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'Correlation of Transverse Facial Dimension in Vertical Facial Morphology- True Size Frontal Face Photographic Study'

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Abstract
Background*: Dental photography in the recent times has become a forerunner in diagnosis and treatment planning due to its low cost and less technique sensitivity. The importance of clinical photography in orthodontics mainly focuses on facial esthetics.*
Materials and methods*: In this cross sectional study,true size frontal face photograph was taken for 180 subjects of aged 17 to 30 years with different growth pattern which was defined by Jarabak ratio and GoGn to Sn angle in normodivergent,hypodivergent and hyperdivergent group. Various transverse facial dimensions were measured in adobe Photoshop software CS3 version 10.*
Results: *Data was analyzed using SPSS version 23,One way ANOVA for Intergroup comparison showedIntercanthaldistance, outercanthal distance,intercommisural distance,intergonial distance,'N-Gn'(anterior facial height), Facial index and Bizygomatic width was highly significant (p <0.001) while internasal distance was statisticallysignificant (p≤ 0.047). post hoc LSD test showed that normodivergent growth pattern had no sexual dimorphism, hypo divergent growth pattern showed that males had greater internasal distance and females had greater intercanthal ,intercommisural distance which was statistically significant . In Hyperdivergent growth pattern , females had higher intercanthal, outercanthal, intercommisural, intergonial distance, males had greaterinternasal and facial index which was statistically significant whereas N'-Gn' and bizygomatic width was nonsignificant among gender.*
Conclusion: *Transverse facial dimensions in vertical facial morphology revealed thatHyperdivergent had more Outercanthal distance, intergonial distance, N'-Gn' (Facial height), facial index and bizygomatic width. Normodivergent had more intercanthal distance and intercommisural distance. Hypodivergent had more internasal distance.Normodivergent growth pattern had no sexual dimorphism. Hypodivergentand hyperdivergent growth pattern had sexual dimorphism.*
Key words*: transverse facial dimensions, growth pattern, photograph.*

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I. Introduction

Facial morphology is unique to every individual in the world, no one is similar with the other in any way. The proportional relationship between facial height and width is the first step in facial evaluation during orthodontic diagnosis. The facial pattern of an individual can be taken into consideration as an important factor that aids in the treatment selection and protocol.

Although facial proportions, angles and contours vary with age, and race, one wonders if there are any differences between male and female. Digital photography has multilevel significance and represents a synonym of contemporary dentistry as it is simple, fast, cost effective, less technique sensitive and utterly useful in documenting procedures of work, pursuing clinical investigations and also, the paradigm shifting towards soft tissue had elevated the status of photography in orthodontic field. True size frontal face photography is one of the reliable tool to analyze soft tissue of facial dimensions and proportions. A good knowledge of digital photography can help a clinician to a far greater extent than he can imagine.

Hence in orthodontics, correlation of transverse facial dimension with vertical facial morphology in untreated adults to investigate gender differences for proper diagnosis and treatment planning accompanied byfacial configuration of an individual should have to be taken into consideration as an important factor that aids in the treatment selection, biomechanical consideration and stability of treatment outcome.

II. Material and methods:

The present cross sectional study was carried out in the Department of Orthodontics and DentofacialOrthopedics, Government Dental College & Hospital, Ahmedabad. It was approved by the ethical committee. 180 subjects (17-25 years) from Government Dental College were selected for the study.

Selection Criteria:

Inclusion criteria:

- Age group of the selected subjects in the range of 17-25 years (Mean age – 21.5 years)
- Subjects with CVMI stage 6 (Hassel and Farman method completion of growth).
- No previous history of orthodontic treatment, surgery, trauma.
- No apparent facial asymmetry.
- All permanent teeth should be present except third molars.
- Maxillo-Mandibular skeletal pattern in vertical relation defining average, hypodivergent and hyperdivergent jaw relationship was selected according to Jarabak's ratio and GoGn to SN.

Exclusion criteria:

- Missing or supernumerary teeth.
- TMJ disorder, muscle dysfunction and presence of unilateral chewing.
- Any other systematic disturbances.
- Any other oral destructive habits, habit of bruxism & presence of attrition.
- Presence of any developmental dental anomalies, dental caries and restorations.

Cephalometric study

For all the subjects, standardized lateral cephalometric radiographsweretakenincentricocclusionwithlipsinrelaxed and the Frankfort plane oriented horizontally according to Natural Head Position (NHP) to classify samples. The digital cephalometric tracing was done using FACAD orthodontic tracing software version3.11.
180 subjects were found to meet the criteria for sampling from the cephalometric tracing.

Cephalometric Parameters

Anterior facial height(N-Me)
Posterior facial height(S-Gn)
Jarabak's ratio = Posterior facial height (S-Go) x 100 Anterior facial height(N-Me)
Go-Gn to SN

Sample size:

GROUP		GoGn toSN	Jarabak's Ratio	TOTAL	SUBGROUPS
A	Average	32±4°	62-65%	60	A1= 30 males A2=30 females
B	Hypo divergent	<28°	>65%	60	B1=30 males B2=30 females
C	Hyper divergent	>36°	<62%	60	C1=30 males C2=30 females

FRONTAL FACE PHOTOGRAPHY

Same 180 subjects were subsequently chosen for True size frontal facial photography

ARMAMENTARIUM FOR FULL FACE FRONTAL PHOTOGRAPHY:

- Drafter.
- Nikon camera with macrolens of 100mm
- Studio photo light
- Tripod
- Adobe photoshope software CS3 VERSION 10.0.

