IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 18, Issue 8 Ser. 6 (August. 2019), PP 76-82
www.iosrjournals.org

An Assessment and Comparison of Pi Analysis with Other Sagittal Discrepancy Indicators

Abbas Sanjeliwala, Falguni Mehta, Renuka Patel, Amit Bhattacharya, Harshik Parekh, Rahul Trivedi

***Abstract**: Sagittal discrepancy is measuring antero-posterior relationship of the maxilla and mandible. It was one of the most common skeletal malocclusion for which patients seek orthodontic treatment and therefore an accurate evaluation of anteroposterior discrepancy is critical for orthodontic diagnosis. Various sagittal parameters have been used for assessment of sagittal discrepancy. Pi analysis was one of such parameters. Present study was carried out in Department of Orthodontia, GDCH Ahmedabad, for assessment and comparison of Pi analysis with other parameters . 120 pretreatment lateral cephalogram were traced and the values obtained were statistically analyzed . Result showed the mean values of Pi analysis for skeletal Cl I was 2.28°± 0.813°, for Cl II Div 1was 8.60°±0.894°, for Cl II Div 2 was 8.93°±0.753° and for Cl III malocclusion was -2.65°±1.402° and for Pi linear skeletal Cl I was 3.03 ± 0.74 mm, for Cl II Div 1was 9.63±0.72 mm, for Cl II Div 2 was 9.73±0.69 mm, for Cl III malocclusion was -2.65±1.50 mm. Result showed Pi analysis to be the most sensitive parameter among other parameter for assessing sagittal discrepancy.*

***Keywords**: Sagittal discrepancy, Pi analysis, Yen angle, W angle, beta angle.*

Date of Submission: 29-07-2019 Date of Acceptance: 14-08-2019

I. Introduction

Sagittal discrepancy is measuring antero-posterior relationship of the maxilla and mandible. It is one of the most common skeletal malocclusion for which patients seek orthodontic treatment and therefore an accurate evaluation of anteroposterior discrepancy is critical for orthodontic diagnosis. Earlier the skeletal pattern was analyzed clinically by overall profile view of the patient and palpation of anterior surfaces of the basal part of the jaws with teeth in occlusion[1,2]. After introduction of Cephalometrics by Broadbent in 1931, it has become an important diagnostic aid in Orthodontics[3]. After Wylie's first attempt to describe antero-posterior jaw relationship, various authors have evaluated, documented and established different values and norms for malocclusions in sagittal plane, few of which are Beta angle, Yen angle, W angle, APP-BPP, McNamara's maxillomandibular differential[3]. All these parameters are used to evaluate sagittal discrepancy. These parameters make use of points like point A, point B, condylion and sella to evaluate sagittal discrepancy. However, reliability of these parameters have been questioned as these parameters whether angular or linear may not give definitive picture of sagittal discrepancy as they may be affected by growth changes, changes due to tooth movement and variation due to ethnicity[4-6].

S. Kumar in 2012 introduced Pi analysis which uses point G and Point M, which are centroid point and hence considered stable, are projected on true horizontal line passing through point N (nasion) [1,3,5]. This true horizontal line is constructed perpendicular to true vertical obtained from radiographic image of true vertical metallic scale[5]. True horizontal plane being extra cranial reference plane is independent of growth changes and highly reproducible. Point G and M are projected perpendicularly on true horizontal plane as G´ and M´ respectively. Internal angle between line GG´ and G´M is taken as Pi angle[3-5]. The name is chosen because the angle resembles symbol Pi (л) in geometry [3-5]. Linear distance between G´and M´on true horizontal plane is taken Pi linear[5].

This study is carried out for assessment and accuracy of Pi analysis in various groups of malocclusion and its comparison with other sagittal discrepancy indicators.

II. Material And Methods

This study was carried out at the Department of Orthodontics and Dentofacial Orthopedics, Government Dental College and Hospital, Ahmedabad. Pretreatment lateral cephalometric radiographs of 120 subjects visiting Department of Orthodontics and Dentofacial Orthopaedics, Government Dental College and Hospital, Ahmedabad in the age group of 16 to 25 years of age were taken as a sample for this study.Ethical clearance was obtained by institutional ethical committee. **The criteria used for subject selection were:**

- Should not have undergone orthodontic treatment previously.

