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Intercompany Comparison Of Prefabricated Arch Forms In Different Malocclusion Groups In Himachali Population

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Abstract
Introduction: Purpose of this study is to perform intercompany(Dentsply, Modern, Orthotech, Rabbit force) comparisonfor goodness of fit of preformed 0.016" stainless steel Standard and Euroformarch form at three transverse dimensions.
Material and Method: Sample consisted of 75 pretreated mandibularcasts of patientof age group 12 to 20 years of Himachali ethnic origin. They were divided into 3 groups: Group 1- Angles Class I (n - 25), Group 2- Angles Class II Div I (n- 25), and Group 3- Angles Class II Div 2 (n- 25).The occlusal photographs of mandibular cast were taken with a digital camera Nikon D- 40. With the help of Image J software, the dimensions of the dental arches were determined transversely (Intercaninewidth, MeanIntermolar width and Posterior Intermolar width) and saggitally(Canine depth, Mean arch length andTotal length). With the help of these dimensions, graphs were plotted and goodness of fit of arch forms was studied at transverse dimensions.
Results: Closeness of fit sequence for standard form is Orthotech>Dentsply> Modern> Rabbit force at Intercanine and MeanIntermolar widthforallmalocclusion groups. For Euroform results were not consistent.
Conclusion: So we conclude that no company can be said to have best fit as results vary at three transverse dimensions for all groups.

Key Words
Standard, Euroform, Intercanine width, Intermolar width.1.

Introduction

The size and shape of the arches have considerable implications in orthodontic diagnosis and treatment planning, affecting the space available, dental aesthetics, and stability of the dentition[1-2]. The use of preformed arch wires is widespread in orthodontics. Identification of the dental arch form of the orthodontic patient is an important parameter in achieving a stable, functional, and esthetic dentition. Failure to customize preformed arch wires with the patient's arch form might increase the probability of relapse and lead to an unnatural smile[3].

Technological advances in materials, with the use of new arch wires and appliances, have certainly enabled to obtain achievement of rapid results during phase of alignment and leveling between arches[4]. Improperly formed arch wires create and contribute too many post treatment problems. Unplanned contraction or expansion, especially in the cuspid or molar region, produces instability. Correct cuspid or molar width should be determined and decided upon as an integral part of the diagnostic procedure and once these widths have been established, they should be maintained throughout treatment. This will prevent unnecessary movement of the teeth which is undesirable and could cause tissue damage. Maintaining symmetry is very important in forming archwires. Asymmetrical wires leave the anterior or buccal segments out of harmony and make midline deflections difficult to correct[5].

The mandibular dental arch is considered as major reference element of diagnosis and therapy in dentofacial orthopedics[6]. According to Braun and Legan[7], the stability of the form and dimensions of mandibular dental arch is a factor of stability of therapeutic results. The process of individualizing arch forms from the original mandibular arch has become popular[8-9]. Various studies have used normal, untreated study casts for determining arch form mathematically or for characterizing arch form through various measurements, with incisal edges, cusp tips and molars cusps as landmarks[10].

Boone has suggested that the individuality of a patient's arch form and dimensions must be recognized and respected if a successful treatment outcome is to be achieved[11]. Many believe that arch form and size are unique for each individual and are principally controlled by the form of the basal bones[12]. Arch form and size should be recognized as part of a morphologic human pattern[13-15]. With these considerations in mind, an investigation is undertaken to evaluate the mandibular dental arch form and prefabricated stainless steel arch forms.