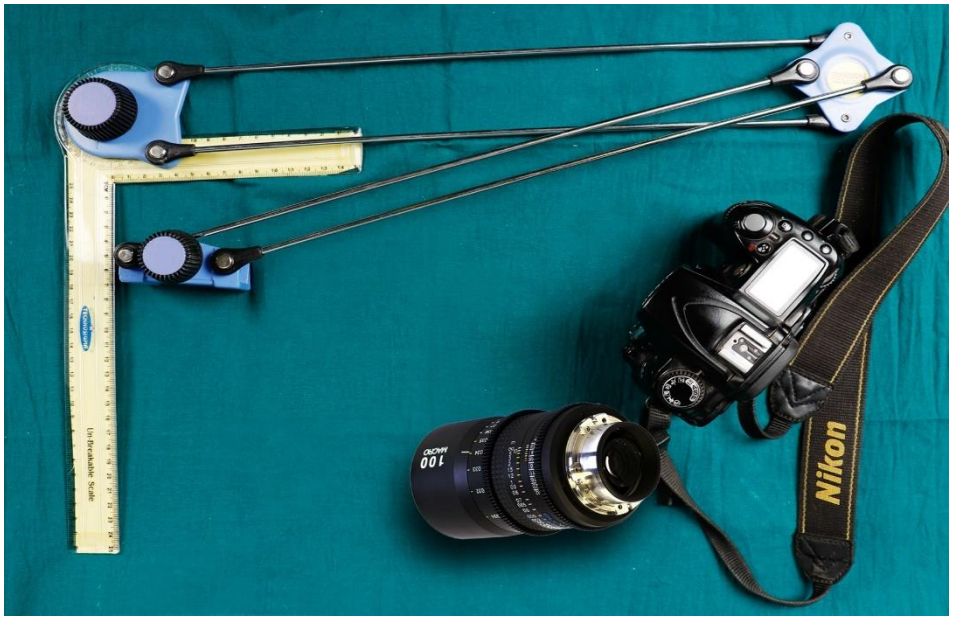
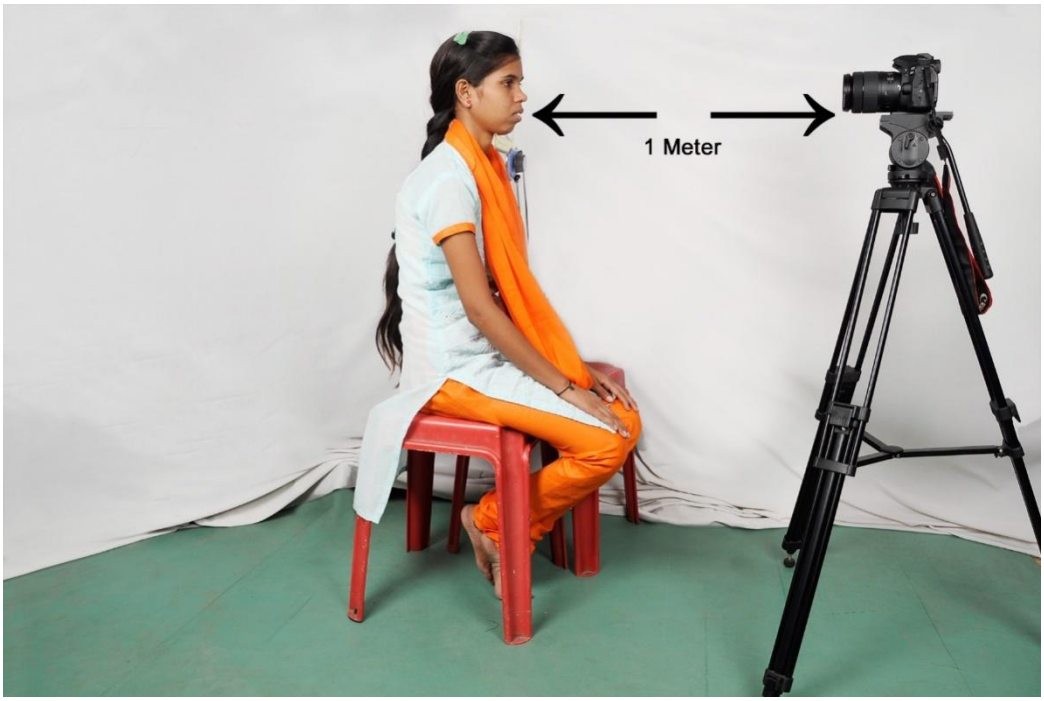