- Should not have any trauma to the face, TMJ disorders, congenital deformities, syndromes and craniofacial anomalies.
- Should not have missing or extracted or grossly carious teeth.

For the present study, cephalograms of 120 subjects were divided into four different types based on Angle's classification of malocclusion, ANB angle and Wits appraisal.

Skeletal Malocclusions	Class I	Class II	Class III
ANB angle	0°-4°	>4°	<0°
Wits value	-1 to 3 mm	>3mm	<-1mm

Cl II group was further divided into Cl II Div 1 and Cl II Div 2 respectively based on proclination of maxillary anterior teeth.

The lateral cephalograms were traced by a standard technique using 2H 0.5 lead pencil on acetate tracing paper by a single operator to minimize error.

True vertical line was drawn from radiographic image of a true vertical metallic scale and true horizontal was drawn perpendicular to the true vertical passing through Nasion (N).

Various reference points, planes and linear and angular parameters were drawn and recorded for evaluation as shown in figures.

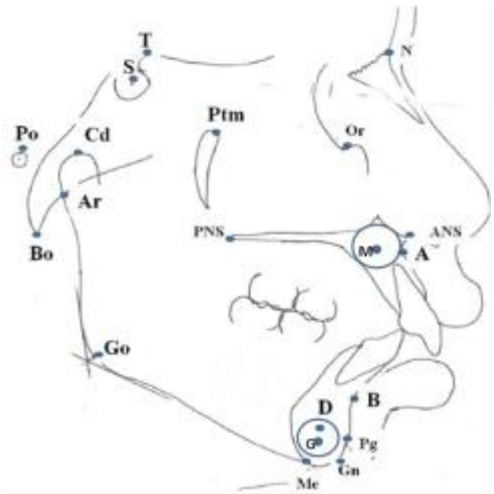


Fig 1: reference points

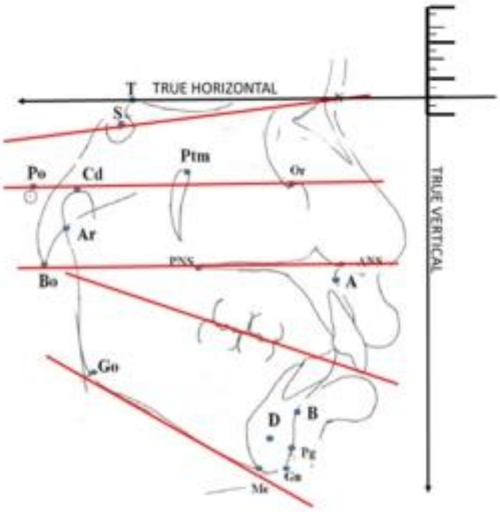


Fig 2: reference planes

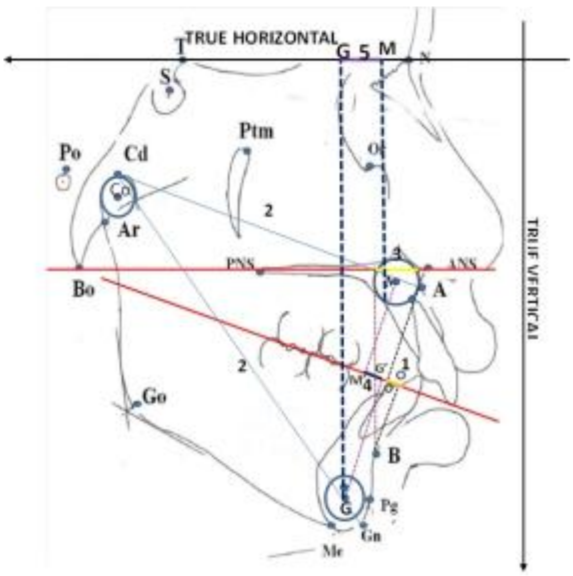


Fig 3: linear parameters

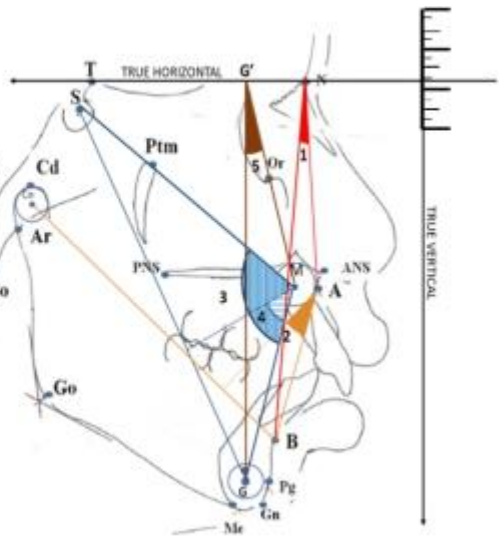
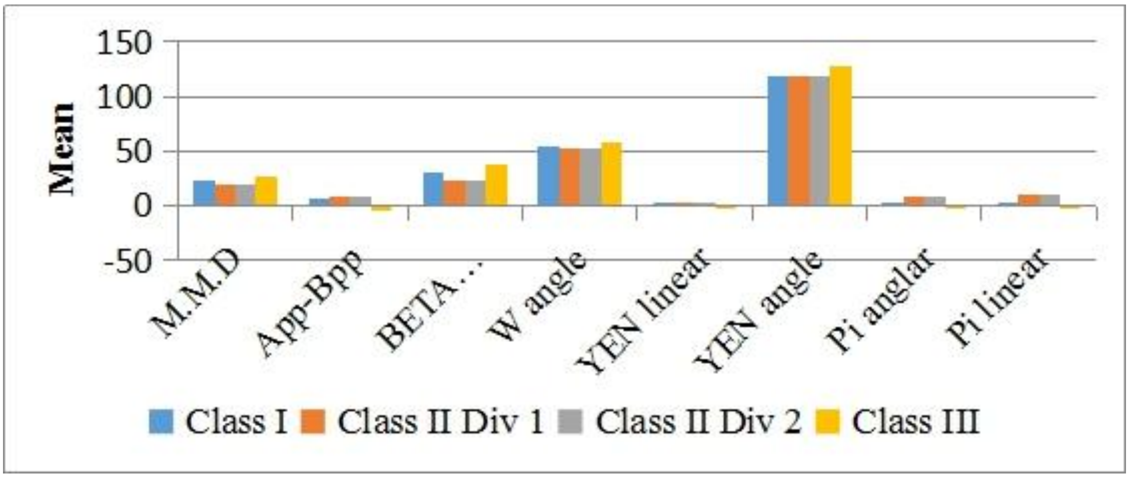


