A NEW REGRESSION EQUATION FOR PREDICTION OF WIDTH OF UNERUPTED CANINE AND PREMOLARS OF MAXILLARY ARCH IN NORTH INDIAN POPULATION.

Dissertation

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In the partial fulfilment of the requirements for the degree

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MASTER OF DENTAL SURGERY

In

ORTHODONTICS AND DENTOFACIAL ORTHOPAEDICS

By

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Under the guidance of

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BABU BANARASI DAS COLLEGE OF DENTAL SCIENCES, LUCKNOW

(Faculty of Babu Banarasi Das University)

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DECLARATION BY THE CANDIDATE

I hereby declare that this dissertation entitled ***"A NEW REGRESSION EQUATION FOR PREDICTION OF WIDTH OF UNERUPTED CANINE AND PREMOLARS OF MAXILLARY ARCH IN NORTH INDIAN POPULATION."*** is a bonafide and genuine research work carried out by me under the guidance of ***Dr. Tripti Tikku***, Professor, Department of Orthodontics and Dentofacial Orthopaedics, Babu Banarasi Das College of Dental Sciences, Babu Banarasi Das University, Lucknow, Uttar Pradesh.

Date: 30.03.2022

Place: Lucknow

Dr. Deepak Chandra

CERTIFICATE BY THE GUIDE

This is to certify that the dissertation entitled ***"A NEW REGRESSION EQUATION FOR PREDICTION OF WIDTH OF UNERUPTED CANINE AND PREMOLARS OF MAXILLARY ARCH IN NORTH INDIAN POPULATION."*** is a bonafide work done by ***Dr. Deepak Chandra***, under my direct supervision and guidance in partial fulfilment of the requirement for the degree of MDS in Orthodontics and Dentofacial Orthopaedics.

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Abstract

Introduction: Mixed dentition analysis is an important aspect of orthodontic diagnosis and treatment planning. Amongst the various methods available, the simplest and most accurate method is regression equation (RE) as it is population specific. The aim of present study was to formulate regression equation for prediction of sum of unerupted canine and premolar of maxillary arch using sum of mandibular four incisors and mandibular first molar in north Indian population and to check the reliability of Moyers mixed dentition analysis and newly formulated Regression equation for maxillary arch in our population. Also it was decided to evaluate sexual dimorphism in the present study.

Material and method: The sample consisted of 252 adult subjects divided in two groups- Group I(n=124 males) and Group II(n=128 females. Mesiodistal width of permanent four mandibular incisors and 1st molar of both sides were measured to be used as independent variable and average of actual width of maxillary permanent canine and premolars to be used as dependent variable to make the regression equation. All measurements were made with a digital vernier scale (aerospace 2000). Predicted width was obtained from regression equation and Moyers table and compared to the average of actual width of maxillary canine and premolars.

Results and Observation: As males have significantly larger tooth size than females, thus it was decided to formulate separate regression equation were made for males and females. Regression equation was devised for maxillary arch as Y=7.69+0.29X(males) and Y=9.82+0.241X(females). Predicted width by regression was accurate for our population as the difference was statistically non-significant with actual width. Predicted width by Moyers overestimated tooth size and difference was statistically significant with actual width and to the predicted width obtained by regression equation.

Conclusion: The proposed regression equation gave the best and accurate prediction of mesiodistal width of unerupted maxillary canine and premolars width as compared to Moyers prediction table, thus can be used for mixed dentition analysis in orthodontic diagnosis and treatment planning. A sexual dimorphism was established for tooth size.

Key-words: Mixed dentition analysis, Prediction, Linear regression equation, unerupted maxillary canine and premolar, Moyers prediction table.

Malocclusion in growing individuals is not just an aesthetic concern but it also disturbs the functional and structural balance during critical periods of growth and development. The etiology of malocclusion can be attributed to multiple factors which ultimately results in tooth size and arch length discrepancy. Mesiodistal width of tooth has an anthropological significance because it provides certain information on the human evolution with respect to dietary changes[1]. Clinically the mesiodistal width is correlated with arch alignment and large teeth were associated with crowded dental arches[2-3]. It is imperative to intercept any discrepancy in size of tooth and arch length at the earliest so as to prevent development of malocclusion. The best time for correction of such malocclusion is mixed dentition stage and to correct malocclusion at this stage, space analysis is must so that reliable estimation of size of unerupted canine and premolar can be done. Various Mixed Dentition Arch Analysis (MDA) have been proposed, such as by Tanaka-Johnston[3], Moyers, Hixon-Oldfather[4] etc. MDA helps to assess adequacy of space distal to lateral incisor and mesial to first molar for eruption of canine and premolar. Four different methods of MDA have been proposed, (i) periapical x-ray[5] and 45° cephalometric radiograph[6], (ii) prediction tables[3,7,8], (iii) a combination of prediction tables and radiographic metho[5,9,10] and (iv) regression equation.

The periapical method involves direct measurement on the radiograph[11,12] and is often associated with the problem of overestimation of tooth size which is probably due to magnification error. Magnification error was compensated for in the 45° cephalometric radiograph[6], however involved additional radiation exposure. To avoid these difficulties and errors, prediction tables or prediction equations were proposed by authors such as Tanaka-Johnston[3] and Moyers[7]. Moyers analysis allowed estimation of size of unerupted canine and premolar using prediction table. A prediction table for

prediction of width of permanent maxillary and mandibular canine and premolars at various probability levels (5-95%) was devised based on sum of mandibular incisors which are present at that age. The recommended probability level for most accurate prediction was at 75% and width of canine and premolar was estimated and checked if sufficient space was available to accommodate them. Tanaka-Johnston gave prediction equation for estimation of size of unerupted canine and premolar where the mesiodistal width of unerupted canine and premolar can be predicted by taking half the width of incisors and adding 10.5mm and 11mm for mandibular and maxillary tooth respectively. The advantage of prediction tables over radiographic methods are simplicity and ease of application, thus making it widely acceptable and used MDA technique. Though these methods were simple and easy and used width of mandibular incisor as independent variable which had already erupted in mouth at the time of interception of malocclusion, however accuracy of predicted width of canine and premolar was not reliable for different population group. This could be because the result of studies conducted by Moyers and Tanaka-Johnston as were based on the Caucasian descent of north European population and not applicable in other population groups. Racial variation among different population group has been observed in various studies[8,13-16]. According to previous studies environmental factors play more important role than genetic factors in determining the dimensions of dental arch and teeth. Difference in tooth size, crown morphology among and within population is due to the ongoing process of evolution[2,17,18,19]. As racial variations in tooth size is evident prediction technique should be population specific. This will help in accurate interpretation of probability tables or prediction equation for estimation of size of unerupted teeth. Hixon and Oldfather used the combination method for predicting width of unerupted canine and premolar[4] where periapical x-ray and plaster models were used.

However, this method tends to overestimate or underestimate the size of unerupted canine and premolars and did not give accurate result for all population groups.

Regression equation is yet another method utilized for prediction of mesiodistal width of unerupted permanent canine and premolars. It is a technique which allows for analysis of multiple variables mathematically. The estimated values are referred to as independent variables and the values that explain the variation in independent variables are called as independent variables. The linear regression equation provides a single slope which depends on the relation between independent and dependent variables, thus minimizing errors (as seen in radiographic method) and is consistent. As prediction tables used sum of width of four mandibular incisors for prediction of unerupted teeth so the earlier regression equations were also formulated using the same combination for different population group.

Various combinations have been tried for formulating regression equation to predict the mesiodistal width of permanent canine and premolars[21-25]. The combination included sum of mandibular four incisors[13,26,27,28], sum of lower incisors and molars[25,32,] maxillary 1st molars and maxillary four incisors[29], upper central incisor and lower first molar[30,31,33]. It was seen from various studies[25,32,34,] that sum of width of mandibular incisors and mandibular 1st molar gave better correlation with width of erupted canine and premolars. Hence regression equation was formulated using same combination for different population groups for mandibular arch, maxillary arch[35] and for both mandibular and maxillary arch. Few studies have been conducted for North Indian and south Indian population[36,37] as well for formulating regression equation using the same combination. In one study on north Indian population regression equation was formulated for both maxillary and mandibular arch[8] but the sample size was less (i.e. 80 subjects). In another study on same population, conducted in our depart-

ment, regression equation was formulated for mandibular arch only[32]. According to these studies done on Indian population, both Moyers and Tanaka-Johnston MDA have been found to be ineffective for predicting width of unerupted canine and premolars. Hence it was decided to formulate regression for maxillary arch in North Indian population using the same combination (mandibular incisors and 1st molars) on a larger sample size.

Sexual dimorphism was observed in tooth size in various studies[21-23,38-39]. As variation in teeth size is obvious between genders, hence estimation of size of unerupted teeth will also have sexual dimorphism thus separate regression equation was needed to be devised for males and females.

Considering this the aim of this study was to formulate regression equation for prediction of sum of unerupted canine and premolar of maxillary arch using sum of mandibular four incisors and mandibular first molar in north Indian population and to check the reliability of Moyers mixed dentition analysis and newly formulated Regression equation for maxillary arch in our population. Also it was decided to evaluate sexual dimorphism by formulating regression separately for males and females.

The aim of this study was to formulate regression equation for prediction of sum of unerupted canine and premolar of maxillary arch using sum of mandibular four incisors and mandibular first molar in north Indian population and to check the reliability of Moyers mixed dentition analysis and newly formulated Regression equation for maxillary arch in our population. Also it was decided to evaluate sexual dimorphism by formulating regression separately for males and femalesObjectives:

i. To check the applicability of Moyers Mixed Dentition Analysis in predicting width of unerupted canine and premolar of maxillary arch in our population.
ii. To evaluate sum of mesiodistal width of mandibular permanent incisors and first molars.
iii. To evaluate sum of mesiodistal width of permanent canine and premolars of maxillary arch on right and left side.
iv. To evaluate correlation between sum of mesiodistal width of mandibular permanent incisors and first molars and sum of mesiodistal width of permanent canine and premolars of maxillary arch.
v. To formulate regression equation to predict mesiodistal width of unerupted maxillary canine and premolar.
vi. To compare the actual sum of mesiodistal width of permanent canine and premolar of maxillary arch to that obtained by newly devised regression equation.

1. **Ballard ML; and Wylie WL (1944)[55]**

   They devised a mathematical formula for estimation or prediction of the width of unerupted canine and premolar. Two predictive equation was used. One was formulated using sum of mandibular incisors which was only for the estimation and other included sum of mandibular four incisor and molars for estimation of width of unerupted teeth. The latter prediction equation gave better results with more constant measurement of the unerupted teeth (canines and premolars).

2. **Nance HN (1947)[11]**

   The study was taken to determine the space available in the arch for unerupted canines and premolars by measuring the mesiodistal widths of the primary molars and canine on dental casts, and determined the space required by measuring the mesiodistal widths of unerupted tooth on the radiographs. This method was accurate in most of the cases. The total arch length(1^{st} permanent molar on one side to 1^{st} premolar on the other side) was also measured which showed that, in the transition stage of mixed to permanent dentition, molars move mesially by an average of 1.7mm on each side in the lower arch and 0.9mm on each side in the maxillary arch. Active treatment carried out during mixed dentition by taking advantage of favourable Leeway in tooth size between deciduous canine and premolar and permanent tooth which succeeds them will lead to stable occlusion.

3. **Ballard ML, Wylie W, Calif FS(1947)[56]**

   A regression equation based on the study previously conducted study was formulated to predict the width of unerupted permanent canine and premolars. After calculating correlation between sum of incisors and mesiodustal width of canine and premolars was 0.64. the newly formulated regression equation was X=9.41+0.527.

the authors also devised a regression equation based on the sum of mandibular incisors and 1st molars. The formula came to be X=5.52+0.431Y+0.55Z. Here X is the predicted width and y is sum of mandibular incisors and z corresponds to the mediodistal width of mandibular molars. No difference was observed between any of these regression equations, hence the use of first equation was suggested where only sum of mandibular incisor was used. When the predicted width was compared from the regression equation and from the X-ray was compared it was shown that regression error's result was less prone to errors.

4. Carey CW[57] (1949)

The authors suggested that it is possible to diagnose cases reporting in mixed dentition with fair degree of accuracy regarding the possibilities of treatment with or without extraction of premolars in permanent dentition. A prediction table was devised for the estimation of the sizes of lower cuspids and bicuspids by measuring the mesiodistal diameter of the four lower incisors. Following formula was used:

LD= LA+2X+3.4

Here,

LD- linear dimension that should be equal to the length of the brass wire.

LA-sum of width of lower anterior teeth

X- estimated size of the two premolars and cuspids from the prediction table

If the difference between LD and length of brass wire is less than 2.5mm then maintaining space will preserve the alignment but if it is more than 2.5mm some slicing after eruption of premolar is needed.

5. Hixon and Oldfather[4] (1958)

The authors investigated the efficiency of 12 methods of tooth size prediction of canines, 1st premolar and 2nd premolar by correlating the combination of width as seen on cast, film or cast & film both. The sample consisted of hydrocal casts of mandibular arch collected from 41 individuals and intraoral x-ray films. For all teeth the mesiodistal diameters were measured at right angles to the long axis of the tooth using a 'boley gauge'

The weakest relationship was between the size of the deciduous posteriors C,D,E and permanent 3,4,5 (r= 0.56). The relationship(r=0.69) between the sum of lower incisors and 3,4,5 was in close range to that reported by Ballard and Wylie and by Grieve. The strongest relationship(r=0.88) was to that between the measurement of 1&2 on cast, width of 4,5 on film correlated with actual width of 3,4,5 when they had erupted. Actual width of 3,4,5 was predicted using this combination. In mixed dental analysis, the estimated size of 3,4 and 5 can then be compared with the space available for their eruption. This space available can be obtained by measuring from the mesial surface of the mandibular permanent molars to the distal of the lateral incisors with a Boley gauge. On average the combined width of 3,4,5 was 2.1mm smaller than that of C,D,E.