Figure shows armamentarium of photographic study

Things taken care of

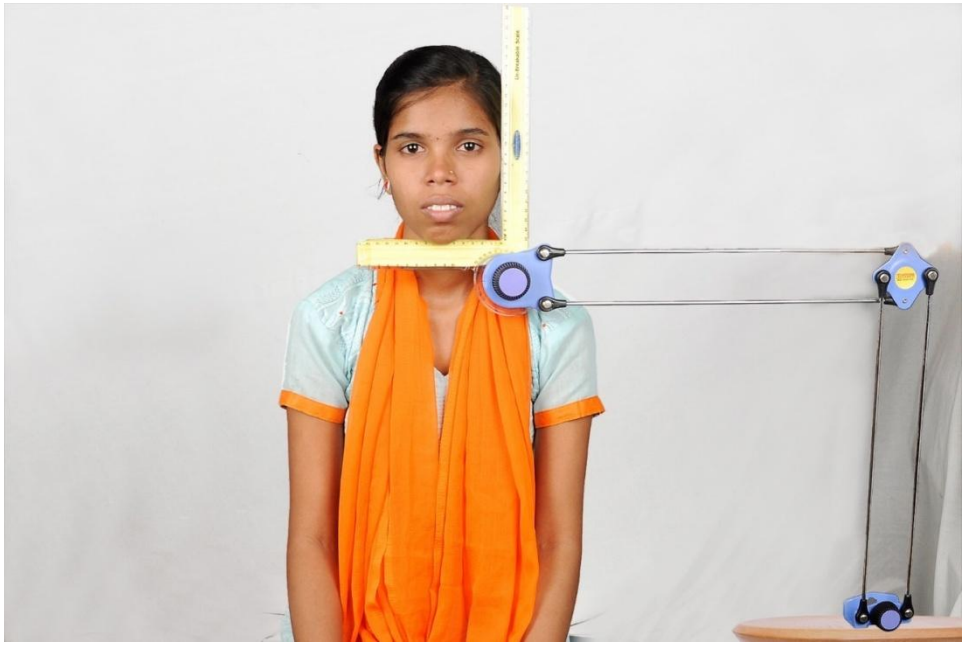
-Portrait view with the frame extending to just above the top of head and lower frame line around the larynx.
- Photograph should be symmetrical with the inter-pupillary line parallel to floor
- A focusing screen with grid is very useful
- Patient assumes a natural head position and looks straight ahead into the camera.
- Camera position middle of the face and in portrait format.
- Space should be left on all sides of the photograph.
- Light should come diagonally from the front, leaving the patient shadow out of view of the camera.
-Male subjects without moustache and female subjects without make up.



Figureshows position of patient and camera during true size frontal photography

The digital camera (NIKON) mounted with the lens (EF 100mm, 100 Macro Lens, shutter speed 1/200, ISO-100 and aperture (f= 25) flash was used for all photographic records. It was secured on a tripod for stabilization and adjustment according to the subject's height. Magnification was set at 1:10 with distance fixed

at 1 meter from Reid's horizontal plane to camera lens. The 100-mm macro lens was chosen to avoid facial deformations and maintain natural proportions. The camera was used in its manual position to achieve maximum image quality given the local lighting condition. Studio light was used for illumination. A drafter wasparallel to midsagittal and Reid's horizontal plane (Reid's horizontal plane passes through the outer cantus of the eye and the superior attachment of the ear).



Figureshows position of patient and drafter (Technosigmaminidrafter) during frontal facial photography.

The true size frontal photos obtained was processed in Adobe Photoshope software version 10 and grid (1cm x 1cm) was incorporated and integrated according to drafter which is parallel to Reid's horizontal plane and mid sagittal plane. Adjustment of approximately 5% zoom in or zoom out was done to obtain 1:1 true size photograph. All measurements were taken using Adobe photoshope software CS3 version 10.0.
Following are soft tissue photographic landmarks given by *PeerasakChortrakarnkij, Daniel Lonic, Hsiu-Hsia Lin, and Lun-Jou Lo (2016)*were used in the present study:

- Exocanthion Ex L and Ex R Soft tissue point located at the outer commissure of each eye fissure
- Endocanthion En L and En R Soft tissue point at which the inner ends of each upper and lower eyelid meet
- ZygionZy L and Zy R Most lateral soft tissue point on the soft tissue contour of each zygomatic arch, located at the level of the 3D hard tissue cephalometriczygion landmark
- Alar curvature Ac L and Ac R Soft tissue point located at the facial insertion of each alar base
- CheilionCh L and Ch R Point located at each labial commissure
- Gonion Go L and Go R Most lateral point on the soft tissue contour of each mandibular angle, located at the same level as the 3D hard tissue cephalometricgonion landmark.
- Nasion N' Midpoint on the soft tissue contour of the base of the nasal root at the level of the frontonasal suture.
- GnathionGn' soft tissue point at the intersection of facial and mandibular plane.

Figureshows soft Figure shows trueFigure shows true size frontal tissue anatomic landmarks size frontal photo with points vertical and horizontal line.
with collabrated grid.

PARAMETERS FOR PHOTOGRAPHIC ANALYSIS:

Inter canthal distance (En L- En R)
Outer canthal distance (Ex L- Ex R)
Bi zygomatic width (Zy L-Zy R)
Inter nasal distance (Ac L-Ac R)
Inter commisural distance (Ch L-Ch R)
Intergonial distance (GoL-GoR)
N'-Gn'(Facial height)
Facial index= morphological facial height (N'-Gn') x 100 bi zygomatic width(ZyL- ZyR)

III. Result

The statistical methods that were used in the present study- Mean, Standard deviation, Standard error, P value, One way ANOVA, Independent "t" test, CHI-SQUARE TEST and Post hoc tuckey test (LSD)

Table no 1: Intragroup comparison of various cephalometric parameters in vertical facialmorphology groups according to gender