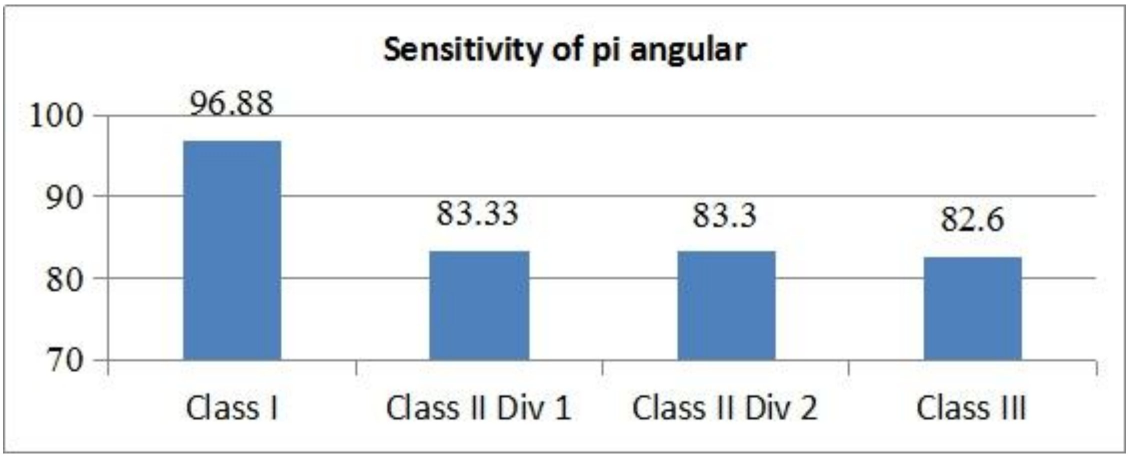
Fig 4: angular parameters

III. Result

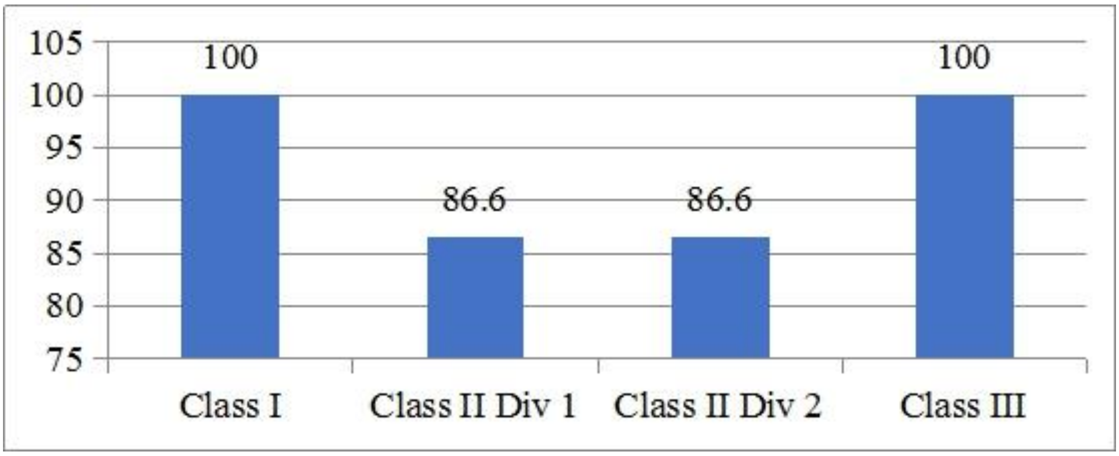
Data thus obtained was analysed using SPSS version 23. Tests performed were descriptive for scale data, one way anova with post hoc tukey test for intergroup comparisons. Pearson's correlation and multiple regression analysis were done to estimate the best predictor for Pi analysis.



Graph 1: Mean value of various parameter



Graph 2: sensitivity of Pi angle for different group



Graph 3: sensitivity of Pi linear for different group

Group			BETA angle	W Angle	YEN angle	Pi Linear
Class I	Pi angle	R	.040	.128	.264	.575**
		p value	.829	.484	.144	.001
Class II Div 1	Pi angle	R	.119	.336	.320	.784**
		p value	.532	.069	.085	.000
Class II Div 2	Pi angle	R	.095	.265	.229	.706**
		p value	.625	.165	.231	.000
Class III	Pi angle	R	**.435***	-.390	-.255	.829**
		p value	**.038**	.066	.240	.000

Table 1 : Correlation between Pi angle and other parameters

Group			**Beta angle**	**Yen angle**	**W angle**	**Pi Angle**	**M.M.D**	**App-Bpp**	**YEN linear**
Class I	pi linear	R	-0.264	-0.052	-0.190	.575**	-.232	.102	-.089
		p value	0.144	0.777	0.296	.001	.202	.580	-.626
Class II Div 1	pi linear	R	-0.090	-0.320	-0.023	.784**	.168	-.424*	.197
		p value	0.636	0.084	0.904	.000	.375	-.019	-.297
Class II Div 2	pi linear	R	-0.156	-0.005	-0.172	.706**	.153	-.169	-.029
		p value	0.461	0.980	0.363	.000	.419	-.371	.878
Class III	pi linear	R	-0.297	-0.327	-0.393	.829**	-.631*	-.270	.029
		p value	0.169	0.128	0.063	.000	.001	-.212	.894

Table 2: Correlation between Pi linear with other parameters

Variable	Regression coefficient R	Equation	R square	Std error of estimate
M.M.D	.554[a]	18.17 - 0.694 * M.M.D	.307	3.940
Beta Angle	.888[a]	23.01 -0.654 * Beta angle	.789	2.176
W Angle	.676[a]	69.60 - 1.20 * W angle	.457	3.486
Yen Linear	.906[a]	(-0.508) + 2.5 * Yen Linear	.821	2.002
Yen Angle	.217[a]	15.59 -0.091 * Yen angular	.047	4.620
Pi Linear	.990[a]	(-0.303) + 0.939 * Pi Linear	.980	.671

Table 3: Regression estimation for best predictor of Pi angle.