Arch wires are vital and active part of

Fig 1A

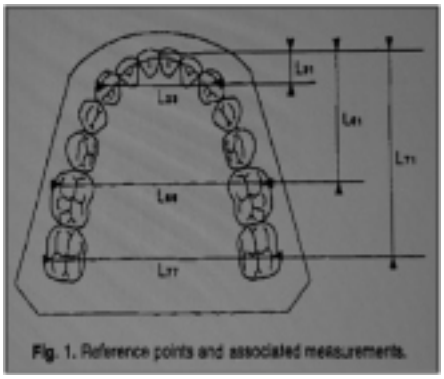


Fig - 1B

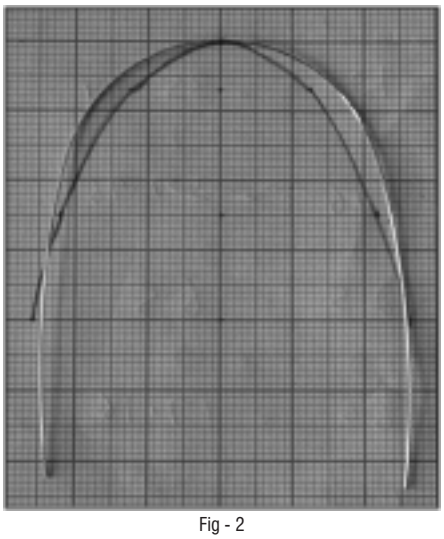


Fig - 2

orthodontic appliance. They store and deliver power through brackets and bands, to teeth and surrounding tissues[5]. Today in the era of competition and limited time availability among people prefabricated arch wires has become popular among orthodontist to save time and also not compromising treatment results. Commercially two forms of Stainless steel arch forms (Euro form, Standard/ Trueform/ Natural) are marketed commonly by most Companies (Dentsply, Modern, Orthotech, Rabbit force).

So the primary objective of this study is to do intercompany comparisons of 4 companies (Dentsply, Modern, Orthotech, Rabbit force) for goodness of fit of 0.016" stainless steel Standard and Euroform arch form at three transverse dimensions in Himachali ethnic population and second objective is to compare whether there is difference in use of Standard or Euroform for different malocclusion groups.

Material And Method

This study was conducted in the Department of Orthodontics, Himachal Dental College, Sundernagar. Sample consisted of 75 pretreated mandibular casts of patient of age group 12 to 20 years of Himachali ethnic origin was taken.

They were divided into 3 groups-

- Group 1- Angles Class I (n - 25)
- Group 2- Angles Class II Div I (n - 25)
- Group 3- Angles ClassII Div 2 (n - 25)

All the casts met the following inclusion criteria-

(1) Angle's dental Class I, II div 1 and III malocclusions.
(2) Permanent dentition with normal tooth size and shape
(3) 3-mm or less arch length discrepancy.
(4) Clinically acceptable symmetry of mandibular dental arch.

The occlusal photographs of mandibular cast were taken with a digital camera Nikon D-40 macrolens (Nikon corporation, Tokyo, Japan). Camera was mounted on tripod stand and photographs were taken according to the method described by Naif Almasoud and David Bearn[16]. According to this method photographs were taken parallel to long axis of Incisors teeth (Perpendicular position 90) considering the ideal projection. This ideal projection shows the labial and lingual surfaces of the anterior teeth**(Fig 1a)**

The image was then imported into the Image J software. Saggital and transverse measurements of mandibular dental arches were done from the casts using this software. They were taken from the following reproducible reference points: the midincisal edge (Buccal Side), the canine cusp tips, mesiobuccal cusp tips of first molars and the distobuccal cusp tips of second molar. These points constitute the landmarks of mandibular dental arch form. They define the breaking points of the arch and limit sectors on which different muscle groups have an action. The precision gained by the use of other points would be minimal because of the strong correlations observed between the different measurements taken from these points. Dimensions of the dental arches were determined according to the three saggital and three transverse measurements[9] **(Fig 1b)**

Arch breadth was evaluated from[4](Fig 1b)

1) Intercanine width - Canine cusp tips(L_{33})
2) Mean Intermolar width - Between mesiobuccal cusp of first molars (L_{66})
3) Posterior Intermolar width - Between distobuccal cusp of 2nd molar (L_{77})

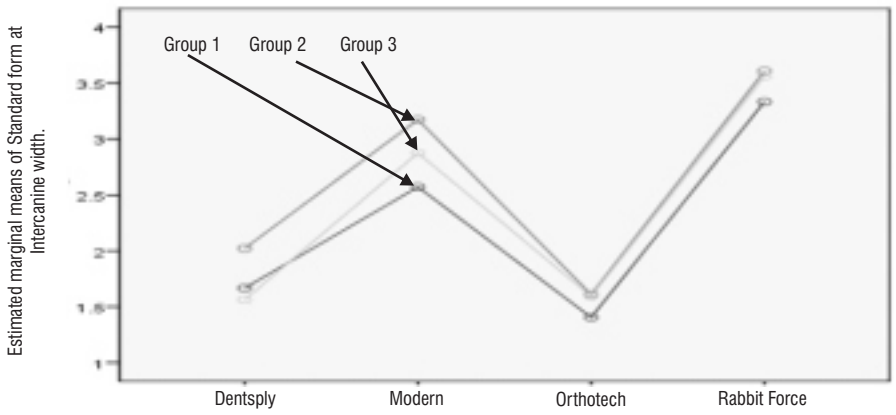
Arch length was evaluated from[4] (Fig 1b)