The index of forecasting efficiency for this technique shows a 25% improvement over previously suggested methods. The variability found between the combined widths of the deciduous molars and cuspids and their permanent successors ranged from 0.1mm to 4.4mm.

6. **Bull RL[58] (1959)**

The author measured the mesiodistal width of erupted first molars on periapical radiographs and compared them with measurements of the same teeth on the dental

casts. The radiographic measurements came 3.3% greater than the direct measurement if the target film distance was 8 inch. After increasing the target film distance to 16-inch the values were 2.3% greater than actual. A mathematical formula was devised for this, Y=d X c/)2d-c). Here, Y is the estimated width of the tooth, d is mesiodistal width of the tooth on the radiograph taken at target film distance of 8inches and c is the mesiodistal width at 16 inches distance.

7. Hunter SW., Priest RW.[59] (1959)

The purpose of this study was to evaluate the experimental errors and discrepancies involved in the measurement of tooth size using plaster casts using two methods. Measurements in the first method were first taken using a pair of engineering dividers and a millimeter scale engraved with readings in tenths of millimetre and in the second method involved use of a regular sliding caliper with a verniar scale as an integral part of instrument. In all possibility all the 24 teeth i.e., central incisor through first molars in all quadrants were taken except in cases with poorly contoured restorations. The measurements were taken with the arms of divider or callipers parallel to the long axis of tooth. In all measurements the dividers gave significantly larger values than the sliding callipers. The mean size of this difference was 0.153±0.026mm.

8. Rosenzweig KA[60](1970)

In this study of tooth form as a distinguishing trait between sexes and human populations a report based on use of crown index of premolars and molars for a comparison of the dentition of six Mediteranian groups in Israel for males and females as well as the ratio of the mandibular to the maxillary tooth(Bolton ratio). The ratio of maxillary dentition to mandibular dentition was 94% in both sexes. The teeth of

males were larger than those of females for each type of tooth in both the arches, although they exhibited a similar pattern of tooth size.

9. **Balit HL[17](1975)**

The authors in the article described variations between and within the population with regard to tooth size, age of eruption, congenitally missing teeth and crown morphology. The association of genetic and environmental factors were considered for this variation. The genetic basis for this variation was best explained by a poly-genic model of inheritance. Most of the environmental factors which affect the den-tition are supposedly occurring during the prenatal period.

10. **Zilberman Y, Kaye EK, Vardimon A[61](1977)**

The authors tested the accuracy of predicting the mesiodistal widths of unerupted permanent canines and premolars from the X-rays and their estimations based on the already erupted permanent teeth in a group of Israeli children. 46 Jewish chil-dren were selected randomly from the orthodontic department of the dental school in Jerusalem. The sum of the mesiodistal widths of the canines and premolars ob-tained from the x-ray films and estimates from Moyers tables were correlated to the actual mesiodstal width of these measured on the study casts of the permanent den-tition by means of the regression equation. The observed post eruptive widths relat-ed more closely to predicted values obtained from x-ray measurements than from the tabulated estimations.

11. Kaplan RG, Smith CC, Kanarek PH[62](1977)

This study was taken to compare the accuracy of three methods of predictions, namely, Hixon-oldfather, Tanaka-Johnston and Moyers. The sum of mesiodistal width of the canine and both the premolars in each quadrant was determined by measuring the teeth on the cast and radiographs of 104 children and comparing the measurements with data calculated by the three methods. It was found Hixon-Oldfather analysis had the least tendency to underpredict tooth size.

12. Ferguson FS, Macko DJ, Sonnenberg EM[8](1978)

The authors utilized a stepwise regression in the selection of mixed dentition variables capable of predicting the sum of mesiodistal width of unerupted canines and premolars. Stone casts were made before and after the eruption of canines and premolars. On first examination at 10 years, intraoral radiographs were obtained using a modified bisecting angle technique. For prediction of the sum of widths of maxillary canines and premolar teeth, they recommended the use of the buccolingual width of the maxillary first molar and sum of widths of the maxillary canines and premolar measured radiographs. For the sum of widths of mandibular canines and premolars teeth they recommended measurement of the unerupted canines and premolars on radiograph. Measurement of mandibular incisors was not found to be useful in estimating the size of canines and premolars.

13. Ingervall B, Lennartsson B[63] (1978)

A prediction of breadth of permanent canines and premolars in the mixed dentition was proposed. The sample consisted of 77 children in the age range of 9y1m to 10y10m. when the children first came for observation the mandibular incisor and

molars were in occlusion whereas permanent canines and premolars were still to erupt. Multiple stepwise regression was used in the selection of mixed dentition variables capable of predicting the total breadth of unerupted canine and premolars. To predict the total breadth of the upper canine and premolars the buccolingual breadth of upper first permanent molars and measurements on x-ray of the breadths of upper canine and premolars proved to be most useful. In the prediction of the total breadth of lower canine and premolars the best results were obtained with the measurements of the breadth of these teeth in the x-ray. The breadth of the incisors were least useful predictor of the width of unerupted canines and premolars.

14. Staley RN, Shelly TH, Martin JF[5](1979)

The purpose of this study was to determine if, with multiple regression equation a more accurate method is now available for predicting the widths of unerupted mandibular canines and premolars of mixed dentition patients. A regression analysis was done on data obtained from 83 caucasian subjects who participated in IOWA growth sudy. Measurements were taken on plaster casts of mandibular incisors, canines, premolars and 1st molars. Measurements of the mandibular incisors, canines, premolars and 1st molars were also obtained from the periapical radiographs. Multiple regression analysis revealed that combinations of three radiograph measurements or two radiograph measurements and one cast measurement produced very high corelation coefficients in males and females. As the mandibular canines are significantly larger in males than in females it was decided to develop separate prediction equations for each sex. The newly formulated equations were also the most accurate method of prediction in the orthodontic patient.

15. Staley RN, Hoag JF[64](1978)

The authors revised the Hixon-oldfather mixed dentition analysis in an attempt to determine whether an improved equation could be found. They used the same method, measuring the mandibular central and lateral incisors in one quadrant on casts and the first and the second premolar teeth in the same quadrant on radiographs. Regression equations were developed from the measurements of right and left sides of the mandibular arch. The equations was found to be same but the correlation coefficients were higher and the standard difference lower than those reported by Hixon-Oldfather.

16. Gardner RB. [65](1979)

The author compared accuracy of 4 different prediction methods and determine whether a combination of methods can be used to improve upon their accuracy. The methods used were of Nance, Johnston and Tanaka, Hixon and Oldfather, and Moyers. The sample consisted of forty-one subjects in mixed dentition stage. In accordance with Hixon-oldfather and nance, only cases with pre-treatment radiographs were selected. The measurement was taken using Boley gauge calibrated in tenths of a millimetre to the nearest 0.05mm. a comparison of correlation coefficients and slopes of the predicted arch length versus the actual arch lengths revealed that the Hixon-Oldfather method confirmed closest to the ideal. However, no combination of the four methods produced a more accurate equation than thre single most accurate method. There was no effect of gender to the patient to the accuracy of any of the four-prediction equation. All methods in question tend to overpredict the arch length size by 1-3mm except for Hixon-Oldfather equation, which underpredicted by 0.5mm.

17. Bishara SE and Staley RN[10](1984)

In this study, a new measurement from IOWA growth study subjects revealed that Hixon-Oldfather method underpredicted the sum of the canine and premolar widths. This finding led to revision of the prediction equation which significantly improved the predictive capability of the Hixon-Oldfather method. The revised prediction equation used the same predictor(independent) variable used by Hixon-Oldfather i.e mesiodistal width of mandibular central & lateral incisor and the first and second premolar width on the periapical radiographs. The measurements of the predictor and dependent variable were taken for the most part from the left side of the mandibular arch of each subject. In contrast, the revised method averaged the measurements of predictor and dependent variables from the right and left sides of the lower arch of each subject. The revised equation resulted in a lower and more satisfactory standard error of estimates as compared to the original equation. In order to confirm the usefulness of the new prediction equation, it was tested in a sample of orthodontic patients. The results of cross validation were excellent.

18. Bishara SE, Jakobsen JR, Abdullah EM, Garcia AF[66](1989)

The mesiodistal width and buccolingual crown length of three population(USA,Egypt, and Mexico) was assessed. It was found that the prediction equations for space analysis in mixed dentition to determine tooth size and arch length discrepancies in the American population can be used in Egyptian and Mexican population with some modifications.

19. **Schirmer UA, Wiltshire A[67] (1997)**

The authors studied mixed dentition analysis for black patients of African descent. The moyers prediction table for comparing the size of unerupted canines

and premolars were formulated at the university Michigan from a sample consisting of northern European white subjects. Data were collected from a series of 100 randomly selected study models of black patients. Results of a study revealed that the Moyers prediction table was neither accurate nor applicable when applied to a population different ethnic origin such as black subjects of African group. Significant differences were found except for the prediction of maxillary canines and premolars in females at the 85 & 95 percentile probability levels. A new probability table specific to the black population was thus formulated.

20. **Al-Khadra BA [13](1993)**

The author took up this study to examine the applicability of Moyers mixed dentition analysis and the Tanaka-Johnston method of prediction in Saudi population and to develop a standard prediction formula to be used for this particular population. The sample size was kept at 34 after initial screening for inclusion and exclusion criteria. By using the MDW of permanent mandibular incisors, all canines and premolars a regression equation was derived, Significant difference in predicted widths of the maxillary canine and premolars with Tanaka-Johnston equation and that of actual measurements was observed. An overestimation in the size of teeth in the mandibular arch was also seen, with differences more constant at all sizes of the incisors. However the measured value follows closely the Moyers chart at the confidence level of 35% rather than at 75%. It can thus be ascertained that both of these methods are not a good predictor of mesiodistal width of uneruptrd canine and premolar in Saudi population. Regression constants were determined in an attempt to estimate the buccal segments from the mandibular incisors.

21. Paula SD., Almeida MA., Lee PC.[6] (1995)

They assessed the reliability of using oblique cephalometric radiograph for early prediction of the mesiodistal width of unerupted lower canines and premolars. Sample consisted of mandibular models and oblique cephalometric radiograph of 40 Brazilian children (20 boys and 20 girls) in the mixed dentition phase. Further models were obtained for the same sample once they attained permanent dentition and gender differences seen for the teeth. Measurements of unerupted 3,4,5 taken from 45° was significantly greater than actual males but had good correlation coefficient. They attributed this difference to manifestation of error and made correlation table using regression equation after compensation for magnification error. Actual width of 3,4,5 to predict width from these tables had greater correlation in comparison to other prediction methods i.e., Moyers, Tanaka-Johnston, Carrey's and Ballard &Wylie.

22. Lee-chan S, Jacobson N, Jacobson S[68] (1998),

This study was taken up with the purpose of determining the bewst correlation between the sum of of the mandibular permanent incisors and the combined mesiodistal crown diameters of the maxillary and mandibular canine and premolars in asian-american subjects. The study alsio aimed to check the applicability of Tanaka-Johnston prediction table in Asian-American population and the third objective was to develop a new prediction method for this specific population. 201 Asian American subjects meeting all inclusion criterias were selected for this study and the maximum age was restricted to 21years. The mandibular permanent central and lateral incisors were taken as independent Variables and the sum of mandibular and maxillary canine and premolars were taken as dependent variables for the study. The regression equation thus formulated for maxillary arch was Y=8.2+0.6X

and for mandible it was 7.5+0.6X. the difference between the actual width and tanaka-Johnston predicted width and the difference between predictred value from regression equation and Tanaka-Johnston was found to be highly significant. On statistical comparison of actual value and predicted value from regression equation was non-significant.

23. **Diagne F, Diop-Ba K, Ngom PI, El Boury O[28] (2003)**

devised a regression equation for the prediction of mesiodistal width of maxillary and mandibular permanent canine and premolars of Senegalese population by measuring the mesiodistal diameter of permanent mandibular incisors of 50 subjects. The regression equation was developed separately in maxillary arch for males(Y=9.60+0.55X). No significant difference between the mean of actual and predicted width was seen, however sexual dimorphism in the tooth size was observed.

24. Yuen KK, Lai-king Tang E, Lai-ying So L.[14](1998)

in a study of Hong-Kong Chinese population devised a new regression equation for the prediction of mesiodistal width of canine and premolars on the basis of mandibular permanent four incisors(independent value). the regression equation for males was Y=7.97+0.66X of maxilla and Y=8.22+0.58X for mandible. Regression equation developed for females was Y=8.30+0.61X of maxilla and Y=6.66+0.64X for mandible.

25. **Bernabe E. and Flores-Mir C[22] (2005)**

This study was conducted to determine the best sum of combinations in Peruvian population that has the best prediction capability for the permanent premolars & canines, calculation & validation of a multiple regression equation that included sex and arch as predictor factors and the last objective was evaluation of clinical significance of the new prediction equation. The study was conducted on 300(150 male & 150 female) randomly selected students from the sample fulfilling all the inclusion criteria. To determine the best tooth-type combination for predicting SPCP, 15 different groups were configured only on the basis of permanent teeth already erupted in early mixed dentition. It was found that lower incisors are not best predictors for the SPCP. The authors devised a multiple linear regression equation on the basis of combination of lower central incisors, upper central incisors and maxillary first molars as this presented with the highest standardized coefficient followed immediately by arch and sex of the students. When the new proposed MLRE was applied to the validation sample, underestimation of the actual SPCP of more than 1mm occurred only in 7% cases. Thus this MLRE was considered to be a good diagnostic alternative on the basis of its prediction capability for the given population.