Group	Parameter	Gender	N	Mean	Std. Deviation	Std. Error Mean	Mean Difference	P value
Hypo	Nme	Male	30	109.40	5.531	1.010	10.633	<0.001**
		Female	30	98.77	2.861	.522		
	Sgo	Male	30	76.500	4.4237	.8077	7.3333	<0.001**
		Female	30	69.167	2.6792	.4892		
	JR	Male	30	71.5203	2.73108	.49862	1.25467	0.066 NS
		Female	30	70.2657	2.45458	.44814		
	GOGNSN	Male	30	25.767	3.0477	.5564	.9000	0.195 NS
		Female	30	24.867	2.2087	.4032		
Normo	Nme	Male	30	106.03	3.499	.639	3.447	0.003*
		Female	30	102.59	4.866	.904		
	Sgo	Male	30	65.700	3.3130	.6049	.3000	0.690 NS
		Female	30	65.400	2.4155	.4410		
	JR	Male	30	62.9900	1.24273	.22689	-.69333	0.024*
		Female	30	63.6833	1.07128	.19559		
	GOGNSN	Male	30	29.667	2.2944	.4189	-1.4000	0.051 NS
		Female	30	31.067	3.0843	.5631		
Hyper	Nme	Male	30	110.00	2.639	.482	0.000	1 NS
		Female	30	110.00	2.639	.482		
	Sgo	Male	30	58.067	2.8154	.5140	0.0000	1 NS
		Female	30	58.067	2.8154	.5140		
	JR	Male	30	56.0600	2.33025	.42544	.00000	1 NS
		Female	30	56.0600	2.33025	.42544		
	GOGNSN	Male	30	35.467	1.7367	.3171	0.0000	1 NS
		Female	30	35.467	1.7367	.3171		

Table no 2: Comparison of various transverse facial dimension parameters in photographic analysis among gender in Hypodivergent group.

Parameter	Gender	N	Mean	Std. Deviation	Std. Error Mean	Mean Difference	P value
Intercanthal Distance	Male	30	33.64	1.73100	.31604	-2.18367	0.004*
	Female	30	35.82	3.64501	.66548		
Outer canthal Distance	Male	30	92.51	2.40887	.43980	-.93400	0.160 NS
	Female	30	93.44	2.67032	.48753		
Internasal distance	Male	30	40.78	2.29820	.41959	1.86000	0.012
	Female	30	38.92	3.17906	.58041		
Intercommisural Distance	Male	30	44.15	1.90274	.34739	-6.09467	<0.001**
	Female	30	50.24	3.39064	.61904		
Intergonial Distance	Male	30	108.80	1.76683	.32258	-.17767	0.696 NS
	Female	30	108.98	1.74015	.31771		
N'-Gn'	Male	30	108.80	1.58714	.28977	.16867	0.717 NS
	Female	30	108.63	1.98025	.36154		
Facial Index	Male	30	80.27	2.46943	.45085	-.66900	0.216 NS
	Female	30	80.94	1.57211	.28703		
Bizygomatic width	Male	30	135.82	4.63631	.84647	.80533	0.442 NS
	Female	30	135.01	3.31479	.60519		

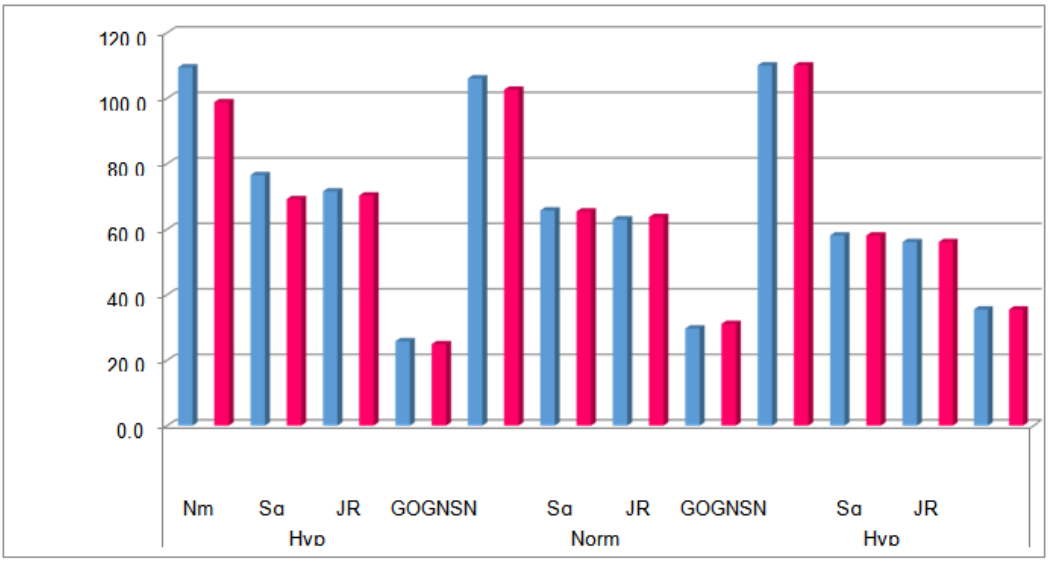


Table no 3: Comparison of various transverse facial dimension parameters in photographic analysis among gender in Normo Divergent group.

