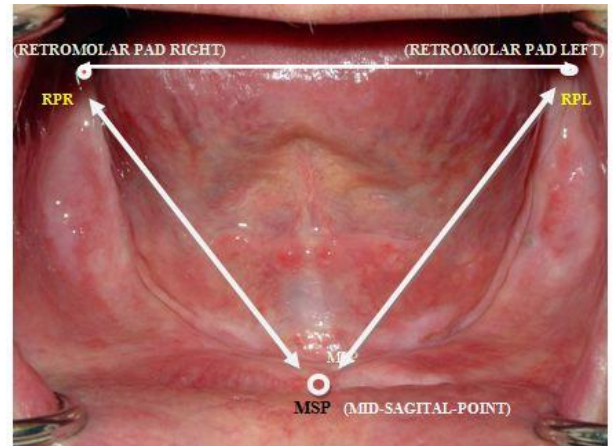


Fig 3: Measurement of mandibular arch

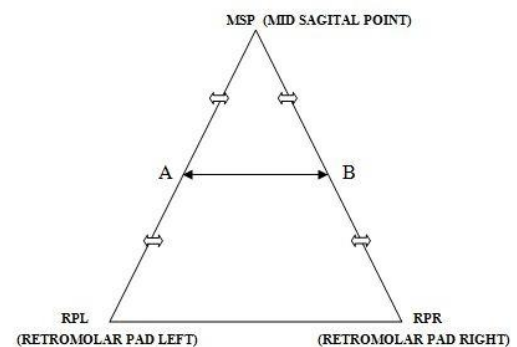


Fig 4: Location of mid values of mandibular arch

TRAYS DIMENSION

MAXILLARY EDENTULOUS TRAY (FIGURE-5), (Figure-6)

- A point P' was marked in the deepest midsagittal portion of anterior section of the tray and a line was extended from P' along the midline to the posterior border of the tray. The distance was measured. (P'-PPS')
- The most posterior end of the tray corresponding to hamular notch area was located (HN') on either side.
- Distance HN'-HN' measured using scale and divider.
- Average HN-SD distance obtained from the patient was used to draw HN'-SD' line on the tray. This line is drawn parallel to P'-PPS'.

this way points SD' is located on the tray on either side. Distance SD'-SD' measured

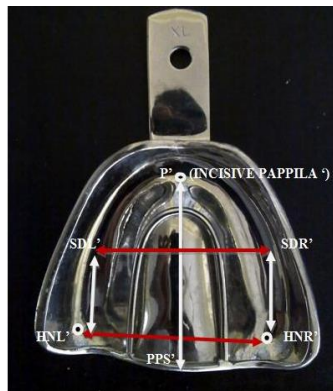


Fig 5: Maxillary edentulous tray

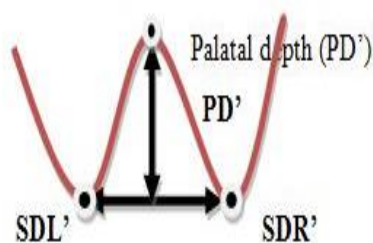


Fig 6: Measurement of palatal depth of the tray

Using SD'-SD' line and after making a perforation in the tray distance PD' was measured.

MANDIBULAR EDENTULOUS TRAY (FIGURE-7)

- A point was made in the deepest midsagittal portion of anterior section of the tray and was designated as (MSP')
- The deepest and midpoint of the of posterior border in the trough of the tray was marked as RP(L)' and RP(R)' on either side. The distance between RP(L)' to RP(R)' was measured with a vernier caliper. Distance RP(L)'-MSP' and RP(R)'-MSP' were also measured. Using these values a triangle was drawn (**FIGURE - 8**), MSP'-RP(R)'-RP(L)', Midpoint of MSP'-RP(L)', A' and midpoint of MSP'-RP(R)', B', located and distance A'-B' measured.