26. Paredes V., Gandia JL., Cibrian R.[69](2006)

The authors devised a digital model to predict unerupted tooth sizes in the mixed dentition for an easy, accurate fast and automatic digital method using reference teeth and tooth-size tables and to determine which reference tooth or combination of reference teeth show the best predictive values for canines and premolars in a Spanish population. The study was conducted on dental cast of 100 subjects (30 girls & 70 boys) with a mean age of 14.8years (11-22.7yrs). Four permanent refer-

ence teeth (maxillary and mandibular molar & central incisor and a combination of upper incisor and lower molar) was used for this study. It was found that upper central incisor and lower first molar combination was the best reference teeth. By using the combination method, following regression equation was developed.

Predicted values= (0.805 X real values) +1.461

Using this equation, 83% of the teeth were predicted with less than 0.5mm of error, 15% with 0.5-1.0mm and 1.7% had and error between 1.0-1.5mm. Prediction of lower teeth was better than upper teeth, whereas maxillary lateral incisor prediction was poorest. A difference of 4mm between predicted values and real values was considered as a good prediction. An advantage of digital model over manual model is the ability to predict tooth size in each arch individually.

27. Altherr ER., Koroluk LD., Phillips C.[70] (2007)

The objective of this study was to determine the predictive accuracy of the Tanaka-Johnston mixed dentition space analysis(MDS) in male and female population of European and African descent in North Carolina. The sample study consisted of 60 white and 60 black (30 male and 30 females in each group). Symmetry and space analysis differences for the maxilla and the mandible were analyzed separately. In the maxillary arch the predicted combined mesiodistal width of the canine, the first premolar and the second premolar in a quadrant was calculated by adding 11.0 mm to half the combined width of the 4 mandibular incisors. The predicted widths of these teeth were compared with the actual widths measured on the casts. A difference of ±2mm per arch was considered to be significant as this may affect the extraction decision in patients with moderate crowding(4-7mm). interclass correlation coefficient(ICC) for tooth measurements on the models ranged from 0.93(mean=-

0.03, P=0.78) to 0.98(mean=-0.01, P= .93), thus indicating very high consistency in the measurement technique. On average male black subjects had larger teeth than their counterparts. The Tanaka-johnston method consistently overestimated the widths of the canines and premolars in the white females and slightly underestimated the actual widths of the canines and the premolars for the remaining groups. In the maxillary arch the tanaka-johnston analysis the overprediction was 50% of the white females and for the male subjects and black females it was within 2mm per arch. Linear regression formula was developed for each ethnic and sex group and because of significant interaction in the maxillary arch formulas were developed separately for each jaw in every group.

Based on the linear equation it was deduced that sex and ethnicity have synergistic effect on tooth size as white females had the smallest teeth and black males have the largest. It also made clear that Tanaka-Johnston analysis overestimated tooth sizes in both arches for white females. The regression equation predictions reduced the overprediction in both arches for white females and the underprediction in mandibular arch in black males.

28. Tahere HN., Majid S., Fateme M., Fard K., Javad M.[53](2007)

A total of 50 subject fulfilling all the inclusion criteria was selected to examine the accuracy of Moyers probability table and Tanaka-johnston equation and also formulate a regression equation to determine the mesiodistal width of unerupted canine and premolars. A difference between moyers and tanaka-johnston method to that of newly formulated regressiojn equation was observed in the Iranian population. Both the previously devised methods either over-or underpredicted the MD width of unerupted C & Pm. Mean size of teeth in Iranian population were found to

be less than those of other studies. Sexual dimorphism was observed in the sum of the mesiodistal width of canine and premolars.

29. **Melgaço CA, de Sousa Araújo MT, de Oliveira Ruellas AC**[25](2007).

Proposed a regression equation for the prediction of the sum of the mesiodistal width of the mandibular permanent canines and premolars using the sum of mesiodistal width of mandibular permanent four incisors and 1st molars as predictors. The sample consisted of 100 subjects from Brazil. The regression was formulated separately for males (Y=7+0.824X), females(9.2+0.766X) and combined (Y=6.55+0.829X).No statistically significant difference was found between the mesiodistal width of canine and premolars of both sides, still the combined width of both sides of mandibular canine and premolars was used. On statistical analysis it was found that the difference between the values of actual and predicted width of mandibular canine and premolar for male(p=0.809), females(p=0.684) and overall(p=0.454) was non-significant with p values >0.05.

30. Al-Omari IK, Zaid B., Al-Bitar and Hamdan AM[71] (2008)

The aim of this study was to determine the tooth size disocrepacies ina representative population of Jordanian origin and to compare tooth size discrepancy between genders. A total of 367(174 males and 193 females) were selected for the study meeting all the inclusion criteria. Anterior and overall Bolton ratio was established. No significant difference in the tooth size discrepancy was found between males and females.

31. **Jaiswal AK., Paudel KR., Shrestha SL., Jaiswal S[72] (2009):**

The authors took this study to test the correlation between predicted and actual mesiodistal width of unerupted canine and premolar of maxillary and mandibular arch, to construct new probability tables and prediction formula and last to compare the reliability of predicted values to that of moyers and tanaka-johnston. The sample for the study consisted of 200 nepalese subjects within age range of 17-23. Statistically significant difference was found between the mesiodistal width between male and female. Moyers and Tanaka-Johnston both either overpredicted or underpredicted the actual width of canine and premolars which was found to be statistically significant.

32. **Arslan SG., Dildes N., Kama JD.[33] (2009)**

A total of 412 turkish children(210 males & 202 females) in the age range of 12-14 years with complete dentitions were selected for a new regression equation. A new regression equation for Turkish males and females was devised separately for maxillary and mandibular arch. No significant difference between sum of right and left canine and premolar was observed thus mean value of both sides were combined. The sum of all teeth from second premolar of one side to that of other side in both the arches was found to be statistically larger in males than females. Thus different regression equation for both female and males was formulated. Overestimation of mesiodistal width of tooth was observed when using Tanaka-Johnston analysis for Turkish population. Reliability test of the newly devised regression equation was done on sample of 50 Turkish children which confirmed the applicability and accuracy of newly formulated equation.

33. **Talebi M., Parisay I., Sarraf A., Mazhari F.[73](2010)**

The authors took on this cross sectional study on 106 subjects to evaluate equations for predicting the size of unerupted canines and premolars of both maxillary and mandibular arch in Iranian population. A reference equation was formulated using the combination of mandibular first molars and maxillary central incisors. No significant differences was observed between the left and right sides of both arches in this population and also between left and right side of both arches when the data was evaluated using multivariable stepwise regression analysis. A strong correlation was observed between the size of the permanent mandibular first molars and permanent maxillary central incisors and the size of canines and premolars in the maxilla. Prediction of maxillary teeth was more accurate than mandibular arch when this newly devised RE was used in Iranian population.

34. Boboc A. and Dibbets J[23] (2010)

The authors took up this study to develop and accurate method of estimation of mesiodistal width of unerupted permanent canine and premolar and also to evaluate the accuracy of the various prediction methods. For this, a total of 320 plaster casts were selected and divided into two groups. The first group consisted of 223(109male& 114 female) subjects and was used to develop the equation and the second group of 97 subjects(49 male and 48 female) served as test group. The expected value of mesiodistal width of canine and premolars was calculated using 8 different methods of width prediction. The accuracy of these methods was analyzed by calculating the difference between the EV of the canine and premolar and their real value (RV). In ideal situation the difference between EV and RV should be zero. The best combination to predict the mesiodistal width of unerupted canine and

premolar has come out to be of mandibular right central incisor, mandibular right 1st molar and maxillary left central incisor. The accuracy of new prediction method by adding 1 canine or premolar in the equation came about 93%. Various other prediction methods had an accuracy ranging from 34% to 66%, with the highest being of Bachmann(66%in maxilla and 69% in mandible) and the lowest of Tanaka-Johnston(34%).

35. **Bherwani AK. and Fida M.[26](2011)**

This study was conducted with 4 main goals in mind of studying the relationship of crown diameters of mandible incisors, canines & premolars, secondly to check any sexual dimorphism in mesiodistal width, thirdly to construct a prediction table and lastly to check the applicability& reliability of Tanaka-Johnston and Moyers method in Pakistani population. 200 samples (100boys& 100girls) were selected after careful examination. The mean age of subjects was 14.2yrs for males and 13.9yrs for females. In the study no significant width difference was observed between the left and right sides for teeth measured individually as well as in combined segments of canine and first and second premolar for boys, girls or the sexes combined. Moyers table (75th percentile) and Tanaka-Johnston both were found to be unreliable in Pakistan(karachi) population after a careful evaluation done by paired 't'- test. No significant difference was found between the sexes when canines and premolars were compared.

36. **Ahluwalia P., Jodhka S., Thomas AM.[38](2011)**

The authors wanted to examine the applicability of Tanaka-Johnston method of prediction in a different population and to develop a standard prediction formula by regression equation to be used in Punjabi population. Total of 202 children(85 fe-

males & 115 males) were selected for study. The regression equation formulated is as follows:

The mean values for teeth evaluated were found to be greater in males as compared to females. A good correlation was observed between actual and predicted combined widths of canines and premolars in males and females which was statistically significant with greater deviation from the actual values in mandibular arch in females. Sexual dimorphism was apparent with males having larger teeth than females.

37. Tome W., Ohyama Y., Yagi M., Takada K.[74] (2011)

The study was taken to identify differences in accuracy of prediction of the summed widths of unerupted permanent canines and premolars for males vs females, of Japanese population. A total of 200 dental cast were taken (100 males and 100 females), with age ranging from 14-21 years for patients with incisor irregularity of more than 3mm. The mean mesiodistal crown diameter of teeth except upper central incisor and lower central and lateral incisor differed between the male and female subjects. In the male subject group, there were statistically significant correlations between central incisor and lateral incisor widths in the maxilla(r= 0.673) and in the mandible(r=0.755) and in the female subject group there were statistically significant correlation between the central incisor and the lateral incisor width for the mandible (r=0.656) with width of 3,4,5. The regression equation derived for predicting the mesiodistal crown widths of unerupted permanent canines and premolars are as follows :

Male :

Upper : Y= 1.265 x U1 + 0.371 x U2 + 0.451 x U6 +4.422

Lower : Y= 0.743x L1 + 1.680x L2 + 0.748x L6- 0.806

Female:

Upper : Y= 0.567xU1 +0.812x U6+ 0.073x UIMD +5.248

Lower : Y=0.653x L1+ 0.670x L2 + 0.0634x L6 + 0.097x LBAL +3.911

The accuracy in predicting the sum of mesiodistal tooth crown widths of unerupted permanent canines and premolars in the male subject group was higher than in female subject group. The accuracy in prediction was ± 1.5mm in both males and females.

38. Ibrahim IA., Elkateb MA., Wahba NA., Harouny NME[31] (2011)

The authors prepared a computerised analysis to determine the best possible sum of permanent tooth widths of different combination for the prediction of of sum of maxillary and mandibular canines and premolars in Egyptian sample. For this purpose, study cast of 72 subjects was taken and a regression equation was prepared describing the relation between combinations of sums of permanent tooth widths and sum of widths of permanent canines first and second premolars. Image scanning of dental models was done using a flatbed scanner, with the occlusal surface facing the glass and located in a specialized position in relation to a special plastic ruler in middle of the glass window. The age of samples ranged between 16-18 years. The predicted mesiodistal width of maxillary and mandibular permanent canines, first and second premolars calculated by the equation was compared with actual mesiodsital width (MDW) of tooth on the cast. A statistically significant positive correlation was observed between the sum of maxillary right and left canines and premolars, mean MDW of mandibular canines and premolars and for sum of MDW of lower incisors and molars. After evaluation of the equation, it was concluded that, mandibular permanent first molars and of maxillary permanent central

incisors was the best predictor for the mandibular permanent canines and premolars in a sample of Egyptian subjects.

39. Buembo W., Kutesa A., Rwenyonyl CM[75](2012)

the authors developed a formula for predicting the widths of unerupted canines and premolars in a Ugandan population and check reliability of Moyers table and Tanaka-Johnston prediction values in Ugandan population. The sample consisted of 220 school children aged 12-17 years with all permanent teeth. For prediction equation, mesiodistal width of the four mandibular permanent incisors, maxillary and mandibular canines and premolar teeth was measured. The formula derived is as follows:

$$Y= a+b(x)$$

a significant correlation between the mandibular incisor and sum of the maxillary canine and premolars and the sum of the mandibular canine and premolars. The overall regression coefficient of mandibular canine and premolars was 0.83 and for maxillary canine and premolar was 0.78. No significant difference was observed between the sizes predicted by the equation and from the Moyers table at 65% level for the boys and 75% for the girls in the mandibular arch. In the maxillary arch, no significant difference was found at 75^{th} level in boys and 95^{th} level in girls. This is an indication that Moyers prediction table can be used to predict width of unerupted tooth in Ugandan population at certain percentile levels of probability. The Tanaka-Johnston technique overestimates the actual size of the Ugandan tooth widths.

40. **T** Tikku T, Khanna R, Sachan K, Agarwal A, Srivastava K, Yadav P. [32]**(2013)**

Developed a new regression equation for the unerupted canine and premolar for mandibular arch in the north Indian population. The study was taken up

200 subjects with mean age of 19.83±4 years. The authors used the combination of mandibular permanent four incisors and 1st molars to predict the width of unerupted mandibular permanent mandibular canine and premolars. The regression equation was formulated separately for males(Y=7.70+0.7386X0, for females (13.00+0.6065X) and for over all sample (7.15+0.7450X). A comparison was done between the actual mesiodistal width and the value obtained from the newly devised regression equation where it was found that the difference was non-significant. Thus making this regression equation a reliable and accurate source of prediction of mesiodistal width of unerupted mandibular canine and premolars.