Parameter	Gender	N	Mean	Std. Deviation	Std. Error Mean	Mean Difference	P value
Intercanthal Distance	Male	30	38.77	3.29720	.60198	1.55867	0.110 NS
	Female	30	37.21	4.10532	.74953		
Outer canthal Distance	Male	30	93.63	2.88319	.52640	-.37167	0.593 NS
	Female	30	94.00	2.45633	.44846		
Internasal distance	Male	30	39.04	3.15996	.57693	-.15100	0.851 NS
	Female	30	39.20	3.03487	.55409		
Intercommisural Distance	Male	30	50.31	3.44455	.62889	.44433	0.616 NS
	Female	30	49.87	3.37282	.61579		
Intergonial Distance	Male	30	108.93	1.66541	.30406	.00633	0.988 NS
	Female	30	108.93	1.51671	.27691		
N'-Gn'	Male	30	109.12	1.69540	.30954	.22933	0.621 NS
	Female	30	108.90	1.87606	.34252		
Facial Index	Male	30	86.40	1.17988	.21542	.24300	0.415 NS
	Female	30	86.16	1.11085	.20281		
Bi zygomatic width	Male	30	126.30	2.58550	.47205	-.10667	0.864 NS
	Female	30	126.41	2.19764	.40123		

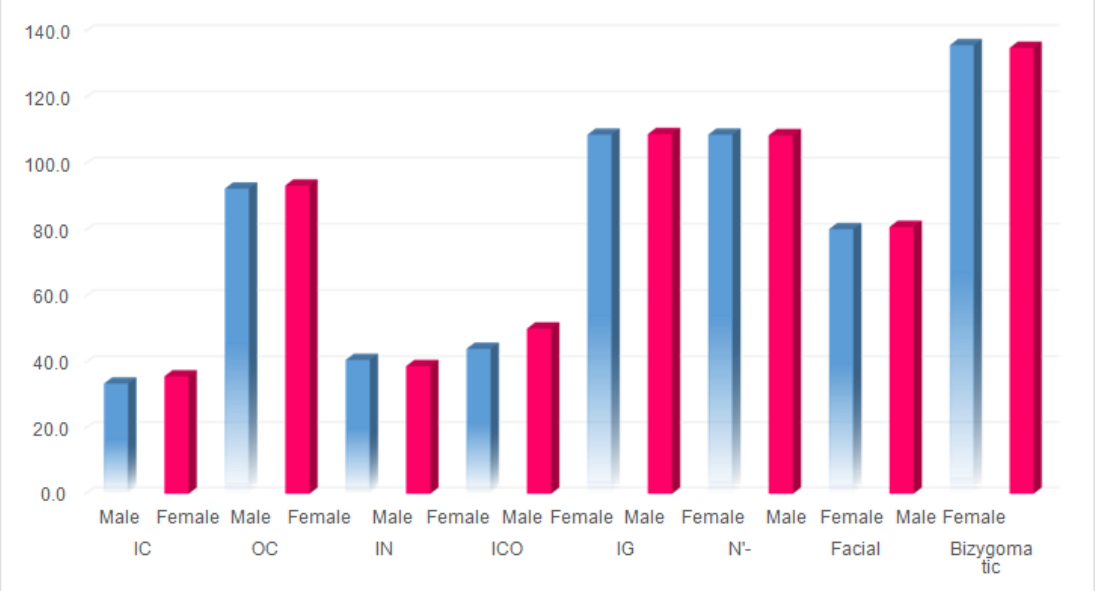


Table no 4: Comparison of various transverse facial dimension parameters in photographic analysis among gender in Hyper Divergent group.

Parameter	Gender	N	Mean	Std. Deviation	Std. Error Mean	Mean Difference	P value
Intercanthal Distance	Male	30	37.17	1.98301	.36824	-1.17391	0.026*
	Female	30	38.35	1.96847	.35939		
Outer canthal Distance	Male	30	95.05	2.38175	.43485	-1.46667	0.006*
	Female	30	96.52	1.50560	.27488		
Internasal distance	Male	30	39.50	2.17115	.39640	1.80333	0.001*
	Female	30	37.70	1.82970	.33406		
Intercommisural Distance	Male	30	48.02	4.29691	.78451	-1.93667	0.024*
	Female	30	49.96	1.58141	.28872		
Intergonial Distance	Male	30	113.19	1.61233	.29437	-1.38067	0.003*
	Female	30	114.57	1.87343	.34204		
N'-Gn'	Male	30	127.02	1.97441	.36048	.24733	0.626 NS
	Female	30	126.78	1.93239	.35281		
Facial Index	Male	30	92.12	1.17401	.21434	.95467	0.001*
	Female	30	91.16	.86158	.15730		
Bizygomatic width	Male	30	137.87	2.93999	.53677	-1.07667	0.136 NS
	Female	30	138.95	2.56364	.46805		