Variable	Regression coefficient R	Equation	R square	Std error of estimate
M.M.D	0.562	19.98 -0.653 * M.M.D	0.315	4.16
Beta Angle	0.902	25.20 - 0.707 * Beta Angle	0.814	2.17
W Angle	0.702	77.034 - 1.33 * W angle	0.493	3.58
Yen Linear	0.916	(-0.590) + 2.69 * Yen Linear	0.839	2.02
Yen Angle	0.257	19.17 - 0.115 * Yen Angle	0.66	4.86
Pi angle	.990[a]	0.433 + 1.04 * Pi angle	0.98	0.71
APP-BPP	0.711	27.03+1.8* APP-BPP	0.431	1.349

Table 4: Regression estimation for best predictor of Pi linear.

IV. Discussion

Antero posterior discrepancy is one of the most common malocclusion for which patients seek orthodontic treatment.

Sagittal relation can be determined from clinical observation to some degree, but are much more accurately evaluated from lateral radiographs. Various authors have proposed, both angular and linear variables to measure various malocclusion including sagittal jaw discrepancy. However, none of the parameter can be used universally as angular measurements can be erroneous due to changes in anatomical landmarks, growth, orthodontic teeth movement, whereas linear parameters can be affected by inclination of the reference planes. Thus, a parameter which is independent of cranial reference plane or dental occlusion would be a desirable adjunct in determining true sagittal relation without being influenced by other factors. Pi analysis is one of such parameters.

Pi angle is measured by projecting point G (center of the largest circle placed at a tangent to the internal anterior, inferior, and posterior surface of mandibular symphysis) and point M (center of largest circle placed at a tangent to the anterior, palatal and superior surface of premaxilla) on true horizontal line (line perpendicular to true vertical plane passing through N) as point G´ and point M´ respectively. Angle between line GG´ and G´M is taken as Pi angle. The mean value of Pi angle for skeletal Cl I is 2.28° ± 0.813°, for Cl II Div 1is 8.60°±0.894°, for Cl II Div 2 is 8.93°±0.753° and for Cl III malocclusion is -2.65°±1.402°. The difference between them is statistically high significant (P<0.001). The values are in accordance with the study conducted by **Kumar.S et al[5]** which showed the mean value of Pi angle 3.40°±2.04° for skeletal Cl I, 8.94°±3.16° for Cl II, and -3.57°±1.61° for Cl III malocclusion. Similar values are observed in the study of **Mittal.D et al[4], Jain et al[1]** and **Bohra.et al[7]**. The results are in contrast with the study of **Mittal et al[4]** which showed the mean value of Pi angle for Cl III is -9.79°±4.117°. This, difference may be attributed to severity of malocclusion and/or ethnic variation.

Pi linear is taken as linear distance between point G´ (perpendicular projection of point G on true horizontal plane) and point M´ (perpendicular projection of point M on true horizontal plane) on true horizontal line. The mean value of Pi linear for skeletal Cl I is 3.03 ± 0.74 mm, for Cl II Div 1is 9.63±0.72 mm, for Cl II Div 2 is 9.73±0.69 mm, for Cl III malocclusion is -2.65±1.50 mm. The difference between them is statistically high significant (P<0.001). The values are in accordance with the study conducted by Kumar.S et al[5] which showed the mean value of Pi linear 3.40±2.20 mm for skeletal Cl I, 8.90±3.56 mm for Cl II, and -3.30±2.30 mm for Cl III malocclusion. Similar values are observed in the study of Jain et al[1]. Pi linear is taken as linear distance between point G´ (perpendicular projection of point G on true horizontal plane) and point M´ (perpendicular projection of point M on true horizontal plane) on true horizontal line. The mean value of Pi linear for skeletal Cl I is 3.03 ± 0.74 mm, for Cl II Div 1is 9.63±0.72 mm, for Cl II Div 2 is 9.73±0.69 mm, for Cl III malocclusion is -2.65±1.50 mm. The difference between them is statistically high significant (P<0.001). The values are in accordance with the study conducted by Kumar.S et al[5] which showed the mean value of Pi linear 3.40±2.20 mm for skeletal Cl I, 8.90±3.56 mm for Cl II, and -3.30±2.30 mm for Cl III malocclusion. Similar values are observed in the study of Jain et al[1].

Rest of the parameters showed mean value in accordance with study of **Mittal.D et al[4], Jain et al[1]** and **Bohra.et al[7].** All parameters showed statistically significant value for differentiation of various group of malocclusion.