41. Goyal RK., Sharma AP, Tandon P, Nagar A, SinghGP(2014)

The author devised a mixed dentition analysis for the prediction of mesiodistal width of unerupted canine and premolars of maxillary arch. The sample for the study was 80 (40males and 40 females). The independent variable was the sum of mandibular four permanent incisors and 1st molars and the dependent variable was mesiodistal width of maxillary canine and premolars. Separate regression equation was formulated for males(Y=2.9+0.40X) and females (Y=0.56+0.45X). the correlation between actual and predicted value from regression equation was excellent however the correlation between predicted value of regression equation and Tanaka-Johnston was found to be statistically significant.

42. **Al-kabab FA, Ghanome NA and Banabilh SM[24] (2014**)

The authors devised a regression equation for prediction of the size of the unerupted permanent canine-premolar segment and establish prediction tables for clinical use based on the normative standard of mesio-distal tooth widths of permanent

teeth in Yemeni population. The sample size was kept at 400 school children(200 boys and 200 girls) with a mean age of 13.80± 0.42 years. The results show that Moyer's chart at the 75th, 50th, and 35th percentile confidence level were overestimated when used in Yemeni population. Hence a regression equation was formulated for Yemeni population using width of sum of mandibular incisors.

Regression equation for the maxillary arch (boys:Y=13.55+0.29X; girls: Y=9.56+0.41X) and for the mandibular arch (boys: Y=9.97 +0.40X; girls: Y=9.56+0.41X) were used to develop a new prediction probability table. The coefficient ranged from 0.28 to 0.47 with higher coefficient values in girls. A significant gender discrepancy was observed as mesiodistal width of mandibular incisors and canines-premolars were significantly larger in males and females.

43. **Thimmegowda U.,** Niwlikar KB, Khare V, Prabhakar AC **[36](2015)**

The objectives of this study was to test the reliability of moyers MDA and also to formulate a new regression equation for Bangalore population sample. A significant difference for all the means for mesiodistal width of mandibular incisors and maxillary canine and premolars width was observed between males and females, where males had larger teeth. Moyers probability table was checked at 50% level for the given sample and it was observed that it underpredicted the MD width of canine and premolars.

44. **Memon S and Fida M[40](2015),**

Developed a prediction equation for estimating the mesiodistal width of mandibular canine and premolars using the width of mandibular first permanent molars and four incisors(independent value). The study was conducted on 288 subjects of Pakistani descent between the age of 11-20 years. The regression

equation was formulated separately for males and females as a difference in tooth size was observed. The equation for males was Y=14.63+0.61X and for females was Y=14.36+0.61X. Here Y is the predicted value of the mesiodistal width of canine and premolar and X is the mesiodistal width of four mandibular incisors and 1st molars. The mean difference of actual width and the predicted value was statistically non-significant for males(p=0.84) and females(p=0.67).

45. Vanjari K, Nuvvula S, Kamatham R[76](2015),

This study was taken up with an aim to suggest the best predictors for determining the mesiodistal width of canine and premolars and to propose new regression equation for male and females. A total of 101 children in the age range of 11-15 years fulfilling all the inclusion criterias were selected for the study. 33 possible combinations of permanent maxillary and mandibular first molars, central and lateral incisors were framed and correlated with mesiodistal width of canine and premolars. Significant correlation was noted between the considered pattern and mesiodistal width of canine and premolars with a difference between girls and boys. A simple linear regression equation was formulated separately to predict the mesiodistal width of canine and premolar of both the arches. The regression thus formulated using the combination same as our study for maxilla in males was Y=9.253+0.547X and for females it was Y=9.541+0.517X. The accuracy of prediction improved considerably with the inclusion of as many teeth as possible in regression equations. The newly proposed regression equation based on the erupted teeth may be considered clinically useful for space analysis.

46. Nahidh M[50] (2016)

The present study used the combined mesiodistal width of maxillary and mandibular central incisors and first molars to predict the combined mesio-distal width widths of maxillary and mandibular canines and premolars in iraqi sample. A total of 110 iraqi subjects were selected for the study between 17-25 years of age. Non-significant difference between the predicted width and actual mesio-distal width were seen in this study.

47. Mittal S., Pathak A., Mittal K., Pathania V.[34] (2016):

A study was conducted to determine a linear regression equation to predict the sum of mesiodistal width of permanent canine and premolars in the Himachali population. 250 children were selected between ages 12 and 15 years fulfilling all the inclusion criteria. Melgaco's method gave high correlation in Himachal population. High correlation was found in this study between the predicted sum of canines and premolars and those obtained by regression equation, which was higher than various other studies[ ]. It was also found that Moyers prediction table overestimated or underestimated the mesiodistal width in current population.

48. **Thimmegowda U., et al.[36](2017)**

The aim of this study was to check the validity of Tanaka-Johnston prediction method, Moyers prediction table in the Bangalore population and also to formulate a new regression equation to determine the mesiodistal width of unerupted canine and premolar of both mandibular and maxillary arch. No significant difference between teeth on right and left sides was observed for either upper or lower arch. The estimated lower canine and premolar width by Tanaka-Johnston method was statis-

tically greater than the actual width. Males had a larger LCPm width as compared to those of females in this population. A satisfactory correlation was established between MD width of mandibular incisors and MD width of unerupted canine and premolars. A borderline significance was observed between the MD width of incisors between the two sexes. In this study it was found that 50% level is more applicable to boys and for females 75% probability level is advisable.

49. **Bhatnagar A., Sinha AA., Chaudhary S., Manuja N., Kaur H. and Chaitra TR[52] (2017)**

    The present study was performed to assess the applicability of two regression equations based on mixed dentition analysis and to propose and evaluate a new regression equation based on the lower incisors and first permanent molars in school children of Moradabad city. For this 100 children(50boys and 50girls) were selected. The authors used regression studies conducted by Tanaka-Johnston and that of Bernabe and Flores -Mir. A new regression equation specific to particular population was devised. In both male and female subjects, Tanaka-Johnston, Bernabe and Flores-Mir and the new regression equation overestimated the mesiodistal width of the unerupted canines and premolars. Male teeth were generally found larger than females. It was concluded that sum of mandibular permanent incisors plus width of first molars was a better predictor when compared to other methods. Both the methods of , Bernabe and Flores-Mir and of Tanaka-Johnston tend to overestimate the actual size of unerupted permanent canine and premolar tooth widths.

50. **Gyawali et al. [77](2017),**

    The authors wanted to check the applicability of Moyers and Tanaka-Johnston table and also to develop a regression equation to predict the width of unerupted canine

and premolars of both arches in Nepali brahmin population. For this 100 Nepalese brahmins meeting inclusion criteria were selected from the OPD of institute of medicine, Kathmandu. For the formulation of regression equation the sum of mandibular four permanent incisor was used as predictor of independent variable. The regression equation thus formulated for maxilla in males was Y=8.991+0.563X and in females it was Y=3.650+0.777X. for mandible the regression equation for males was Y=4.603+0.729X and in females it was Y=5.583+0.668X. on comparison of predicted value using regression equation to that of Moyers and tanaka-johnston method a statistically significant difference was observed. Non-significant difference was observed between the actual values and the values derived from the regression equation.

51. Houng VT., Thiradilok S., and Manopatanakul S.[78] (2018)

The study was aimed at finding an accurate and effective prediction equation of crown widths of the permanent canine and premolars for Vietnamese child population. The study was taken up by the authors with two objectives of developing new formulas for prediction of MDW of unerupted canine & premolars and also to evaluate the validity of newly created equations for Vietnamese child population. A total of 240 tooth width were measured from 4 boys and 6 girls between ages 24-34 yrs. This study included various combinations(1^{st} molars, lateral and central incisors) for prediction but the lateral incisors was left out of the study because of size variability.

52. Shrestha A., Pradhan D.[45] (2019)

The authors took up this study to compare the Moyers prediction table with actual value in Nepalese Newar population. For this study, combined mesiodistal width of mandibular incisors, maxillary and mandibular permanent canines and premolars were measured in 150 study models of Newar orthodontic patients(75 males & 75 females). In male, Moyers table underestimated the actual size of canine and premolars at all probability levels except at 95% level where it overestimated for maxilla and at 95% and 85% for mandible. In females, it underestimated the value which was statistically significant at all probability levels except at 95% for maxillary canine and premolars. The study affirmed the fact that teeth in male is larger than in females. Combined mesiodistal width of lower incisors, combined width of canine and premolars on both arches also showed statistically significant sexual dimorphism with males having greater value.

53. Duraiswamy V, Vasaviah SK, Gopalan T, J Babyjohn, muttah A[54](2020)

This study was conducted to introduice Moyers mixed dentition probability table to perform mixed dentition analysis for the children of Salem. Sample consisted of 200 children(100 male and 100 female) between age range of 12-16 years. A positive correlation was found between the sum of mandibular incisors and the sum of maxillary and mandibular cuspids as compared to the maxillary canines and premolars. Females had larger tooth size as compared to male subjects.

The study was conducted in Department of Orthodontics and Dentofacial Orthodpaedics with an aim to formulate regression equation for prediction of mesiodistal width of unerupted canine and premolars of maxillary arch using sum of mandibular four incisors and mandibular first molar in north Indian population.

Sample

The sample for the study included study models of maxillary and mandibular arch of 250 subjects in the age range of 18-25 years obtained from the patients of OPD of Babu Banarasi Das college of Dental Sciences, Lucknow. The sample was equally divided in 2 groups- Group 1 Included 124 male subjects with mean age 20.43±2.32 years and Group 2 Included 128 females with mean age of 20.08±2.21 years.

The sample for this study was selected after careful clinical examination with following inclusion and exclusion criteria:

Inclusion criteria

- All subjects must be native of north India (at least 2 generations)
- Well aligned arches with Class I molar relation
- Fully erupted maxillary incisors, canines, premolars and 1st permanent molars
- The subject should not have undergone any orthodontic treatment in the past.

Exclusion Criteria: -

- Teeth with proximal caries or interproximal restoration
- Crowding more than 2mm
- Severe rotation that hinders taking accurate measurement taking
- Patients with signs of attrition, tooth material loss due to caries, congenitally missing teeth

- Arch with impacted teeth
- Teeth with hypoplasia or any other anomaly.

Ethical committee approval:

Ethical approval has been obtained from the "Institutional Review Committee" and from the Babu Banarasi Das University. Informed consent was taken before dental examination and impression making as per the guidelines.

Material :

The materials used in this study is as follows:-

A. For obtaining study models(Fig 1)
    a. Maxillary and mandibular impression trays
    b. Alginate (Zelgan 2002)
    c. Bowl
    d. Spatula (curved and straight)
    e. Dental stone type III(Orthokal)
    f. Sodium hypochlorite

B. For measurement of study models :-

    Digital Vernier caliper from Aerospace Industries (Fig 2)

Fig1. Materials used for obtaining study models.(a) impression trays, (b) alginate impression material (c) bowl and spatula (d) dental stone type III(orthokal)

Fig2. Digital vernier caliper(aerospace)

Methodology

A. For making study models :

1. The patient was seated in an upright position so as to prevent gagging due to backward flow of excess material into the throat.
2. Impression trays was selected keeping a gap of 6mm around teeth.
3. Alginate was mixed in the prescribed water powder ratio(1:2) using curved spatula.
4. The smooth creamy mix of alginate was obtained by spatuating the mix against the side of the bowl while using the vigorous figure of eight motion.(Fig3)
5. The alginate was loaded into the impression trays and was firmly placed inside patient mouth by standing at the back of patient for the maxillary arch and in front of the patient for the mandibular arch.(Fig4)
6. After alginate was set in patient mouth the tray was removed.
7. Impression was first kept under running water to clean of the saliva and then it was disinfected by dipping in 2% glutaraldehyde solution. After this the impression was kept under running tap water to remove the disinfectant.
8. Impression was now poured using dental stone. Dental stone was mixed with water to obtain a thin mix and was tapped multiple times after pouring it in the impression to remove air bubbles. Thick mix of stone was then poured and allowed to set.
9. Cast was removed from the impression and trimmed appropriately using model trimmer.

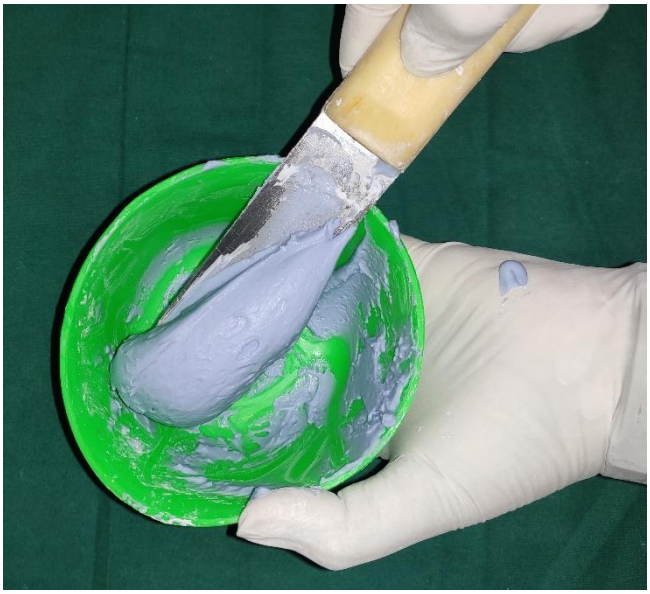


Fig3: Smooth creamy mix of alginate

Fig4: Patient position for (a) maxillary impression and (b) mandibular impression

B. **<u>For taking measurement</u>**:

1. A digital vernier caliper(aerospace) read to 0.02mm was used measure the mesiodistal widths of four mandibular incisors, mandibular 1st molars, and maxillary canines and premolars(both quadrant).
2. The measurements were taken directly on the dental casts as carefully as possible to avoid any damages to the dental cast.