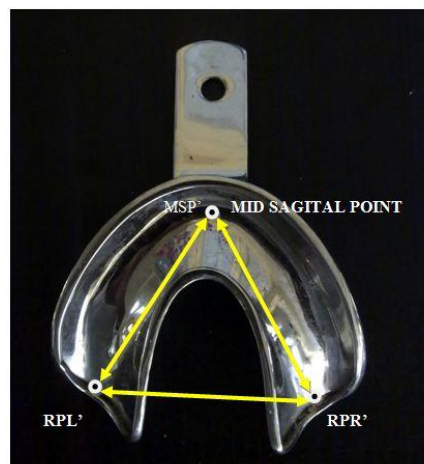


Fig 7: Mandibular edentulous tray

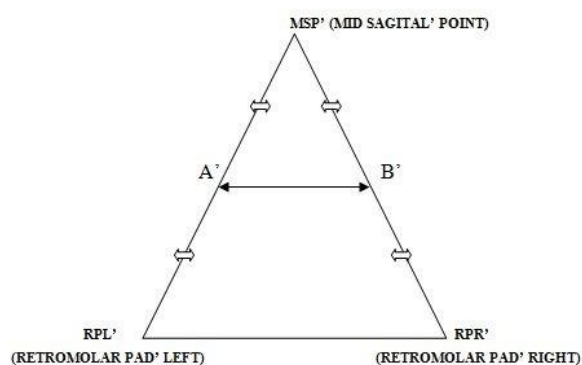


Fig 8: Location of mid values of mandibular edentulous tray

Based on the measurements obtained from the trays and those obtained from the population by way of survey were subjected to statistical analyses using one sample t test. Statistical analysis was made based on the two hypothesis i.e. Null hypothesis and Alternate hypothesis which are as follows:-

Null Hypothesis: There was no significant difference in the mean value of the tray (manufacturer) and the mean value obtained (in the survey) i.e. $\mu_0 = \mu_k$

Alternate Hypothesis: There was a significant difference in the mean value of the tray (manufacturer) and the mean value obtained (in the survey) i.e. $\mu_0 \neq \mu_k$

Table 1: Comparison of mean value of parameter between large size arches and large sized trays- Maxilla.

Parameter	Mean	Std dev	SE of Mean	P-Value				
				GDC	Jabbar	Ecotent	SDS	Bosworth
MIP-PPS	59.44	2.55	0.45	<0.001*	<0.001*	<0.001*	0.003*	<0.001*
M-M	56.06	3.08	0.54	0.001*	0.001*	0.913	0.061	0.001*
HN-HN	55.78	3.33	0.59	<0.001*	0.001*	0.047*	<0.001*	0.005*
M-HN	22.59	2.89	0.51	<0.001*	<0.001*	<0.001*	0.428	<0.001*
PD	22.09	3.08	0.54	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*

Table 2: Comparison of mean value of parameter between large size arches and large sized trays- Mandible.

Parameter	Mean	Std dev	SE of Mean	P-Value				
				GDC	Jabbar	Ecotent	SDS	Bosworth
MIP-PRP ^R	63.51	1.86	0.27	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*
MIP-PRP ^L	63.28	2.27	0.33	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*
PRP ^R -PRP ^L	56.26	3.38	0.49	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*
A-B	28.26	1.70	0.25	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*

Table 3: Comparison of mean value of parameter between medium size arches and medium sized trays- Maxilla.

Parameter	Mean	Std dev	SE of Mean	P-Value				
				GDC	Jabbar	Ecotent	SDS	Bosworth
MIP-PPS	54.19	1.41	0.21	0.360	<0.001*	<0.001*	<0.001*	<0.001*
M-M	54.32	2.99	0.44	0.004*	<0.001*	0.004*	0.467	0.004*
HN-HN	54.40	3.43	0.50	<0.001*	0.003*	0.428	<0.001*	<0.001*
M-HN	21.87	3.24	0.47	0.021*	0.021*	<0.001*	0.784	<0.001*
PD	20.79	2.81	0.41	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*

Table 4: Comparison of mean value of parameter between medium size arches and medium sized trays- Mandible.