Graph 2 and 3 shows sensitivity vaue for Pi angle and Pi linear. Result shows Pi angle and Pi linear to be highly sensitive to truly determine skeletal malocclusion.

Table 1 shows correlation between Pi angle and other parameters. A significant positive correlation is observed between Pi angle and Beta angle for Cl III malocclusion only **(r=0.435) (p=0.038)**. This is in contrast with the study conducted by **Bohra et al[7].** who found no significant correlation between Pi angle and Beta angle in all the classes of malocclusion. Study of **Jain et al[1]** found negative correlation between Pi angle and Beta angle **(r=-0.791)**. This difference observed may be because of variation in sample.

Weak negative correlation exists between Pi angle and Yen angle (**r=-0.255) (p=0.240)** and between Pi angle and W angle **(r=-0.390) (p=0.066)** for Cl III malocclusion. This is in accordance with the study of **Mittal et al[4]** who observed weak negative relation between Pi angle and Yen angle **(r=-0.403) (p=0.153)** and Pi angle and W angle **(r=-0.248) (p=0.392).** Significant negative correlation was observed between Pi angle and Yen angle **(r=-0.757)** and Pi angle and W angle **(r=-0.706)** in the study of **Jain. S et al[1].**

A statistically high significant correlation is found between Pi angle and Pi linear for skeletal Cl I **(r=0.575) (p=0.001)**, for Cl II Div 1 **(r=0.784) (p=0.001)**, for Cl II Div2 **(r=0.706) (p=0.000)** and for Cl III **(r=0.829) (p=0.000)**. This is in accordance with the study of **Kumar et al[5]** and **Jain et al[1]** who observed statistically highly significant correlation between Pi angle and Pi linear **(r=0.960)** and **(r=0.872)** respectively.

Table 2 shows the correlation between Pi linear and other parameters. Negative correlation exists between Pi linear and Beta angle for skeletal Cl I **(r=-0.264) (p=0.144)** and Cl II Div 1**(r=-0.090) (p=0.636)** and Cl II Div2 **(r=-0.156) (p=0.410)** and Cl III malocclusion **(r=-0.297) (p=0.169)**, however correlation is statistically not significant. This is in accordance with the study of **Jain et al[1]** who observed statistically significant negative correlation between Pi linear and Beta angle **(r=-0.717)**.

Negative correlation is observed between Pi linear and Yen angle for skeletal Cl I malocclusion **(r=-0.052) (p=0.777)**, for Cl II Div 1 **(r=-0.320) (P=0.084)**, for Cl II Div 2 **(r=-0.005) (p=0.980)** and for skeletal Cl III malocclusion **(r=-0.327) (p= 0.128)** and negative correlation is observed between Pi linear and W angle for skeletal Cl I malocclusion **(r=-0.190) (p=0.296)**, for Cl II Div 1 **(r=-0.023) (p=0.904)**, for Cl II Div 2 **(r=-0.172) (p=0.363)** and for Cl III malocclusion **(r=-0.393) (p= 0.063)**.However this correlation is statistically not significant .This is in accordance with the study of **Jain et al[1]** who observed statistically negative correlation between Pi linear and W angle **(r=-0.612)** and between Pi linear and Yen angle **(r=-0.678).**

Weak negative correlation exists between Pi linear and McNamara's maxillomandibular differential **(r=-0.232) (p=0.202)** for Cl I malocclusion. However, the correlation is statistically non-significant. A statistically significant negative correlation between Pi linear and McNamara's maxillomandibular differential is observed for Cl III malocclusion **(r=-0.631) (p=0.001).** This shows that as value of Pi linear increases, maxillomandibular differential value decreases. This may be due to projection of point M on true horizontal whereas Maxillomandibular differential is calculated by subtracting effective maxillary length from effective mandibular length.