3. Two anatomic contact points with maximum width was used to record the mesiodistal dimension of the tooth.
4. The caliper beaks were grinded to a finer level so that insertion was made easy in the interproximal areas with narrow contact points.
5. The caliper beak was inserted from the labial(buccal) side and held occlusally parallel to the long axis of the tooth and vestibular surface of the cast(Fig5).
6. The beaks were then closed until gentle contact points of the tooth was made.

Fig 5. Taking measurement using vernier caliper

C. **For formulating regression equation :-**

1. Mesiodistal width of canine and premolars of right and left side was taken separately for males and females.
2. The values of right side and left side was compared statistically using t-test. As there was statistically non-significant difference between the val-

ues of right and left side, hence the average was taken as dependent value for the regression equation.

3. The sum of the mesiodistal width of mandibular incisors and 1st molars was summed for male and female subjects separately. This was considered as independent variable for formulation of regression equation.
4. The average sum of mesiodistal width of maxillary canine and premolars of both side was considered as dependent variable.
5. Regression equation thus formulated for maxillary arch is as follows

   male:- Y' = 7.64+0.29* X

   female:- Y' = 9.82+0.241* X

   Where, X is sum of mesiodistal width of permanent four mandibular incisors and permanent 1st molars of both sides.

D. Prediction of width of unerupted maxillary canine and premolar:

A. Using regression equation:

Values of sum of four permanent mandibular incisors and both 1st molars was substituted for X (independent value) in the newly devised regression equation for males (Y' =7.64+0.29* X). The value of y as predicted width of 3,4,5 was calculated using the newly devised RE. Similarly for females, values were put in the RE devised for females (Y' =9.82+0.241* X) and the width of 3,4,5 was predicted using the equation.

B. Using Moyers mixed dentition analysis:

At 75% the Moyers table(Fig6) has been considered to be of greatest practical use, hence the actual width of unerupted canine and premolar was compared to that of predicted width by Moyers prediction values at

75%. Predicted width of 3,4,5 was calculated using moyers prediction table for male and female(Fig). sum of four permanent mandibular incisor was calculated and was used as reference and corresponding value for unerupted canine and premolars was checked and was noted down on excel sheet. The values was noted for both males and females separately.

B, Maxillary Bicuspids and Cuspids

	MALES												
21/12 = (%)	19.5	20.0	20.5	21.0	21.5	22.0	22.5	23.0	23.5	24.0	24.5	25.0	25.5
95	21.2	21.4	21.6	21.9	22.1	22.3	22.6	22.8	23.1	23.4	23.6	23.9	24.1
85	20.6	20.9	21.1	21.3	21.6	21.8	22.1	22.3	22.6	22.8	23.1	23.3	23.6
75	20.3	20.5	20.8	21.0	21.3	21.5	21.8	22.0	22.3	22.5	22.8	23.0	23.3
65	20.0	20.3	20.5	20.8	21.0	21.3	21.5	21.8	22.0	22.3	22.5	22.8	23.0
50	19.7	19.9	20.2	20.4	20.7	20.9	21.2	21.5	21.7	22.0	22.2	22.5	22.7
35	19.3	19.6	19.9	20.1	20.4	20.6	20.9	21.1	21.4	21.6	21.9	22.1	22.4
25	19.1	19.3	19.6	19.9	20.1	20.4	20.6	20.9	21.1	21.4	21.6	21.9	22.1
15	18.8	19.0	19.3	19.6	19.8	20.1	20.3	20.6	20.8	21.1	21.3	21.6	21.8
5	18.2	18.5	18.8	19.0	19.3	19.6	19.8	20.1	20.3	20.6	20.8	21.0	21.3
	FEMALES												
95	21.4	21.6	21.7	21.8	21.9	22.0	22.2	22.3	22.5	22.6	22.8	22.9	23.1
85	20.8	20.9	21.0	21.1	21.3	21.4	21.5	21.7	21.8	22.0	22.1	22.3	22.4
75	20.4	20.5	20.6	20.8	20.9	21.0	21.2	21.3	21.5	21.6	21.8	21.9	22.1
65	20.1	20.2	20.3	20.5	20.6	20.7	20.9	21.0	21.2	21.3	21.4	21.6	21.7
50	19.6	19.8	19.9	230.1	20.2	20.3	20.5	20.6	20.8	20.9	21.0	21.2	21.3
35	19.2	19.4	19.5	19.7	19.8	19.9	20.1	20.2	20.4	20.5	20.6	20.8	20.9
25	18.9	19.1	19.2	19.4	19.5	19.6	19.8	19.9	20.1	20.2	20.3	20.5	20.6
15	18.5	18.7	18.8	19.0	19.1	19.3	19.4	19.6	19.7	19.8	20.0	20.1	20.2
5	17.8	18.0	18.2	18.3	18.5	18.6	18.8	18.9	19.1	19.2	19.3	19.4	19.5

Fig6. Moyers prediction table for maxillary cuspids and bicuspids

E. Comparison of predicted width of unerupted maxillary canine and premolars with actual width of canine and premolar.

Average of actual width of canine and premolar of both sides. Predicted width as obtained from regression equation and prediction table was tabulated and adequate statistical comparison were made.

Measurement of reliability

To determine measurement reliability, plaster cast of 10 patients were selected randomly and mesiodistal width of maxillary right 2nd premolar, left canine, mandibular left central incisors, mandibular right lateral incisor and, mandibular left 1st molars were re-measured after two weeks. The original values and re-measured values are given in table 1.

Variable	Reading 1 (n=10) mean±SD(mm)	Reading 2 (n=10) mean±SD(mm)	Mean difference	p-value
SI	22.64±1.43mm	22.65±1.43mm	-0.011	0.214 (ns)
SIM	43.98±2.11mm	43.97±2.11mm	0.008	0.453 (ns)
SCPm	20.38±0.82mm	20.38±0.82mm	-0.001	0.795 (ns)

Table 1: Reliability of measurement

NS- non-significant

SI- sum of mandibular permanent four incisors

SIM-sum of mandibular permanent four incisors and 1st molars

SCPm- sum of average of maxillary canine and premolars

Data analysis

Statistical analysis was carried out by using SPSS software(v11.0). Paired 't'-test was used to assess the paired observation and independent groups were tested using independent student 't'-test.

Formulas used for analysis

The Arithmetic Mean

This is the most commonly used measure of central tendency and is also known as mean or average.

$$x = \frac{\sum_{i=1}^{n} x\, i}{n}$$

The Standard Deviation

$$s = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}}$$

Maximum and minimum:

The lowest and largest value in a data set in referred to as minimum and maximum and the difference of the two gives us the range.

Range= maximum- minimum

Paired t-test:

The difference between paired samples were calculated using the paired sample t-test when the variable in sample 1 is somehow correlated to an observation in sample 2, so that the data may be considered to be happening in pairs. Paired t-test was done using SPSS software.

Simple linear regression equation:

This is the linear relationship between two variables where one may be functionally dependent to another. The magnitude of the dependent variables is assumed to be determined by a function of the magnitude of the independent variable. The independent variable is also known as predictor or regressor whereas the dependent variable is known as the response or criterion variable. The simple linear regression equation is denoted as follows:

$$Y = a+bX$$

Where,

Y- independent variable

X-dependent variable

a- Intercept

b- Slope

The dependent relationship is known as regression equation and a simple regression equation has only 2 variables in it. The regression coefficient intercept(a) describes the background value of the dependent variable(Y) and has same unit as of Y i.e the dependent variable. The regression coefficient, b is also knows as the slope is the change in Y as associated with a unit change in X.

The present study was conducted in the Department of Orthodontics and Dentofacial Orthopedics with an aim to formulate regression equation for prediction of sum of unerupted canine and premolar of maxillary arch using sum of permanent mandibular four incisors and mandibular first molar in north Indian population and to check the reliability of Moyers mixed dentition analysis and newly formulated Regression equation for maxillary arch in our population. Also, it was decided to evaluate sexual dimorphism by formulating regression separately for males and females. The sample size for this study was 252 in age range 18-25 years divided in two groups – Group I included 124 males mean age 20.43±2.322years and Group II included 128 females mean age 20.08±2.21years(Table2). All subjects were selected from the OPD of Department of Orthodontics and Dentofacial Orthopedics, Babu Banarasi Das College of Dental Sciences.

Group	Gender	N	AGE Mean+SD(in years)
I	Males	124	20.43±2.32 years
II	Females	128	20.08±2.21 years

Table2: Distribution of sample for the study

Before formulating regression equation, actual mesiodistal width of erupted maxillary canine and premolars of right and left side, as measured on study models, was compared for differences between the sides for each group. Table 3 shows mean value of actual mesiodistal width of canine and premolars of right and left side of both the groups.

Groups	Mesiodistal width of maxillary canine and premolars of right side Mean +SD(in mm)	Mesiodistal width of maxillary canine and premolars of left side Mean +SD (in mm)	p-value
I	20.82±1.28mm	20.60±1.21mm	0.013
II	20.21±1.11mm	20.19±1.13mm	0.770

Table3: Mesiodistal width of maxillary canine and premolars of right and left side

The mean of actual mesiodistal width of permanent maxillary canine and premolars of Group I on right side was 20.82±1.28mm and was 20.60±1.21mm on left side and difference between the two sides was statistically non-significant. For Group II mean of actual mesiodistal width of permanent maxillary canine and premolar on right side was 20.21±1.11mm and 20.19±1.13mm for left side and the difference between the two was statistically non-significant (Figure7). As there was statistically non-significant difference between the values of mesiodistal width of permanent maxillary canine and premolars between right and left side for both the groups, thus the average of both the sides was taken for formulating the regression equation as well as for further statistical comparison.

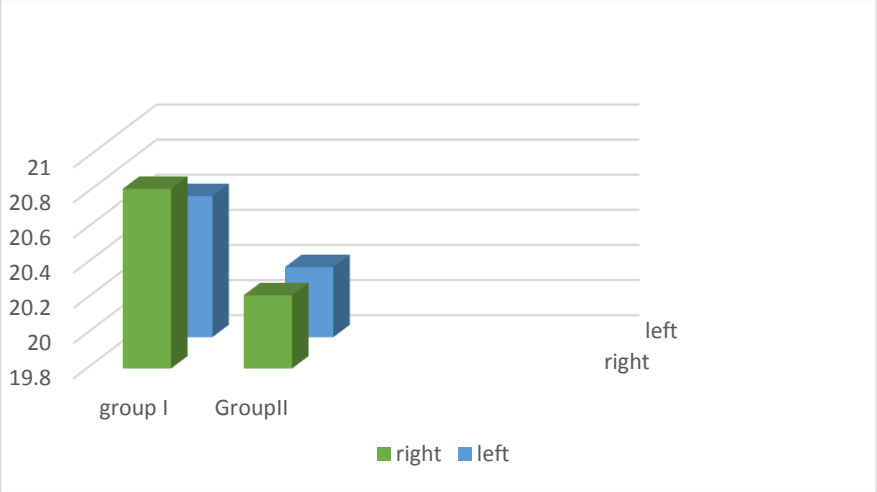
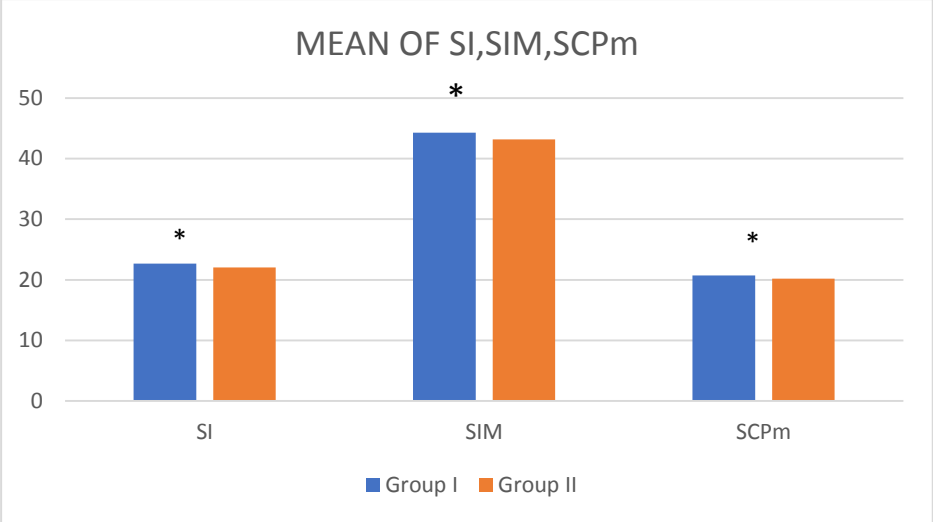


Fig7. Bar diagram showing actual mesiodistal width of maxillary right and left canine and premolar for Group I&II

Sexual dimorphism was evaluated in present study for various combination -Sum of Incisors, sum of Incisors and 1st molars, average mesiodistal width of average of maxillary canine and premolar of both side between male and female(Table 4) and Fig 8.