Parameter	Mean	Std dev	SE of Mean	P-Value				
				GDC	Jabbar	Ecotent	SDS	Bosworth
MIP-PRP ^R	58.98	1.64	0.26	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*
MIP-PRP ^L	59.28	2.03	0.32	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*
PRP ^R -PRP ^L	54.28	3.62	0.57	<0.001*	0.005*	0.005*	<0.001*	<0.001*
A-B	26.73	2.18	0.34	<0.001*	0.001*	0.001*	<0.001*	<0.001*

RESULTS

This study is based on the hypothesis that the commercially available stock trays are not sufficiently standardized. With this in mind we did a

survey among the edentulous patients and certain measurements were obtained. The data obtained was correlated with the data obtained by measuring various commercially available stock trays

Statistical analysis was made based on the two hypothesis i.e. Null hypothesis and Alternate hypothesis which are as follows:-

Null Hypothesis: There was no significant difference in the mean value of the tray (manufacturer) and the mean value obtained (in the survey) i.e. $\mu_0 = \mu_k$

Alternate Hypothesis: There was a significant difference in the mean value of the tray (manufacturer) and the mean value obtained (in the survey) i.e. $\mu_0 \neq \mu_k$

Level of Significance: $\alpha = 0.05$

Statistical test used: One sample t- test

Decision Criterion: We compare the P-Value with the level of significance. If $P < 0.05$, we reject the null hypothesis and accept the alternate hypothesis. If $P \geq 0.05$, we accept the null hypothesis.

Computations: The tables below give us the various computations and the P-Value.

The mean PD measurement obtained in the survey was found to be significantly different from the mean measurement of GDC ($P < 0.05$), Essago ($P < 0.05$) and Khushboo ($P < 0.01$).

The mean P-PPS measurement obtained in the survey was found to be significantly different from the mean measurement of all the brands ($P < 0.001$).

The mean SDL-SDR measurement obtained in the survey was found to be significantly different from the mean measurement of all the brands ($P < 0.001$).

The mean PD measurement obtained in the survey was found to be significantly different from the mean measurement of all the brands ($P < 0.001$).

The mean HNR-HNL measurement obtained in the survey was found to be significantly different from the mean measurement of Jabbar ($P < 0.01$), Ecodent ($P < 0.001$), Essago ($P < 0.01$) and Khushboo ($P < 0.05$).

The mean P-PPS measurement obtained in the survey was found to be significantly different from the mean measurement of all the brands ($P < 0.001$).

The mean SDL-SDR measurement obtained in the survey was found to be significantly different from

the mean measurement of GDC ($P < 0.001$), Jabbar ($P < 0.001$), Essago ($P < 0.05$) and Khushboo ($P < 0.001$).

The mean PD measurement obtained in the survey was found to be significantly different from the mean measurement of GDC ($P < 0.001$), Essago ($P < 0.05$) and Khushboo ($P < 0.001$).

The mean HNR-HNL measurement obtained in the survey was found to be significantly different from the mean measurement of all the brands ($P < 0.001$).

The mean RPL-RPR measurement obtained in the survey was found to be significantly different from the mean measurement of GDC ($P < 0.05$), Jabbar ($P < 0.001$), Ecodent ($P < 0.001$) and Khushboo ($P < 0.001$).

The mean MSP-RPR measurement obtained in the survey was found to be significantly different from the mean measurement of Essago ($P < 0.05$) and Khushboo ($P < 0.05$).

The mean MSP-RPL measurement obtained in the survey was found to be significantly different from the mean measurement of Jabbar ($P < 0.05$), Ecodent ($P < 0.012$) and Khushboo ($P < 0.01$).

The mean A-B measurement obtained in the survey was found to be significantly different from the mean measurement of GDC ($P < 0.01$), Jabbar ($P < 0.001$), Ecodent ($P < 0.001$) and Khushboo ($P < 0.001$).