Statistically significant negative correlation is observed between Pi linear and App-Bpp for skeletal Cl II Div 1 malocclusion **(r=-0.424) (p=-0.019)**. Negative correlation is observed between Pi linear and App-Bpp

for Cl II Div 2 malocclusion **(r=-0.169) (p=-0.371)** and Cl III malocclusion **(r=-0.270) (p=-0.212)**. However, this correlation is statistically non-significant.
Negative correlation exists between Pi linear and Yen linear for skeletal Cl I malocclusion **(r=-0.089) (p=0.777)** and Cl II Div 2 **(r=-0.029) (p=0.878).** However, the correlation is statistically non-significant.
Table 3 shows regression coefficient for best predictor of Pi angle. Result shows Pi linear **(R^2=0.980)** to be the best predictor for Pi angle followed by Yen linear **(R^2=0.821)** and Beta angle **(R^2= 0.789)**. This is in accordance with the study of **Kumar et al[5]** who observed best predictor of Pi angle was Pi linear **(R^2=0.92)**
Table 4 shows regression coefficient for best predictor of Pi linear. Result shows Pi angle to be the best predictor of Pi linear **(R^2=0.98)** followed by Yen linear **(R^2= 0.839)** and Beta angle **($R^{2=}$.814).**

Thus,Pi analysis can be used for assessing sagittal discrepancy owing to its accuracy and reproducibility. However, fewer studies are available for Pi analysis so its findings should be further strengthened by correlating it with other sagittal discrepancy indicators.

Conclusion:

The following conclusions are drawn based on the findings of this study:

- Pi angle and Pi linear shows high significant difference to differentiate between skeletal Cl I, Cl II Div 1, Cl II Div 2 and Cl III malocclusion.

- **On testing sensitivity and accuracy of Pi analysis**

Pi angle shows overall 84.35% sensitivity to discriminate between various groups of skeletal malocclusion.
Pi linear shows overall 93.04% sensitivity to discriminate between various groups of skeletal malocclusion.
Thus Pi analysis can be considered as highly sensitive parameter to discriminate between various groups of skeletal malocclusion

- **On correlating Pi angle with other sagittal discrepancy parameters**

Pi angle shows significant correlation with Pi linear in all groups of malocclusion.
Pi angle shows negative correlation with Yen angle and W angle in skeletal Cl III malocclusion.

- **On correlating Pi linear with other sagittal discrepancy parameters**

Pi linear shows significant negative correlation with McNamara's maxillomandibular differential in skeletal Cl III malocclusion
Pi linear shows negative correlation with Beta angle, Yen angle and W angle.

- **Regression estimation of Pi analysis**

Highest level of correlation is observed between Pi angle and Pi linear (R^2=0.98), so they are considered highly interchangeable in assessment of sagittal discrepancy.

Bibliography

[1]. **Jain.S, Raghunath.N, Murlidhar.N.** A comparison of W angle, Pi angle, and Yen angle for assessing anteroposterior skeletal dysplasia in various malocclusion among regional population: a cephalometric study. IJDRD vol 8, issue 3 Jun 2018.
[2]. **Relwani P., Gowda N.C., Ramegowda S.** Comparative assessment of changes in sagittal relationship of maxilla to mandible in class II malocclusion- a cephalometric study. Indian journal of orthodontics and dentofacial research 2016; 2(2):77-82.
[3]. **Kumar V., Sundareswaran S.** Cephalometric Assessment of Sagittal Dysplasia: A review of Twenty-One methods. JIOS 2014; 48(1):33-41.
[4]. **Mittal D.**, **Ventakesh S., shivamurthy P.G., MathewC S.** A "new vista" in the assessment of antero-posterior jaw relationship. APOS 2018; 5(4):151-156.
[5]. **Kumar S, Valiathan A, Gautam P, Chakravarthy K, Jayaswal P.** An evaluation of the Pi analysis in the assessment of anteroposterior jaw relationship. J Orthod 2012 Dec;39(4):262-269.
[6]. **Sachdeva K.**, **Singla A., Mahajan V., Jaj H.S., Seth V., Nanda M.** Comparison of different angular measurements to assess sagittal skeletal discrepancy- A cephalometric study.
[7]. **Bohra S., Udeshi P.S., Sinha S.P., Saidath K., Shetty K.P., Nayak U.S.K.** predictability of pi angle and comparison with ANB angle, W Angle, YEN Angle and Beta angle in south Indian.
[8]. **Downs WB**. Variations in facial relationships; their significance in treatment and prognosis. Am J Orthod 1948;34(10):812-840.
[9]. **Riedel R.** The relation of maxillary structures to cranium in malocclusion and in normal occlusion. Angle Orthod 1952; 22:142-145.
[10]. **Steiner CC.** Cephalometrics for you and me. Am J Orthod 1953;39(10):729-755.
[11]. **Jenkins DH.** Analysis of orthodontic deformity employing lateral cephalostatic radiography. Am J Orthod 1955;41(6):442-452.
[12]. **Edward Beatty**, A modified technique for evaluating apical base relationships, AJO sept 1975.
[13]. **Jacobson A**. The 'Wits' appraisal of jaw disharmony. Am J Orthod 1975;67(2):125-138.
[14]. **Kim YH, Vietas JJ.** Anteroposterior dysplasia indicator: an adjunct to cephalometric differential diagnosis. Am J Orthod 1978;73(6):619-633.
[15]. **Freeman RS**. Adjusting A-N-B angles to reflect the effect of maxillary position. Angle Orthod 1981;51(2):162-171.
[16]. **Jarvinen S**. The JYD angle: a modified method of establishing sagittal apical base relationship. Eur J Orthod 1982;4(4):243-249.
[17]. **McNamara JA Jr**. A method of cephalometric evaluation. Am J Orthod 1984;86(6):449-469.
[18]. **Chang HP.** Assessment of anteroposterior jaw relationship. Am J Orthod Dentofacial Orthop 1987;92(2):117-122.
[19]. **Cooke MS, Wei SHY**. A summary five-factor cephalometric analysis based on natural head posture and the true horizontal. Am J Orthod Dentofacial Orthop 1988; 93: 213–23.