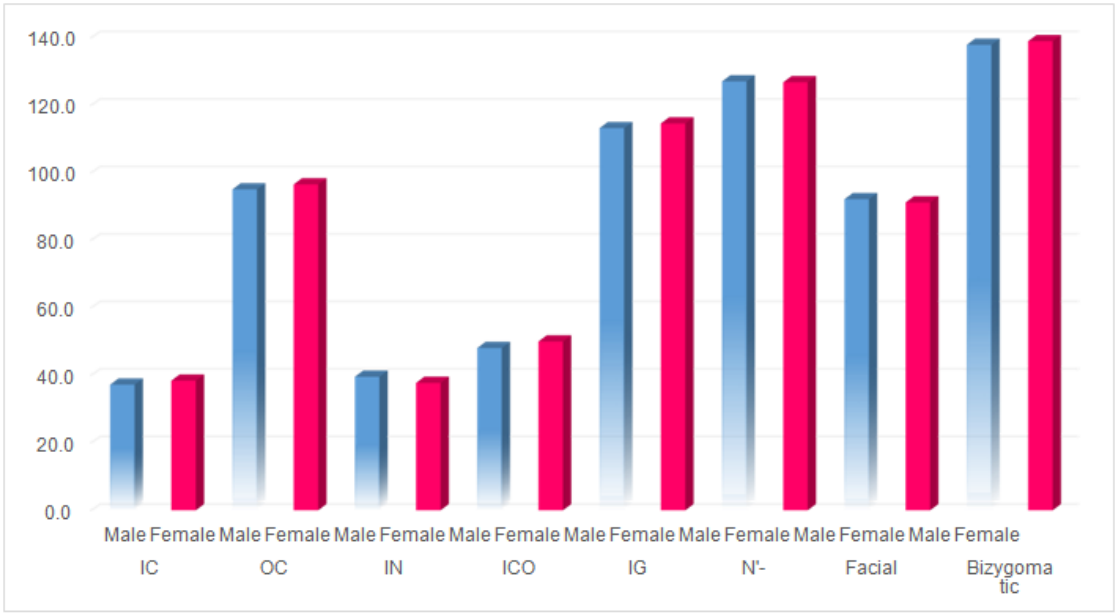


Table no 5: Intergroup comparison of various photographic parameters in vertical facial morphology group.

Parameter	N	Hypodivergent		Normodivergent		Hyperdivergent		F value	P value
		Mean	SD	Mean	SD	Mean	SD		
Intercanthal distance	60	34.7315	3.03571	37.9897	3.77430	37.7697	2.04601	21.473	<0.001**
Outercanthal distance	60	92.9770	2.56492	93.8122	2.66209	95.7863	2.10936	20.680	<0.001**
Internasal distance	60	39.8480	2.90573	39.1202	3.07263	38.6000	2.18845	3.120	0.047*
Intercommisural distance	60	47.1963	4.10779	50.0895	3.38728	48.9900	3.35530	9.693	<0.001**
Intergonial distance	60	108.8885	1.74092	108.9295	1.57924	113.8793	1.86750	164.477	<0.001**
N'-Gn'	60	108.7167	1.78125	109.0097	1.77656	126.8997	1.94090	1933.690	<0.001**
Facial index	60	80.6045	2.07990	86.2802	1.14272	91.6377	1.12874	793.447	<0.001**
Bizygomatic width	60	135.4127	4.01637	126.3533	2.37961	138.4083	2.78813	239.827	<0.001**

Table no 6: shows individual group wise comparison of transverse facial dimensions with vertical facial morphology (Post- Hoc Tuckey LSD test).

Parameter	Comparison Between		Mean Difference (I-J)	Std. Error	Sig.
Intercanthal Distance	Hypo	Normo	-3.25817*	.55511	<0.001**
		Hyper	-3.03816*	.55745	<0.001**
	Normo	Hyper	.22001	.55745	0.918 NS
Outer Canthal Distance	Hypo	Normo	-.83517	.44864	0.153 NS
		Hyper	-2.80933*	.44864	<0.001**
	Normo	Hyper	-1.97417*	.44864	<0.001**
Internasal Distance	Hypo	Normo	.72783	.50193	0.318 NS
		Hyper	1.24800*	.50193	0.037*
	Normo	Hyper	.52017	.50193	0.555 NS
Intermucosal Distance	Hypo	Normo	-2.89317*	.66337	<0.001**
		Hyper	-1.79367*	.66337	0.020*
	Normo	Hyper	1.09950	.66337	0.225 NS
Intergonial Distance	Hypo	Normo	-.04100	.31644	0.991 NS
		Hyper	-4.99083*	.31644	<0.001**
	Normo	Hyper	-4.94983*	.31644	<0.001**
N'-Gn'	Hypo	Normo	-.29300	.33493	0.657 NS
		Hyper	-18.18300*	.33493	<0.001**
	Normo	Hyper	-17.89000*	.33493	<0.001**
Facial index	Hypo	Normo	-5.67567*	.27700	<0.001**
		Hyper	-11.03317*	.27700	<0.001**
	Normo	Hyper	-5.35750*	.27700	<0.001**
Bizygomatic width	Hypo	Normo	9.05933*	.57317	<0.001**
		Hyper	-2.99567*	.57317	<0.001**
	Normo	Hyper	-12.05500*	.57317	<0.001**

IV. Discussion

Table no 1 shows comparison of various cephalometric parameters in vertical facial morphology groups according to gender.

Anterior facial height (N-Me) has mean of 109.40±5.531, 106.03±3.499 and 110±2.639 in males, while in females mean of 98.77±2.861, 102.59±4.866and110±2.639withmeandifferenceof10.633,3.447and0.000 for hypodivergent, normodivergent and hyperdivergent growth pattern respectively.

It is **highly significant** in **hypodivergent (p<0.001**)**, **significant** in **normodivergent (p≤0.003*)** and **nonsignificant (p≤1)** in **hyperdivergent**growthpattern.**Males**havehigheranteriorfacialheightthan females in hypodivergent and normodivergent growthpattern.

Posterior facial height (S-Go) has mean of 76.500±4.4237, 65.700±3.3130 and 58.067±2.8154 in males, while in females mean of 69.167±2.6792, 65.400±2.4155 and 58.067±2.8154 with mean difference 7.3333, 0.3000 and 0.000 of hypodivergent, normodivergent and hyperdivergent growth pattern respectively. It is highly significant in hypodivergent (p<0.001**), significant but to lesser extent in normodivergent (p≤0.690) and nonsignificant (p≤1) in hyperdivergent growth pattern. Males have higher posterior facial height than females in hypodivergent and normodivergent growth pattern.