Parameter	Group I	Group II	p-value
Sum of permanent mandibular incisor±SD(mm)	22.65±1.46mm	22.02±1.40mm	<0.001
Sum of incisor+1st molars±SD(mm)	44.30±2.28mm	43.17±2.02mm	<0.0001
Actual average width of maxillary canine and premolars±SD(mm)	20.71± 1.16mm	20.20±1.02mm	<0.0001

Table4: Comparison between groups I and groups II for different combination of teeth.



*- significant

Fig 8: mesiodistal width of sum of incisor, sum of incisor and 1st molar and sum of canine and premolar

Mesiodistal width was higher in males than females for different combinations- sum of mandibular permanent four incisors in group I(22.65±1.46mm) > Group II(22.02±1.40mm). sum of mandibular four incisor and mandibular permanent 1st molar of group I(44.30±2.28mm)> Group II(43.17±2.02mm). actual width of maxillary canine and premolar group I(20.71±1.16mm)> Group II(20.20±1.02mm) and the difference was statistically significant between males and females for all the combinations.

For formulating regression equation(RE) sum of permanent four mandibular incisors and permanent 1st molars was taken as independent variable and average of maxillary canine and premolars of both the sides was taken as dependent variable(Table 5).

Group	Sum of permanent incisors and 1st molars Mean+SD(mm)	Average mesiodistal width of maxillary canine and premolar Mean±SD	Regression equation obtained for present study
I	44.30mm± 2.28mm	20.71±1.15	7.64+0.29x
II	43.17mm± 2.02mm	20.20±1.03	9.82+0.241x

Table 5 : Descriptive statistics for data needed to formulate RE

The mean of mesiodistal width of four permanent mandibular incisors and mandibular first molars of both the sides was 44.30±2.28 mm for Group I and 43.17±2.02 mm for Group II and this was taken as independent variable. The average mesiodistal width of maxillary canine and premolars was 20.71±1.15 mm for Group I and 20.20±1.03 mm for Group II was taken as dependent variable and the equation was formulated for the north Indian population as follows:

For males: Y=7.64+0.29* X(Fig9)

For females: Y=9.82+0.241* X (Fig10)

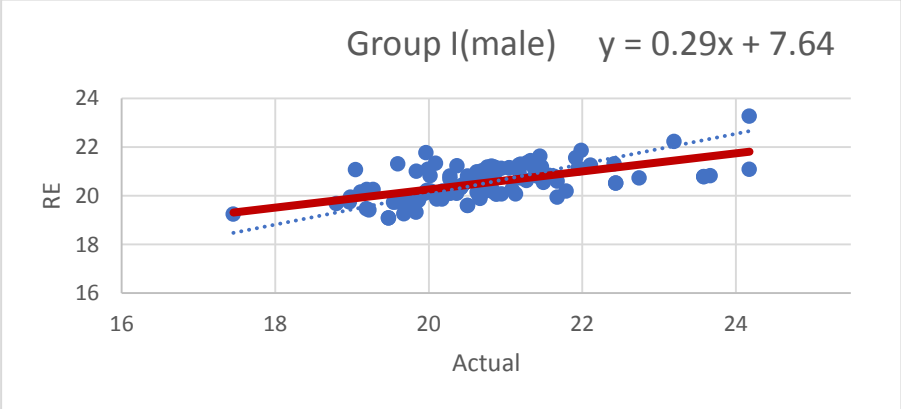


Figure9: correlation between actual and predicted sum of canine and premolars for Group I

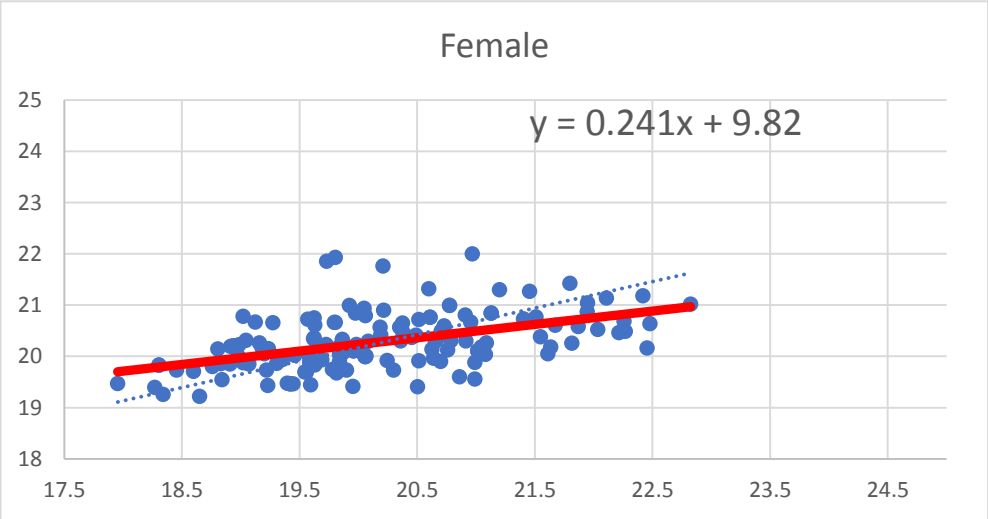


Figure10: correlation between actual and predicted sum of canine and premolars for Group II

The substitution of mesiodistal width of permanent four mandibular incisors and mandibular 1st molars in place of X gave the predicted width of unerupted maxillary canine and premolars for each subject. Table 6 shows mean of predicted mesiodistal width of maxillary canine and premolars as obtained in present study using newly formulated regression equation.

Group	Predicted width of maxillary canine and premolars using regression equation+SD(mm)
I	20.53± 0.71mm
II	20.28± 0.55mm

Table 6. Predicted width of maxillary canine and premolars as per newly formulated Regression equation

For group I the predicted width was 20.53± 0.71mm and for group II the predicted width was 20.28± 0.55mm using the newly formulated regression equation for north Indian population.

For checking the applicability of Moyers prediction table in North Indian population the mean of sum of mandibular incisor was taken and Moyers prediction table for maxillary arch was used to obtain the predicted mesiodistal width of maxillary canine and premolars at 75% probability level (table 7).

Group	Sum of permanent mandibular incisors Mean± SD(mm)	Predicted width of maxillary canine and premolars as per Moyers prediction table Mean ±SD(mm)
I	22.65±1.46mm	21.82±0.74mm
II	22.02±1.40mm	20.90±1.78mm

Table 7: Predicted mesiodistal width of maxillary Canine and premolars as obtained using Moyers prediction table

The sum of four permanent mandibular incisors was found to be 22.65±1.4mm for Group I and 22.02±1.40mm for Group II. Based on this, a predicted width of maxillary canine and premolar, according to Moyers prediction table was 21.82±0.74mm for Group I and 20.90± 1.78 mm for Group II.

Adequate statistical comparison were done to check accuracy of newly formulated regression equation and reliability of Moyers prediction table for our population. Table 8 and Fig11 shows average of actual mesiodistal width of maxillary canine and premolar as well as predicted width of maxillary canine and premolar as obtained by

regression equation and Moyers prediction table. Table 9 shows the comparison of values for the actual and predicted mesiodistal width obtained by regression equation and Moyers prediction table.

Group	Average of actual mesiodistal width of maxillary canine and premolars Mean ± SD (mm)	Predicted width of maxillary canine and premolars using Regression equation Mean ±SD (mm)	Predicted width of maxillary canine and premolar as per Moyers prediction table Mean +SD (mm)	p-value
I	20.71± 1.16mm	20.53±0.71mm	21.82±0.74mm	<0.0001
II	20.20±1.02mm	20.28±0.55mm	20.90± 1.78mm	<0.0001

Table 8: Actual and predicted mesiodistal width of maxillary canine and premolar for group I and Group II

Parameters	Group I (p-value)	Group II (p-value)
Actual v/s predicted width by RE	0.170	0.421
Actual v/s predicted width by Moyers	<0.0001	<0.0001
Predicted width by RE v/s Moyers	0<.0001	0<.0001

Table 9: Comparison of and between the actual and predicted mesiodistal width of maxillary canine and premolar

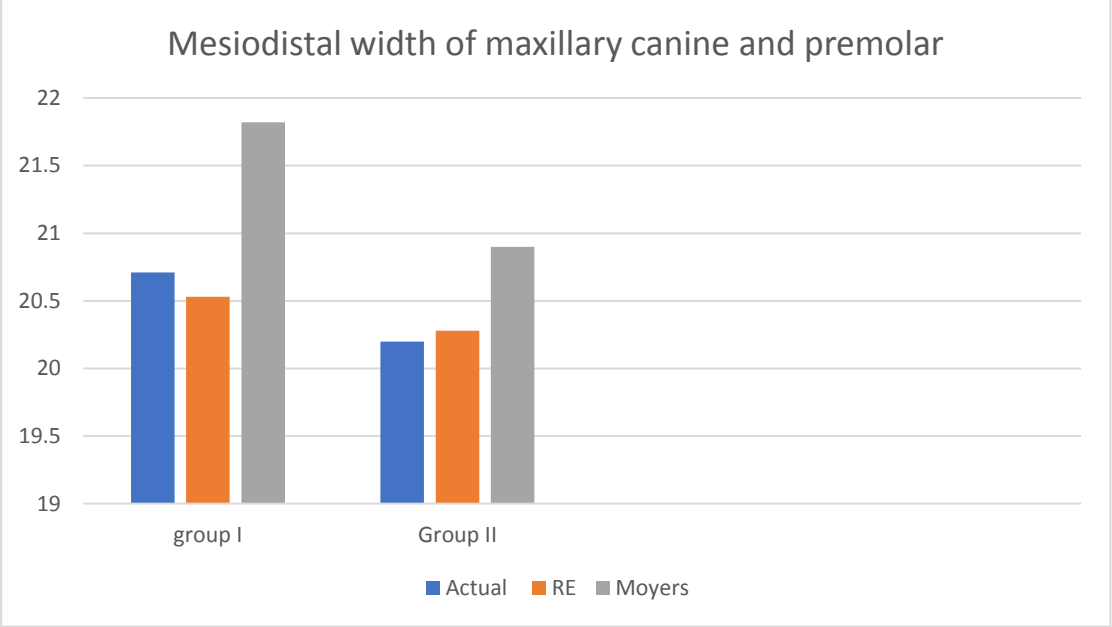


Fig11: Mesiodistal width of actual and predicted width for maxillary canine and premolar of Group I and Group II

For Group I predicted width of maxillary canine and premolar by Moyers prediction table was higher (21.82±0.74mm) and that obtained by the Regression equation (20.53±0.71mm) and it was lesser than average of actual mesiodistal width of maxillary canine and premolar. Overall comparison showed statistically significant difference between them.

On individual comparison, it was seen that predicted width by Regression equation was lesser than actual width, however the difference between them was statistically non-significant. Predicted width by Moyers overestimated in comparison to actual mesiodistal width and the difference was statistically significant. Also predicted width by RE and Moyers prediction table showed statistically significant difference for Group I.

For group II, the predicted width of maxillary canine and premolar by Moyers prediction table was higher (20.90±1.78mm) and that obtained by regression equation

was(20.28±0.55mm) and it was greater than average of actual mesiodistal width of maxillary canine and premolar. Overall comparison showed significant difference between them. On individual comparison, it was seen that predicted width by regression equation was higher than actual width, however the difference between them was statistically non-significant. Predicted width by Moyers overestimated in comparison to actual mesiodistal width and the difference was statistically significant. Also the predicted width by regression equation and Moyers prediction table showed statistically significant difference for group II.

Mixed dentition analysis not only helps in assessing arch length-tooth size discrepancy but also helps in interception of the malocclusion. Amongst various methods used for mixed dentition analysis, radiographic method has an inherent drawback of magnification error, prediction tables under-or overestimate the width in different population group, hence the authenticity of its usage in different groups has been questioned in various studies. Linear regression equation provides an accurate prediction of unerupted tooth based on the mathematical relationship between the independent and dependent variables and are population specific and are universally accepted for its accuracy. Regression equations can be formulated for different population group, thereby negating the racial variation[8,13-16] and are universally accepted.

The correlation of various combinations to be used as independent variable for formulating regression equation had been evaluated and it was found that sum of lower incisors and 1st molars gave best correlation with width of canine and premolars[25,32,34], therefore this particular combination was used in the present study. Sexual dimorphism in tooth size has been shown in various studies[21-23,36] as males tend to have larger tooth size as compared to females. Hence it was decided to formulate regression equation separately for the males and females. Considering this the aim of present study was to formulate regression equation for prediction of sum of unerupted canine and premolar of maxillary arch using sum of mandibular four incisors and mandibular first molar in north Indian population and to check the reliability of Moyers mixed dentition analysis and newly formulated Regression equation for maxillary arch in our population. Also it was decided to evaluate sexual dimorphism in the present study.

A total of 252 subjects in the age range 18-25years with fully erupted teeth were selected for the study divided in two groups. Group I included 124 male subjects with

mean age 20.43± 2.32years and Group II included 128 female subjects with mean age of 20.08±2.21years. All the subjects included in the study had class I molar relation and little to no crowding present(<2mm). As measurements using manual vernier calliper are prone to errors hence all the measurement rounded to nearest 0.01mm were taken using a sliding calliper with electronic vernier scale. All measurements were made along the greatest mesiodistal diameter at the contact point parallel to the occlusal surface of the teeth and also parallel to the vestibular surface of the model[40].