[20]. **Sarhan O.A.** A new cephalometric parameter to aid in dental base relationship analysis. The Angle orthodontist 1990; nanda60:59-64.

[21]. **Nanda RS, Merrill RM.** Cephalometric assessment of sagittal relationship between maxilla and mandible. Am J Orthod Dentofacial Orthop 1994;105(4):328-344.

[22]. **Yang SD, Suhr CH**. F-H to AB plane angle (FABA) for assessment of anteroposterior jaw relationships. Angle Orthod 1995;65(3):223-231.

[23]. **Oktay H.** A comparison ofANB, WITS, AF-BF, and APDI measurements. Am. J. Dentofac. Orthop. 1991; 99;122-8.

[24]. **Baik CY, Ververidou M.** A new approach of assessing sagittal discrepancies: the Beta angle. Am J Orthod Dentofacial Orthop 2004;126(1):100-105.

[25]. **Kapoor.D.N** maxillo mandibular relationship- A cephalometric study.J.indian society. September 2004.

[26]. **Zupancic S, Pohar M, Farcnik F, MO.** Overjet as a predictor of sagittal skeletal relationships. Eur J Orthod 2008;30(3):269-273.

[27]. **Neela PK, Mascarenhas R, Husain A.** A new sagittal dysplasia indicator: the Yen angle. World J Orthod 2009;10(2):147-151.

[28]. **Soliman N.L., El-Batran M.M., Tawfik W.A.** Cephalometric Assessment of sagittal relationship between maxilla and mandible among Egyptian children. Australian journal of basic and applied sciences 2009; 3:706-712.

[29]. **AL-hammadi**. Dentoskeletal overjet: a new method for assessment of sagittal jaw relation. Australian Journal of Basic and Applied Sciences 2011;5(9):1830-1836.

[30]. **Bhad WA, Nayak S, Doshi UH.** A new approach of assessing sagittal dysplasia: the W angle. Eur J Orthod 2013 Feb;35(1): 66-70.

[31]. **Doshi J**.R., **Trivedi K., Shyagali T**. Predictability of Yen angle & Appraisal of various Cephalometric parameters in the assessment of Sagittal relationship between Maxilla and Mandible in Angle's Class II malocclusion. Peoples' journal of scientific research 2012; 5(1):18.

[32]. **Al-Jabaa AH., Aldrees AM**. ANB, Wits and Molar Relationship, Do they correlated in Orthodontic Patients? 2014; 4:6.

[33]. **Shetty S.**, **Husain A., Majithia P**., Uddin S. YEN-Linear: A sagittal cephalometric parameter. JWFO 2013; 2:57-60.

[34]. **Abdullah.aldress AM**. ANB, Wits and Molar Relationship, Do they correlate? 2015; 4:6.

Abbas Sanjeliwala, Nnette. "An Assessment and Comparison of Pi Analysis with Other Sagittal Discrepancy Indicators." IOSR Journal of Dental and Medical Sciences (IOSR-JDMS), vol. 18, no. 8, 2019, pp 76-82.