The mean RPL-RPR measurement obtained in the survey was found to be significantly different from the mean measurement of GDC ($P < 0.001$), Jabbar ($P < 0.001$), Ecodent ($P < 0.001$), Essago ($P < 0.05$) and Khushboo ($P < 0.001$).

The mean MSP-RPR measurement obtained in the survey was found to be significantly different from the mean measurement of GDC ($P < 0.01$), Jabbar ($P < 0.001$), Ecodent ($P < 0.001$) and Khushboo ($P < 0.001$).

The mean MSP-RPL measurement obtained in the survey was found to be significantly different from the mean measurement of GDC ($P < 0.001$), Jabbar ($P < 0.001$), Ecodent ($P < 0.001$) and Khushboo ($P < 0.001$).

The mean A-B measurement obtained in the survey was found to be significantly different from the mean measurement of GDC ($P<0.001$), Jabbar ($P<0.001$), Ecotent ($P<0.001$), Essago ($P<0.05$) and Khushboo ($P<0.001$).

The mean RPL-RPR measurement obtained in the survey was found to be significantly different from the mean measurement of GDC ($P<0.001$), Jabbar ($P<0.01$), Ecotent ($P<0.001$), Essago ($P<0.001$) and Khushboo ($P<0.001$).

The mean MSP-RPR measurement obtained in the survey was found to be significantly different from the mean measurement of Jabbar ($P<0.01$), Ecotent ($P<0.01$), Essago ($P<0.01$) and Khushboo ($P<0.001$).

The mean MSP-RPL measurement obtained in the survey was found to be significantly different from the mean measurement of Jabbar ($P<0.01$), Ecotent ($P<0.01$), Essago ($P<0.01$) and Khushboo ($P<0.001$).

The mean A-B measurement obtained in the survey was found to be significantly different from the mean measurement of GDC ($P<0.001$), Jabbar ($P<0.01$), Ecotent ($P<0.001$), Essago ($P<0.001$) and Khushboo ($P<0.001$).

DISCUSSION

Based on the hypothesis that commercially available edentulous trays are inadequate in obtaining precise preliminary impressions, a survey of edentulous population was done to study the accuracy of available edentulous stock trays.

A total of 100 subjects were surveyed wherein required measurements were obtained as per the details given in material and methods. In similar way measurements were obtained from the five commercially available trays-GDC-Germany, Jabbar-India, Ecotent-India, Khushboo-India and Essago-Germany.

The data obtained were subjected to statistical analysis using standard mean deviation based on P values.

LARGE SIZED EDENTULOUS TRAYS

The data obtained suggested that P-PPS (Papilla- Posterior palatal seal) values obtained from population were significantly higher than

obtained from large trays (statistically significant difference found, $p<0.001$). This clearly suggested that the trays were short in the posterior palatal seal area and some amount of impression remains unsupported by the tray resulting in inaccuracy.

SDR-SDL (Stenson's duct right-Stenson's duct left) values obtained from the population were found to be much higher than that obtained from the large trays (statistically significant difference found, $p<0.001$) except Ecotent-India. From this we can infer that registration of proper sulcus depth in areas close to Stenson's duct is not adequate and trays must be made wider in these areas.

HNR-HNL (Hamular notch right-Hamular notch left) values revealed that data obtained from population were more than that of Large trays. (Statistically significant difference found, $p<0.005$). From this we can infer that registration of proper sulcus depth in areas close to Hamular notch is not adequate and trays must be made wider in these areas.

The PD (Palatal depth) values obtained from the population were found to be much higher than that obtained from the large trays (statistically significant difference found, $p<0.001$) except Ecotent-India, and Jabbar-India. From this we can infer that palatal depth of trays must be increased in these areas, to provide ideal space for impression materials.

RPR-RPL (Retromolar pad right-Retromolar pad left) values from the population were found to be much higher than that obtained from all the large trays (Statistically significant difference found, $p<0.001$). This clearly suggests that the trays should be designed wider from one retromolar pad to the other.