1) Canine depth - Arrow of the anterior curve(L_{31})
2) Mean arch length - From the incisal edge to the line joining the mesiobuccal Canines of first molars(L_{61})
3) Total Length - Incisal edge to line joining the disto buccal cusp of the second molars. (L_{71})

These measurements were used to prepare graphs **(Fig 2)**. Graphs were plotted with these six measurements. On graphs prefabricated arch forms 0.016" Stainless steel were superimposed and goodness of fit of Standard and Euroform of four companies (Dentsply, Modern, Orthotech, Rabbit force) were measured at Intercanine width, Mean Intermolar width, Posterior Intermolar width on plotted graphs for different malocclusion groups studied.

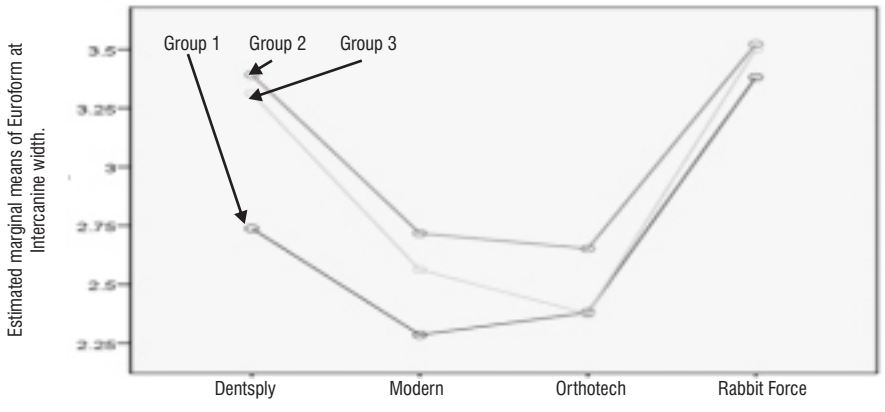
Result

GRAPH 1:
Graph of estimated marginal means of closeness of fit of Standard form arch wire at Intercanine width for different malocclusion groups shows:



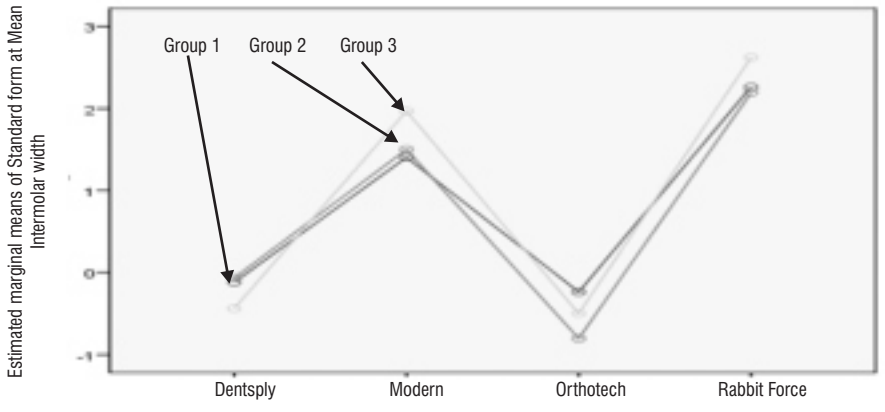
Group 1 - Orthotech > Dentsply > Modern> Rabbit force
Group 2 - Orthotech > Dentsply > Modern> Rabbit force
Group 3 - Orthotech > Dentsply > Modern> Rabbit force

GRAPH 2:
Graph of Estimated marginal means of closeness of fit of Euroform arch wire at Intercanine width for different malooclusion groups shows:



Group 1 - Modern > Orthotech > Dentsply> Rabbit force
Group 2 - Orthotech > Modern > Dentsply > Rabbit force
Group 3 - Orthotech > Modern > Dentsply > Rabbit force

GRAPH 3:
Graph of Estimated marginal means of closeness of fit of Standard form arch wire at Mean Intermolar width for different malooclusion groups shows:



Group 1 - Orthotech > Dentsply > Modern> Rabbit force
Group 2 - Orthotech > Dentsply > Modern> Rabbit force
Group 3 - Orthotech > Dentsply > Modern> Rabbit force

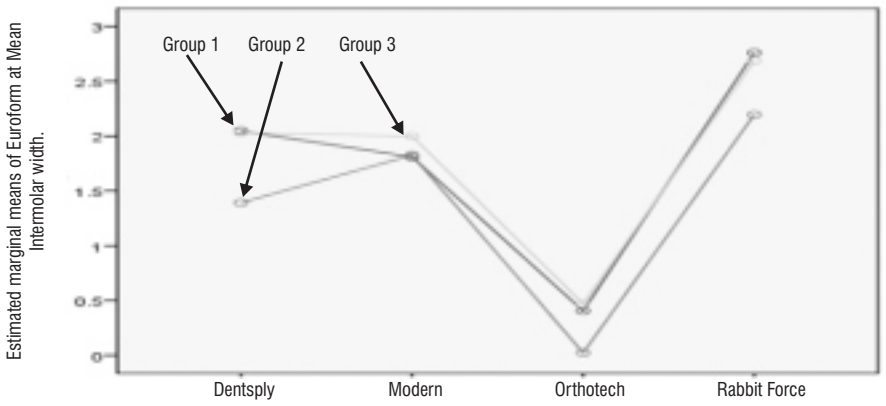
Discussion

Since the time of Edward Angle, orthodontists have tried to determine the ideal arch form or "true line of occlusion". Many different solutions to this problem have been proposed, but few have stood the test of time[1]. As the use of super elastic and preformed stainless steel arch wires becomes common among orthodontists aiming to achieve optimal alignment of dental arches, the identification of the patient's dental arch form is an important parameter in achieving a stable, functional, and esthetic dentition[17,20]

The results of this study tend to support previous findings suggesting that there is no single, universal, ideal arch form applicable to all cases[18]. Biologic variability appears to be so great that even in a sample of untreated normal cases, no predominant arch form could be identified1. So the primary objective of this study was to do intercompany comparison to know whether there is any company differences in dimensions of prefabricated arch forms i. e. (Standard / Euroform) for different malocclusion groups and secondary objective was to compare Standard form with Euroform. The difference in dimensions of prefabricated arch forms i.e. (Standard / Euroform) of different companies for different malocclusion groups are as follows:

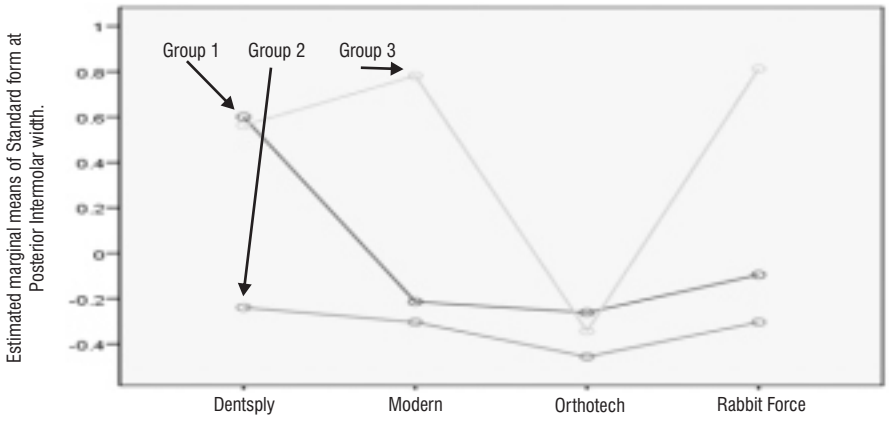
1. For Standard Arch form **(Graph 1,3&5)** result showed that closeness of fit sequence is Orthotech > Dentsply > Modern > Rabbit force at Intercanine width and at Mean Intermolar width showing Standard arch form is narrow in anterior and molar region for Orthotech and wider in anterior and molar region for Rabbit force in all malocclusion groups. This is in accordance with the study conducted by Felton et al1 who reported that there was a little difference between arch forms of Class 1 and Class II malocclusion groups. Our results were also supported by the study conducted by Nojima et al[19] who stated that Class I arches were deeper than the Class II arches with little difference in arch width between the two ethnic groups.
2. The closeness of fit sequence at Posterior Intermolar width was not consistent for all malocclusion groups for Standard form.
3. For Euroform result showed that