For formulating the regression equation, actual mesiodistal width of erupted maxillary canine and premolars of right and left side, as measured on study models, was compared for differences between the sides for each group. The mean value of actual mesiodistal width of maxillary permanent canine and premolar of right side was 20.82±1.28mm and 20.60±1.21mm for left side for group I. Mean value of actual width of mesiodistal width of maxillary permanent canine and premolar for Group II on left side was 20.21±1.11mm and 20.19±1.13mm for right side. As there was statistically non-significant difference between the values of mesiodistal width of permanent maxillary canine and premolars between right and left side for both the groups, thus the average of both sides was taken for formulating the regression equation as well as for further statistical comparison. Further the sum of mandibular permanent four incisors and first molars were taken for formulating the regression equation as an independent variable. The mean sum of mandibular four permanent incisors and first molars was 44.30±2.28mm for Group I and 43.17±2.02mm for Group II.

Sum of mandibular permanent four incisors was summed for predicting width of maxillary permanent canine and premolar using Moyers prediction table. The mean sum of mandibular four incisors was 22.65±1.46mm for Group I and 22.02±1.40mm for Group II.

Sexual dimorphism was evaluated on different combination -sum of incisors, sum of incisors and first molars and the average width of maxillary canine and premolars of both side between males and females. Mesiodistal width was found to be higher in males than females for different combination -sum of mandibular permanent four incisors (Group I(22.65±1.46mm) >Group II(22.02±1.40mm), sum of mandibular four incisors and mandibular permanent 1st molars(Group I(44.30±2.28mm) > Group II(43.17±2.02mm) and actual width of maxillary canine and premolar for Group I(20.71±1.16mm) >Group II (20.20±1.02mm) and the difference found between males and females was statistically significant for all combinations. Hence separate regression equation were formulated for males and females in the present study.

For formulating regression equation sum of permanent four mandibular incisors and permanent 1st molars was taken as independent variable and average of maxillary canine and premolars of both sides was taken as dependent variable.

The regression equation obtained in the present study was Y=7.64+0.29X for Group I(males) and Y=9.82+0.241X for Group II (females). The substitution of mesiodistal width of permanent four mandibular incisors and mandibular 1st molar in place of X gave the predicted width of maxillary canine and premolars (Y) for each subject.

For checking the applicability of Moyers prediction table in North Indian population the mean sum of mandibular incisors was taken and Moyers prediction table for maxillary arch was used to obtain the predicted mesiodistal width of maxillary canine and premolars at 75% probability level.

Adequate statistical comparisons were done to check the accuracy of newly formulated regression equation and reliability of Moyers prediction table for our population in comparison to actual width of permanent maxillary canine and premolars.

The results of present study suggested that newly formed regression equation for north Indian population was accurate as there was statistically non-significant difference between average of actual width of permanent canine and premolars and predicted width obtained from regression equation. Moyers prediction table was not applicable in our population group as it tends to overestimate the width of maxillary canine and premolars and there was statistically significant difference between the values obtained from Moyers prediction table and to that of actual width and the predicted width from regression equation. For Group I the predicted width of maxillary canine and premolar by Moyers prediction table was higher (21.82± 0.74mm) than the actual width whereas predicted width obtained by regression equation (20.53±0.71mm) which was lesser than the average of actual mesiodistal width of maxillary canine and premolar(20.71±1.16mm). For Group II the predicted width of maxillary canine and premolars by Moyers prediction table was higher (20.90±1.78mm) and also that obtained by regression equation (20.28±0.55mm) was higher than average of actual mesiodistal width of maxillary canine and premolars. For both the groups the difference was statistically significant for predicted width by Moyers v/s actual width and statistically non-significant for predicted width by regression equation to actual width.Also predicted width by regression equation and Moyers prediction table showed statistically significant difference for Group I and Group II.

Similar to present study, studies by Nourallah et al[46] (2001), Shetty RM et al[47] (2019), Shahid F et al[48] (2016), Saloom JE et al[49] (2021), Nahidh M et al[50] (2016), Mittar M et al[51] (2012), Goyal RK et al[35] (2014), Bhatnagar A et al[52] (2017), using same combination and various other studies[21,26,28,32-34,36,38-45] with other combinations showed that linear regression equations are population specific and the accuracy of prediction

of mesiodistal width of canine and premolars by regression equation is highest as compared to various prediction tables.

Nourallah et al[46] (2001) formulated a regression equation to predict the mesiodistal width of unerupted canine and premolars of maxillary and mandibular arch in Syrian population. The study was conducted on 600 subjects. The regression equation thus formulated was Y=5.38+0.50x for maxilla and Y=4.93+0.52X for the mandible. The predictions from their study found regression equation to be more accurate as the standard errors(0.79) were found to lowest among all the prediction tables such as Moyers and Tanaka-Johnston.

Shetty RM et al[47] (2019) with a sample of 800 patients formulated a regression equation to predict the sum of permanent canine and premolars for Chhattisgarh population. The linear regression equation was formulated by the correlation between mandibular permanent central incisors and 1st molar and the canine and premolars of both the segments. The regression equation specific to Chhattisgarh population for maxilla was Y=5.31+0.42X for males and 7.20+0.35X for females. Higher correlation and accuracy was observed in prediction using the newly devised regression equation. Also they observed sexual dimorphism in their study for teeth size.

Shahid et al[48] (2016) proposed a new regression equation for the prediction of mesiodistal width of canine and premolar using the mesiodistal widths of mandibular incisors and first permanent molars in the Pakistani population. The prediction equation for maxillary arch in males(18.224+0.54X) and females(16.186+0.58fX) was calculated separately. They obtained low errors of prediction(-0.708) and high correlation coefficient(r=0.898) for predicted width by regression equation and it was concluded that the newly devised regression equation was a better predictor of Mesiodistal width

of permanent canine and premolar. Also they observed sexual dimorphism in their study for teeth size.

Saloom JE et al[49] (2021), aimed to predict the combined mesiodistal width of permanent canine and premolars. The study was conducted on 120 Iraqi Arab subjects in the age group of 17-25 years. The regression equation developed was Y=11.457+0.329X for males and Y=5.204+0.392X for females. To check the reliability of newly developed regression equation, the actual measurements of canine and premolars were subtracted from the values obtained through regression equation. More than 86% of the values lied in the range of ±2mm that was clinically acceptable. Thus it was concluded that the regression developed was more reliable for application in the Iraqi Arab population. Also sexual dimorphism in their study for teeth size was confirmed.

Nahidh M et al[46] (2016), proposed a new regression equation to predict the mesiodistal width of uneupted maxillary canine and premolar on 110 Iraqi Arab subjects. The Regression equation thus formulated was, Y=13.541±0.417X for males and 16.572±0.362X for females. On comparison of actual width to the predicted width of canine and premolar the difference found to be statistically non-significant. Also sexual dimorphism in the teeth size was seen.

Goyal RK et al[35] (2013) devised separate regression equations for males(2.9+0.40X) and females (Y=0.56+0.45X) for the prediction of width of unerupted canine and premolar of maxillary arch in the north Indian population. Despite of same population, the regression equation formulated in their study was different than ours. This could be because of difference in sample size which was 40 males for their study and 124 males for current study. The female sample was also 40 in their study whereas our study had 128 female subjects. The result however were similar to our study

where there was statistically non-significant difference between the predicted width by regression equation and actual width of maxillary canine and premolars.

Mittar M et al[51] (2012), in their study of 200 subjects from Mulana developed a new regression equation to predict the width of maxillary canine and premolars using the mesiodistal width of mandibular permanent four incisors and 1st molars. The regression equation formulated was Y=17.947+0.572X in males and 12.972+0.664X in females. A non-significant difference was found between the predicted width by regression equation to the actual width of maxillary canine and premolars.

Bhatnagar A et al[52] (2017) in the study formulated a regression equation for 465 subjects of Moradabad city. The newly devised regression equation was developed separately for males(Y=6.63+0.366X) and for females(Y=3.050+0.469X). The predicted value obtained from the newly devised regression equation for the maxillary canine and premolars was closer to the actual mesiodistal width of maxillary canine and premolars.

Overall conclusions from above mentioned studies the results showed a non-significant difference between the actual mesiodistal width of maxillary canine and premolars to that predicted width using newly formulated regression equation specific to that particular population, making it most reliable for use in mixed dentition analysis. Also, sexual dimorphism was observed for combination of tooth size which approves of our findings of statistically significant larger tooth size in males than females. Similar to results of maxillary arch, regression equations devised for mandibular arch also gave accurate predictions with statistical non-significant difference between predicted width and actual width of mandibular canine and premolars.

Using the same independent variable (sum of mandibular incisors and 1st molars) Tikku T et al[32] (2013) proposed a regression equation for mandibular arch for the same population group. The regression equation thus formulated was Y=7.70±0.7386X for males and 13.00±0.6065X for females[32]. The difference between the actual width and predicted width using this newly formulated regression equation was statistically non-significant and Moyers prediction table was not applicable for north Indian population.

The applicability of Moyers prediction table was checked in the present study. It was found that Moyers prediction table overestimated the width of maxillary canine and premolars for both males and females. The difference between the actual and predicted width was statistically significant for both males($p<0.0001$) and also for females($p<0.0001$). the same conclusion was found in studies of Nahidh M(2016) in Iraqi, Goyal(2014) north Indian population, Tikku(2013) et al north Indian population, Legovic M(2003) for Zagreb population.

Few studies[35,46,47], have also checked the validity of Tanaka-Johnston prediction table in their respective population group and reported an overestimation of tooth size. However Nahidh(2016) in his study reported a positive correlation between the actual width and predicted width from regression equation to that of predicted from Tanaka-Johnston suggestive of applicability of Tanaka-Johnston for their Iraqi Arab population[50].

It can be concluded that our newly devised regression equation for prediction of maxillary canine and premolars gives the most accurate result for the prediction of maxillary canine and premolars specifically for north Indian population using the combination of sum of permanent mandibular incisors and 1st molars and can be considered as

the best available method for mixed dentition analysis. The prediction accuracy of Hixon-Oldfather was also good but it required measurement of mesiodistal width of unerupted teeth in radiograph and compare it to true and apparent width of teeth i.e. erupted in patient mouth(true width) and it's width on radiograph(apparent width). However, the problem was undesired radiographic exposure for children. Regression equations are used because of their simplicity, non-hazardous nature and accuracy. This newly devised regression equation can be used with ease and without any requirement of software or equipment and also the need to use tables is negated.

The prediction of Unerupted canine and premolar are of significant use in the Mixed dentition analysis for that it will help in diagnosis, space maintenance and treatment planning by the orthodontists. An early diagnosis of space deficiency allows us to start interceptive or preventive therapy as early as mixed dentition stage where the jaws are still growing.

Further studies should be directed at testing the regression equation for a larger sample size which is far more representative so that the validity, applicability and consistency of this regression equation can be evaluated.

This study was conducted in the department of Orthodontics and dentofacial orthopaedics on 252 subjects divided in 2 groups-Group I(n=124 males) and GroupII(n=-128 females) with an aim of formulating a linear regression equation for males and females of north Indian origin to predict the mesiodistal width of unerupted maxillary canine and premolar using the combination of permanent four mandibular incisors and permanent 1st molars of both sides and checking its reliability for our population. Also, applicability of Moyers prediction table and sexual dimorphism was evaluated in the present study.

Following conclusions can be derived on the basis of results obtained from the study

1. Sexual dimorphism was seen for various combinations (mandibular permanent four incisors, mandibular permanent four incisors and 1st molars and maxillary canine and premolars) with males having significantly higher tooth sizes than females. Hence separate regression equation formulated for males and females.
2. The regression equation derived for the north Indian population is as follows

   Y=7.64+0.29* X for group I (males)

   Y=9.82+0.241* X for group II(females)

   Here,

   X is the independent variable (sum of permanent four mandibular incisors and 1st molars of both sides)

   Y is the dependent variable (sum of width of unerupted canine and premolars)
3. The difference between the actual sum of unerupted canine and premolar to that of predicted value from our regression equation was accurate for prediction of mesiodistal width of maxillary canine and premolars of north

Indian population as difference between the predicted and actual width was statistically non-significant.

4. Moyers prediction table was not applicable for our population as difference between predicted width by Moyers showed statistically significant difference with actual width.
5. Racial variation was seen for tooth size as predicted width by regression devised for north Indian population showed statistically significant difference with predicted width by Moyers(originally made for Caucasian population).

To conclude linear regression equation gave the best result for prediction of unerupted canine and premolar and is significant use in the Mixed dentition analysis. It will help in early diagnosis of space deficiency thereby allowing us to start interceptive or preventive therapy as early as mixed dentition stage where the jaws are still growing.

Further studies should be directed at testing the regression equation for a larger sample size which is far more representative so that the validity, applicability and consistency of this regression equation can be evaluated.

Mixed dentition space analysis is an important aspect of diagnosis and treatment planning in orthodontic practice. Thus this necessitates an accurate and consistent tool for prediction of unerupted canine and premolars in either of the jaw in the mixed dentition stage for early identification and necessary interception of any potential malocclusion occurring to ensure proper growth and development of facial structure including the jaw and dentition. Mixed dentition analysis acts as guide of treatment planning and any of the available treatment plan can be selected such as serial extraction, guidance of eruption, space maintenance or periodic evaluation of the patient. Various methods have been proposed for this analysis of space such as radiographic method, prediction tables, combination of table and radiograph, and linear regression equation. The radiographic method has an inherent problem of magnification of images which leads to inaccurate reading whereas prediction tables, because it was developed for a specific population group, does not have universal applicability and accuracy. All of these issues are solved by regression equation which is a simple mathematical formula developed for a particular population group. Considering this, the aim of this study was to formulate regression equation for prediction of sum of unerupted canine and premolar of maxillary arch using sum of mandibular four incisors and mandibular first molar in north Indian population and to check the reliability of Moyers mixed dentition analysis and newly formulated Regression equation for maxillary arch in our population. Also it was decided to evaluate sexual dimorphism in the present study.