MSP-RPR AND MSP-RPL (Midsagittal point retromolar pad right and Midsagittal point retromolar pad left) revealed that antero-posterior dimensions of population were more than that obtained from the Large trays (statistically significant difference found, $p<0.001$) except for GDC, Germany. This clearly indicates that trays of Indian origin need to be made with larger antero-posterior dimensions.

The A-B values from the population were found to be much higher than that obtained from all the large trays (Statistically significant difference found, $p < 0.001$). This clearly indicates that trays need to be made wider laterally near midpoint of the antero-posterior dimensions.

MEDIUM SIZED EDENTULOUS TRAYS

The data obtained suggested that P-PPS (Papilla- Posterior palatal seal) values obtained from population were significantly higher than obtained from Medium trays (statistically significant difference found, $p < 0.001$). This clearly suggested that the trays were short in the posterior palatal seal area and some amount of impression remains unsupported by the tray resulting in inaccuracy.

SDR-SDL (Stenson's duct right-Stenson's duct left) values obtained from the population were found to be much higher than that obtained from the Medium trays (statistically significant difference found, $p < 0.001$). From this we can infer that registration of proper sulcus depth in areas close to Stenson's duct is not adequate and trays must be made wider in these areas.

HNR-HNL (Hamular notch right-Hamular notch left) values revealed that data obtained from population were more than that of Medium trays (Statistically significant difference found, $p < 0.005$) except GDC-Germany. From this we can infer that registration of proper sulcus depth in areas close to Hamular notch is not adequate and trays must be made wider in these areas.

The PD (Patatal depth) values obtained from the population were found to be much higher than that obtained from the Medium trays (statistically significant difference found, $p < 0.001$) except Ecotent-India, and Jabbar-India. From this we can infer that that palatal depth of trays must be increased in these areas, to provide ideal space for impression materials.

RPR-RPL (Retromolar pad right-Retromolar pad left) values from the population were found to be much higher than that obtained from all the Medium trays (Statistically significant difference found, $p < 0.001$). This clearly suggests

that the trays should be designed wider from one retromolar pad to the other.

MSP-RPR AND MSP- RPL (Midsagittal point retromolar pad right and Midsagittal point retromolar pad left) revealed that antero-posterior dimensions of population were more than that obtained from the Medium trays (statistically significant difference found, $p < 0.001$) except for Essago, Germany. This clearly indicates that trays of Indian origin need to be made with larger antero-posterior dimensions.

The A-B values from the population were found to be much higher than that obtained from all the Medium trays (Statistically significant difference found, $p < 0.001$). This clearly indicates that trays need to be made wider laterally near midpoint of the antero-posterior dimensions.

SMALL SIZED EDENTULOUS TRAYS

The PD (Patatal depth) values obtained from the population were found to be much higher than that obtained from the Small trays (statistically significant difference found, $p < 0.001$) except Ecotent-India, and Jabbar-India. From this we can infer that palatal depth of trays must be increased in these areas, to provide ideal space for impression materials.

RPR-RPL (Retromolar pad right-Retromolar pad left) values from the population were found to be much higher than that obtained from all the Small trays (Statistically significant difference found, $p < 0.001$) except Essago-Germany. This clearly suggests that the trays should be designed wider from one retromolar pad to the other.

MSP-RPR AND MSP- RPL (Midsagittal point retromolar pad right and Midsagittal point retromolar pad left) revealed that antero-posterior dimensions of population were more than that obtained from the Small trays (statistically significant difference found, $p < 0.001$) except for GDC-Germany, Jabbar-India and Ecotent-India. This clearly indicates that trays of Indian origin need to be made with larger antero-posterior dimensions.

The A-B values from the population were found to be much higher than that obtained from all the Small trays (Statistically significant difference found, $p < 0.001$) except Essago-Germany. This

clearly indicates that trays need to be made wider laterally near midpoint of the antero-posterior dimensions.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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