GRAPH 4:
Graph of Estimated marginal means of closeness of fit of Euro form arch wire at Mean Intermolar width for different malocclusion groups shows:



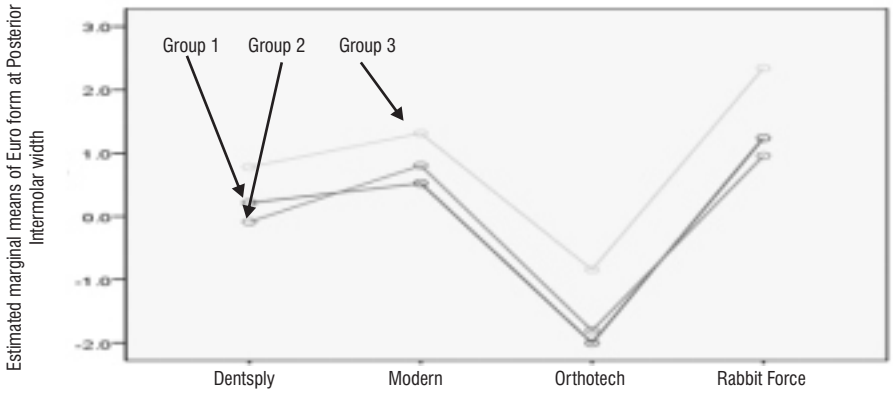
Group 1 - Orthotech > Modern > Dentsply > Rabbit force.
Group 2 - Orthotech > Dentsply > Modern > Rabbit force.
Group 3 - Orthotech > Modern > Dentsply > Rabbit force.

GRAPH 5:
Graph of estimated marginal means of closeness of fit of Standard form arch wire at Posterior Inter molar width for different malocclusion groups shows:



Group 1 - Rabbit force > Modern > Orthotech > Dentsply
Group 2 - Dentsply > Modern > Rabbit force > Orthotech
Group 3 - Orthotech > Dentsply > Modern > Rabbit force

GRAPH 6:
Graph of estimated marginal means of closeness of fit of Euro form arch wire at Posterior Intermolar width for different malocclusion groups shows



Group 1 - Dentsply > Modern > Rabbit force > Orthotech
Group 2 - Dentsply > Modern > Rabbit force > Orthotech
Group 3 - Orthotech > Modern > Dentsply > Rabbit force

closeness of fit sequence does not match at Intercanine width, Mean Intermolar width and Posterior Intermolar width for all three groups.

Our result **(Table 1)** showed that there was no differences between Standard and Euroform for Group 1, Group 2 and Group 3 for Rabbit force Company as significant values come for all. For Dentsply significant values came for all except in Group 1 at 1st Mean Inter molar width. For Modern result are significant for all except in Group 2 at Mean Intermolar width. For Orthotech Results are significant for all except in Group 1 at Mean and Posterior Inter molar width in Group 2 at Mean Intermolar width and for Group 3 at Mean Intermolar width. So these values are consistent with our result as Orthotech had best fit for Standard forms for all three groups in Intercanine and Mean Intermolar width and Rabbit force has poorest fit. So the results of our study is in favour of the study conducted by Yossi et al[20] analysis of Israeli sample indicated that, as malocclusion shifts from Class III through Class I to Class II , the weight of arch form tends to shift from square and ovoid to ovoid and tapered. This clearly indicates that interarch relationship affect mandibular arch forms. This is also supported by Braun et al[21] stated in their report on differences in arch dimensions between Angles classes that the Class II mandibular arches exhibited generalized reduced arch width and depth compared with the Class I arches. As studies are lacking in this field, so further studies are awaited to come to a final conclusion whether there is any intercompany variation in closeness of fit of arch forms for different malocclusion groups.

Conclusion

The following conclusions were drawn from this study :

1. For Standard Arch form **(Graph 1, 3 & 5)** result showed that closeness of fit sequence is Orthotech > Dentsply > Modern >Rabbit force at Intercanine width and at Mean Intermolar in all malocclusion groups , at Posterior Intermolar width sequence is not consistent for all malocclusion groups.
2. For Euroform result showed that closeness of fit sequence does not match at Intercanine width, Mean Intermolar width and Posterior Intermolar width for all three groups.