Jarabak's ratio has mean of 71.5203±2.73108, 62.9900±1.24273 and 56.0600±2.33025 in males, while in females mean of 70.2657±2.45458, 63.6833±1.07128 and 56.0600±2.33025 with mean difference of 1.25467, -0.69333 and 0.0000 of hypodivergent, normodivergent and hyperdivergent growthpatternrespectively.Itisnonsignificantinhypodivergent(p≤0.066), significant but to lesser extent in normodivergent (p≤0.024*) and nonsignificant (p≤1) in hyperdivergent growth pattern. Males have higher Jarabak's ratio than females in hypodivergent and normodivergent growth pattern.

GoGn to SN has mean of 25.767±3.0477, 29.667±2.2944 and 35.467±1.7367 in males, while in females mean of

24.867±2.2087, 31.067±3.0843 and 35.467±1.7367ofhypodivergent,normodivergentandhyperdivergentgrowth patternrespectivelywithmeandifferenceof0.9000,-1.4000and0.0000.Itis nonsignificant in all 3 group patterns ($p\leq0.195$, $p\leq0.051$ and $p\leq1$).Males have higher GoGn to SN value than females in hypodivergent and normodivergent growthpattern.

Table no 2 shows descriptive data of comparison of various transverse facial dimensions parameters in photographic analysis among gender in Hypodivergent growth pattern.
Intercanthal distance has mean of 33.64±1.73100 and 35.82±3.64501in males and females respectively with mean difference of -2.18367 which is significant ($p\leq0.004$*). Intercanthal distance is more in females.
Outercanthal distance has mean of 92.51±2.40887 and 93.44 ±2.67032 in males and females respectively with mean difference of -0.93400 which is non significant ($p\leq0.160$).
Internasal distance has mean of 40.78±2.29820 and 38.92±3.17906 in males and females respectively with mean difference of 1.86000 which is significant ($p\leq0.012$). Males have more internasal distance
Intercommisural distance has mean of 44.15±1.90274 and 50.24±3.39064in males and females respectively with mean difference of -6.09467 which is highly significant ($p<0.001$**). Inter commisural distance is greater in females.
Intergonial distance has mean of 108.80±1.76683 and 108.98± and 1.74015 in males and females respectively with mean difference of -17767 which is nonsignificant ($p\leq0.696$).
N'-Gn' has mean of 108.80 ±1.58714 and 108.63±1.98025in males and females respectively with mean difference of .16867 which is nonsignificant ($p\leq0.717$).
Facial index has mean of 80.27±2.46943 and 80.94 ±1.57211 in males and females respectively with mean difference of -66900 which is nonsignificant ($p\leq0.216$).
Bizygomatic width has mean of 135.82±4.63631 and 135.01± 3.31479 in males and females respectively with mean difference of 0.80533 which is nonsignificant ($p\leq0.442$).
Males have greater internasal distance and females have greater intercanthal and intercommisural distance.

Table no 3 shows comparison of various transverse facial dimensions parameters in photographic method among gender in normodivergent growth pattern
Intercanthal distance has mean of 38.77 ± 3.29720 and 37.21 ± 4.10532 in males and females respectively with mean difference of 1.55867 which is nonsignificant ($p\leq0.110$).
Outercanthal distance has mean of 93.63 ± 2.88319 and 94.00 ± 2.45633in males and females respectively with mean difference of -.37167 which is nonsignificant ($p\leq0.593$).
Internasaldistance has mean of 39.04± 3.15996 and 39.20 ± 3.03487in males and females respectively with mean difference of -.15100 which is nonsignificant ($p\leq0.851$).
Intercommisural distance has mean of 50.31 ± 3.44455 and 49.87± 3.37282in males and females respectively with mean difference of .44433 which is nonsignificant ($p\leq0.616$).
Intergonial distance has mean of 108.93 ± 1.66541 and 108.93 ± 1.51671 in males and females respectively with mean difference of .00633 which is nonsignificant ($p\leq0.988$).
N'-Gn' has mean of 109.12 ± 1.69540 and 108.90 ± 1.87606 in males and females respectively with mean difference of .22933which is nonsignificant ($p\leq0.621$)
Facial index has mean of 86.40 ±1.17988 and 86.16 ± 1.11085 in males and females respectively with mean difference of .24300 which is nonsignificant ($p\leq0.415$)
Bizygomatic width has mean of 126.30 ± 2.58550 and 126.41 ± 2.19764 in males and females respectively with mean difference of -.10667 which is nonsignificant ($p\leq0.864$).
No gender difference is found in normodivergent group for transverse facial dimensions.

Table no 4 shows comparison of various transverse facial morphology parameters in photographic method among gender in hyperdivergent growth pattern.
Intercanthal distance has mean of 37.17 ± 1.98301and 38.35 ± 1.96847 in males and females respectively with mean difference of -1.17391 which is significant ($p\leq0.026$). Females have more intercanthal distance.
Outer canthal distance has mean of 95.05 ± 2.38175 and 96.52± 1.50560 in males and females respectively with mean difference of -1.46667 which is significant ($p\leq0.006$). Females have more outercanthal distance.
Internasal distance has mean of 39.50 ± 2.17115 and 37.70 ± 1.82970 in males and females respectively with mean difference of 1.80333 which is highly significant ($p\leq0.001$**). Males have greater internasal distance.
Intercommisural distance has mean of 48.02 ± 4.29691and 49.96 ± 1.58141 in males and females respectively with mean difference of -1.93667which is significant ($p\leq0.024$). Females have more intercommisural distance.
Intergonial distance has mean of 113.19 ± 1.61233 and 114.57 ± 1.87343in males and females respectively with mean difference of 1.38067 which is significant ($p\leq0.003$). Females have more intergonial distance.