Table 1 shows Paired correlation coefficient between Standard form and Euroform of different companies when superimposed on graphs at Intercanine width, Mean Intermolar width, Posterior Intermolar width. Result shown for different company's are-

1.	Dentsply	:	Results are significant for all except in Group 1 at Mean Inter molar width.
2.	Modern	:	Results are significant for all except in Group 2 at Mean Intermolar width.
3.	Orthotech	:	Results are significant for all except in Group 1 at Mean and Posterior molar width in Group 2 at Mean Intermolar width and for Group 3 at Mean Intermolar width.
4.	Rabbit Force (Libral)	:	Results are significant for all.

TABLE 1 Shows Paired Samples Correlations coefficient test between Standard and Euroform of different companies for different malocclusion groups

Paired Samples Correlations						
	Malocclusion	Arch forms		N	Correlation	Sig.
Dentsply	Group 1	Pair 1	STD ICW & EURO ICW	25	0.732	0.000
		Pair 2	STD MIMW & EURO MIMW	25	0.357	0.112*
		Pair 3	STD PIMW & EURO PIMW	25	0.645	0.002
	Group 2	Pair 1	STD ICW & EURO ICW	25	0.861	0.000
		Pair 2	STD MIMW & EURO MIMW	25	0.549	0.005
		Pair 3	STD PIMW & EURO PIMW	25	0.872	0.000
	Group 3	Pair 1	STD ICW & EURO ICW	25	0.860	0.000
		Pair 2	STD MIMW & EURO MIMW	25	0.563	0.023
		Pair 3	STD PIMW & EURO PIMW	25	0.820	0.000
Modern	Group 1	Pair 1	STD ICW & EURO ICW	25	0.837	0.000
		Pair 2	STD MIMW & EURO MIMW	25	0.732	0.000
		Pair 3	STD PIMW & EURO PIMW	25	0.888	0.000
	Group 2	Pair 1	STD ICW & EURO ICW	25	0.941	0.000
		Pair 2	STD MIMW & EURO MIMW	25	0.451	0.065*
		Pair 3	STD PIMW & EURO PIMW	25	0.923	0.000
	Group 3	Pair 1	STD ICW & EURO ICW	25	0.968	0.000
		Pair 2	STD MIMW & EURO MIMW	25	0.702	0.002
		Pair 3	STD PIMW & EURO PIMW	25	0.951	0.000
Orthotech	Group 1	Pair 1	STD ICW & EURO ICW	25	0.878	0.000
		Pair 2	STD MIMW & EURO MIMW	25	-0.145	0.520*
		Pair 3	STD PIMW & EURO PIMW	25	0.222	0.320*
	Group 2	Pair 1	STD ICW & EURO ICW	25	0.604	0.002
		Pair 2	STD MIMW & EURO MIMW	25	0.337	0.108*
		Pair 3	STD PIMW & EURO PIMW	25	0.611	0.002
	Group 3	Pair 1	STD ICW & EURO ICW	25	0.839	0.000
		Pair 2	STD MIMW & EURO MIMW	25	0.507	0.065*
		Pair 3	STD PIMW & EURO PIMW	25	0.620	0.010
Rabbit Force	Group 1	Pair 1	STD ICW & EURO ICW	25	0.889	0.000
		Pair 2	STD MIMW & EURO MIMW	25	0.636	0.001
		Pair 3	STD PIMW & EURO PIMW	25	0.887	0.000
	Group 2	Pair 1	STD ICW & EURO ICW	25	0.988	0.000
		Pair 2	STD MIMW & EURO MIMW	25	0.619	0.001
		Pair 3	STD PIMW & EURO PIMW	25	0.810	0.000
	Group 3	Pair 1	STD ICW & EURO ICW	25	0.975	0.000
		Pair 2	STD MIMW & EURO MIMW	25	0.908	0.000
		Pair 3	STD PIMW & EURO PIMW	25	0.944	0.000

STD - Standard form; Euro- Euroform P < .01(Significant) P > .05* (Not Significant); Chi Square Test; ICW- Intercanine width; MIMW- Mean Intermolar width; PIMW - Posterior Intermolar width.

So we conclude that no company can be said to have best fit as results vary for both Standard and Euroform at three transverse dimensions for all groups.

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