'N-Gn' has mean of 127.02 ± 1.97441 and 126.78 ± 1.93239 in males and females respectively with mean difference of -.24733 which is nonsignificant (p≤0.626).
Facial index has mean of 92.12 ± 1.17401and 91.16 ± .86158 in males and females respectively with mean difference of .95467 which is significant (p≤0.001*). Males have more facial index. N'-Gn' and bizygomatic width is nonsignificant but the ratio obtained i.e. facial index is significant.
Bizygomatic width has mean of 137.87 ± 2.93999 and 138.95 ± 2.56364in males and females respectively with mean difference of -1.07667 which is nonsignificant (p≤0.136).

Females have higher intercanthal, outercanthal, intercommisural, intergonial distance, males have more internasal and facial index. N'-Gn' and bizygomatic width is nonsignificant.

Table no 5 shows one way ANOVA test tocompare various photographic parameters in between groups of vertical facial morphology. As per result of ANOVA, statistically significant difference is found.
Intercanthal distance, Outercanthal distance, Intercommisural distance, Intergonial distance, N'-Gn', Facial index and Bizygomatic width is stqatistically highly significant.Internasal distance is statistically significant (p≤0.047*).
To compare difference of each group with the other; a post-hoc LSD test is performed as seen in Table VI

Table no 6 shows individual group wise comparison of transverse facial dimensions with vertical facial morphology.

Intercanthal distance is nonsignificant between normo and hyper, hypo have least mean with SD value than normo and hyper with mean difference (-3.25817 and -3.03816) which is statistically highly significant (p<0.001**).
Outercanthal distance is nonsignificant between hypo and normo, hyper have higher mean with SD value than normo and hypo with mean difference (-1.97417 and -2.80933) which is statistically highly significant (p<0.001**).
Internasal distance is nonsignificant between hypo and normo and; normo and hyper, hypo is higher than hyper with mean difference (1.24800) which is statistically significant (p≤0.037*).
Intercommisural distance is nonsignificant between normo and hyper, hypo have least mean with SD value than hyper and normo with mean difference (-1.79367 and -2.89317) which is statistically significant (p≤0.020*) and (p<0.001**) respectively.
Intergonial distance is nonsignificant between hypo and normo, hyper have higher mean with SD value than normo and hypo with mean difference (-4.94983 and -4.99083) which is statistically highly significant (p<0.001**).
N'-Gn'- Facial height is nonsignificant between normo and hypo, hypo have least mean with SD value than normo and hyper with mean difference (-17.89000 and 18.18300) which is statistically highly significant (p<0.001**).
In Facial Index, hyper have higher mean with SD value than normo followed by hypo, is statistically highly significant (p<0.001**) with mean difference (-5.35750, -11.03317 and -5.67567). The facial index is a term used to express the facial proportions. It can be determined by dividing the facial height (measured from Nasion to Gnathion) by the bizygomatic width (measured from the right to the left Zygion).
Probable causes of facial index variation are:

- Age, gender, ethnic group and facial type are responsible -Simone Gillao et al in 2013[8]
- Biting force in adults with rectangular craniofacial morphology and skeletal deep bite is higher than in adults with long face morphology and open bite given by Bedoya A et al in 2015[9]
- Varies with race and ethnicity by Sadia S et al in 2014 better nutrition, improved socio-economic conditions, better health care and changing living conditions acting on intrinsic genetic factors Age , sex and racial differences by ThudamBedita Devi et al in 2016

Bizygomatic width hyper have higher mean with SD value than hypo followed by normo, is statistically highly significant (p<0.001**) with mean difference (-2.99567, -12.05500 and 9.05933).
-Intercanthal distance and intercommisural distance is more in normo than hyper and hypo, Outercanthal distance, intergonial distance, N'-Gn', facial index and bizygomatic width is more in hyper than normo and hypo and internasal distance is more in hypo than normo and hyper.
Superficial musculoaponeurotic system, the skeleton and dentition support is triad that affects soft tissue system by Plooij et al in 2010.[6]

V. Conclusion

Knowledge of facial dimensions is important in evaluation of age, sex, racial differences and in clinical application. So, facial measurements have been used by numerous researchers particularly anatomists, physical anthropologists, forensic scientists, plastic surgeons and orthodontists to establish standardized mean values for skeletal, dental and soft tissue structures as well as for classification of facial morphology of different populations.

Males have increased anterior facial height, posterior facial height,Jarabak's ratio and GOGN to SN than females in hypodivergent and normodivergent growth pattern for cephalometric parameters.

Normodivergent growth pattern had no sexual dimorphism. Hypodivergent growth pattern showed that males had greater internasal distance, females had greater intercanthal and intercommisural distance.Hyperdivergent growth pattern showed that females had greaterintercanthal, outercanthal, intercommisural, intergonial distance, males had more internasal and facial index. N'-Gn' and bizygomatic width was nonsignificant.

Transverse facial dimensions in vertical facial morphology groups revealed thatHyperdivergent had more Outercanthal distance, intergonial distance, N'-Gn' (Anterior Facial height), facial index and bizygomatic width.Normodivergent had more intercanthal distance and intercommisural distance. Hypodivergent had more internasal distance.

Musculoaponeurotic system, soft tissue analogue and Genetics could also be probable contributing factors for dissimilarity in transverse facial dimensions.

Further study can be advocated to overcome the limitations of present study with more sample size and other growth parameters

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