The sample for the study included study models of maxillary and mandibular arch of 252 subjects in the age range of 18-25 years obtained from the patients of OPD of Babu Banarasi Das college of Dental Sciences, Lucknow. The sample was equally divided in 2 groups- Group 1 Included 124 male subjects with

mean age 20.43±2.32 years and Group 2 Included 128 females with mean age of 20.08±2.21 years. Subjects were included based on the criteria that they were of north Indian origin, with class I molar relation, and no or little crowding(<2mm) present. Any subject with any anomaly of tooth or with rotated and crowded arches were excluded from the study. Approval of the Ethical committee was taken before start of the study. After obtaining the study model the process of measuring the values started. Measurements of all the required teeth were taken using a sliding caliper with electronic vernier scale(aerospace 2000) along the greatest mesiodistal diameter at the contact point parallel to the occlusal surface of the teeth and also to the vestibular surface of the model. The teeth measured were mandibular permanent four incisors, mandibular permanent 1^{st} molars of both side, maxillary permanent canines and premolars of both sides. When the combinations of teeth(sum of incisors, sum of permanent four mandibular incisors and 1^{st} molars and sum of maxillary canine and premolars) were compared between males and females, a statistically significant difference was observed between these two and it was seen that males had significantly larger tooth size than females, confirming the sexual dimorphism in tooth size. Hence a separate regression equation was formulated for both males and females. The mesiodistal width of maxillary canine and premolar for right and left side was compared statistically and a non-significant difference was seen. Hence the average of mesiodistal width of maxillary canine and premolar was taken and used as dependent variable for the study. Using the dependent and independent variables a regression equation was formulated for the prediction of mesiodistal width of maxillary canine and premolar separately for males and females. The regression equation obtained for males was Y=7.64±0.29X and for females Y=9.82±0.241X. Here, Y is the predicted width of maxillary canine and premolars and X is the sum of

mesiodistal width of mandibular permanent four incisors and 1st molars. The value of X was substituted to find the predicted value. The applicability of Moyers prediction table at 75% probability was evaluated in the present study where it was found that Moyers prediction table overestimated the size of maxillary canine and premolars for both males and females. The combination of mandibular permanent four incisors and 1st molars was used as independent variable for the prediction of sum of maxillary canine and premolars. a comparison was done to check the applicability of newly formed regression equation to that of actual width. The actual value of average of sum of mesiodistal width of maxillary canine and premolars was compared to the predicted value given by regression equation and Moyers prediction table. All the data was tabulated and adequate statistical comparison were made. Following conclusions can be thus made from the present study,

1. Sexual dimorphism was seen for various combinations(mandibular permanent four incisors, mandibular permanent four incisors and 1st molars and maxillary canine and premolars) with males having significantly higher tooth sizes than females. Hence separate regression equation was formulated for males and females.
2. The regression equation derived for the north Indian population is as follows

   Y=7.64+0.29* X for group I (males)

   Y=9.82+0.241* X for group II(females)

   Here,

   X is the independent variable (sum of permanent four mandibular incisors and 1st molars of both sides)

   Y is the dependent variable (sum of width of unerupted canine and premolars)

3. The regression equation formulated in this study is accurate to predict the mesiodistal width of maxillary canine and premolars as the difference between actual and predicted value by regression equation were statistically non-significant.
4. Moyers prediction table was not applicable for our population as difference between predicted width by Moyers showed statistically significant difference with actual width.
5. Racial variation was seen for tooth size as predicted width by regression devised for north Indian population showed statistically significant difference with predicted width by Moyers(originally made for Caucasian population).

It can now be said that our newly devised regression equation for prediction of maxillary canine and premolars gives the most accurate result for the prediction of maxillary canine and premolars specifically in the north Indian population using the combination of sum of permanent mandibular incisors and 1st molars and can be considered the best available method for prediction which have been previously evaluated. The Moyers prediction table has been found ineffective in the current study for the north Indian population. Also a significant sexual dimorphism was observed in the present study for various combinations of teeth. However, This regression equation should be tested for a larger sample size which is far more representative so that the validity, applicability and consistency of this regression equation can be evaluated.

The prediction of Unerupted canine and premolar are of significant use in the Mixed dentition analysis for that it will help in diagnosis, space maintenance and treatment planning by the orthodontists. An early diagnosis of space deficiency allows us to

start interceptive or preventive therapy as early as mixed dentition stage where the jaws are still growing.

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BABU BANARASI DAS COLLEGE OF DENTAL SCIENCES (FACULTY OF BBD UNIVERSITY), LUCKNOW

INSTITUTIONAL RESEARCH COMMITTEE APPROVAL

The project titled **"A New Regression Equation for Prediction of Width of Unerupted Canine and Premolars of Maxillary Arch in North Indian Population"** submitted by **Dr Deepak Chandra** Post graduate student from the **Department of Orthodontics and Dentofacial Orthopaedics** as part of MDS Curriculum for the academic year 2019-2022 with the accompanying proforma was reviewed by the Institutional Research Committee present on **19th December 2019** at BBDCODS.

The Committee has granted approval on the scientific content of the project. The proposal may now be reviewed by the Institutional Ethics Committee for granting ethical approval.

Prof. Vandana A Pant
Co-Chairperson

Prof. B. Rajkumar
Chairperson

Babu Banarasi Das University
Babu Banarasi Das College of Dental Sciences,
BBD City, Faizabad Road, Lucknow – 226028 (INDIA)

Dr. Lakshmi Bala
Professor and Head Biochemistry and
Member-Secretary, Institutional Ethics Committee

Communication of the Decision of the VIII[th] Institutional Ethics Sub-Committee

IEC Code: 05 **BBDCODS/03/2020**

Title of the Project: A New Regression Equation for Prediction of Width of Unerupted Canine and Premolars of Maxillary Arch in North Indian Population.

Principal Investigator: Dr. Deepak Chandra **Department:** Orthodontics & Dentofacial Orthopaedics

Name and Address of the Institution: BBD College of Dental Sciences Lucknow.

Type of Submission: New, MDS Project Protocol

Dear Dr. Deepak Chandra,

The Institutional Ethics Sub-Committee meeting comprising following four members was held on 18[th] March, 2020.

1.	Dr. Lakshmi Bala Member Secretary	Prof. and Head, Department of Biochemistry, BBDCODS, Lucknow
2.	Dr. Amrit Tandan Member	Prof. & Head, Department of Prosthodontics and Crown & Bridge, BBDCODS, Lucknow
3.	Dr. Sahana S. Member	Reader, Department of Public Health Dentistry, BBDCODS, Lucknow
4.	Dr. Sumalatha M.N. Member	Reader, Department of Oral Medicine & Radiology, BBDCODS, Lucknow

The committee reviewed and discussed your submitted documents of the current MDS Project Protocol in the meeting.

The comments were communicated to PI thereafter it was revised.

Decisions: The committee approved the above protocol from ethics point of view.

Forwarded by:

Lakshmi Bala 18/03/20

(Dr. Lakshmi Bala)
Member-Secretary
IEC

Member-Secretary
Institutional Ethic Committee
BBD College of Dental Sciences
BBD University
Faizabad Road, Lucknow-226028

(Dr. B. Rajkumar)
Principal
BBDCODS

PRINCIPAL
Babu Banarasi Das College of Dental Sciences
(Babu Banarasi Das University)
BBD City, Faizabad Road, Lucknow-226028

Babu Banarasi Das College of Dental Sciences
(A constituent institution of BabuBanarasi Das University)
BBD City, Faizabad Road, Lucknow – 227105 (INDIA)

Participant Information Document (PID)

1. **Study title**

   A NEW REGRESSION EQUATION FOR PREDICTION OF WIDTH OF UNERUPTED CANINE AND PREMOLARS OF MAXILLARY ARCH IN NORTH INDIAN POPULATION.

2. **Invitation paragraph**

   You are being invited to take part in a research study. It is therefore important for you to understand why the study is being done and what it will involve. Please take time to read the following information carefully. Ask us for any clarifications or further information. Whether or not you wish to take part is your decision.

3. **What is the purpose of the study?**

   The purpose of this study is to make regression for correlation between mesiodistal width of incisors and molars to that of sum of mesiodistal width of canine and premolars so that the treatment can be started early.

4. **Why have I been chosen?**

   You have been chosen for this study as you are fulfilling the required criteria for this study.

5. **Do I have to take part?**

   Your participation in the research is entirely voluntary. If you do, you will be given this information sheet to keep and will be asked to sign a consent form. During the study you still are free to withdraw at any time and without giving a reason.

6. **What will happen to me if I take part?**

   You will have to give dental impression of your upper and lower jaw.

7. **What do I have to do?**

   You will have to give dental impression of your upper and lower jaw.

8. **What is the procedure that is being tested?**

   A new regression equation will be made to predict the width of unerupted canine and premolar.

9. **What are the interventions for the study?**

   Impression of upper and lower jaw will be taken taken .

10. **What are the side effects of taking part?**

    There are no side effects on patients of this study.

11. **What are the possible disadvantages and risks of taking part?**

    There are no risks or disadvantages of taking part in this study.

12. **What are the possible benefits of taking part?**

    No benefits or side effect of the study to the person taking part in it.

13. **What if new information becomes available?**

    If additional information becomes available during the course of the research you will be told about these and you are free to discuss it with your researcher, your researcher will tell you whether you want to continue in the study. If you decide to withdraw, your researcher will make arrangements for your withdrawal. If you decide to continue in the study, you may be asked to sign an updated consent form.

14. **What happens when the research study stops?**

There is no such procedure involved so no chance of anything going wrong.

15. **What if something goes wrong?**

    If any severe adverse event occurs, or something goes wrong during the study, the complaints will be handled by reporting to the institution (s), and Institutional ethical committee.

16. **Will my taking part in this study be kept confidential?**

    Yes it will be kept confidential.

17. **What will happen to the results of the research study?**

    Result is the sole property of the Department of the Orthodontics BBDCODS

Lucknow. Your identity will be kept confidential in case of any report/publications.

18. Who is organizing the research?

This research study is organized by Department of Orthodontics and Dentofacial
Orthopaedics, BBDCODS Lucknow.

19. Will the results of the study be made available after study is over?

Yes.

20. Who has reviewed the study?

The study has been reviewed and approved by the Guide, Head of the Department of Orthodontics and Dentofacial Orthopaedics, and the (IEC) (IRC) of the institution.

Contact for further information

Dr. Deepak Chandra
PG student
Department of Orthodontics and
Dentofacial Orthopedics
BabuBanarasi College of Dental
Sciences.
Lucknow-226028
Email id: Deepak.c.yadav@gmail.com
Mob - 8544336176

Dr. Lakshmi Bala,
Member Secretary IEC
Babu Banarasi College of
Dental Sciences.
Lucknow
bbdcods.iec@gmail.com

Signature of PI……
Name……
Date ……

बाबू बनारसी दास कॉलेज ऑफ़ डेंटल साइंस

(बाबू बनारसी दास विश्व विद्यालय के एक घटक संस्था)

बीबीडी सिटी, फैजाबाद रोड, लखनऊ - 227105

(भारत)

प्रतिभागी जानकारी दस्तावेज़ (पीआईडी)

1. अध्यन्न शीर्षक :

उत्तर भारत की आबादी में मैक्सिलरी आर्क की दूध का दांत **कैनाइन तथा प्रिमोलर की चौड़ाई** पूर्वानुमान करने के लीये नया इक्वेषन बनानां

2. निमंत्रण पैरा

आपको इस शोध में भाग लेने के लिए आमंत्रित किया जा रहा है, इसलिए यह समझना आवश्यक है की यह अध्यन्न क्यों किया जा रहा है और इसमें क्या शामिल होगा । कृपया निम्न जानकारी को सावधानी पूर्वक पढ़ें । किसी भी स्पष्टीकाण के लिए हमें पूछे । आप भाग लेना चाहते है या नहीं आपका निर्णय है ।

3. अध्यन्न का उद्देश्य क्या है ?

दूध का दांत **कैनाइन तथा प्रिमोलर की चौड़ाई** पूर्वानुमान करने के लीये नया इक्वेषन बनानां

4. मैं क्यों चुना गया हूँ ?

आपको इस अध्यन्न के लिए चुना गया है क्यूंकि, आप इस अध्यन्न के लिए आवश्यक मापदंडो को पूरा कर रहे है ।

5. क्या इसमें मुझे भाग लेना चाहिए?

अनुसंधान के छेत्र में आपकी भागीदारी पूरी तरह स्वैछिक है। यदि आप करते है तो आपको इस जानकारी को रखने के लिए पत्र दिया जायेगा और एक सहमित पत्र पर हस्ताक्षर करने के लिए कहा जाएगा। अध्यन्न के दौरान आप कभी भी किसी भी समय और बिना कारण दिए वापस लेने के लिए स्वतंत्र हैं ।

6. क्या होगा यदि मैं इस अध्यन्न में भाग लेता हूँ ?

ऊपरी और निचले जबड़े की छाप देना होगा।

7.मुझे क्या करना होगा?

आपको अध्ययन की जांच के लिए अपनी नियमित जीवन शैली बदलने की ज़रूरत नही है ।

8. किस प्रक्रिया का परीक्षण किया जा है ?

कैनाइन तथा प्रिमोलर की चौड़ाई पूर्वानुमान करने

9. इस शोध में कौन से हस्तक्षेप दिए जायेंगे ?

ऊपरी और निचले जबड़े की छाप

10 इस अध्यन्न में भाग लेने का क्या दुष्प्रभाव है ?

इस अध्यन्न के मरीजो पर कोई दुष्प्रभाव नही होते है ।

11. इस अध्यन्न में भाग लेने के संभावित जोखिम और नुक्सान क्या है?

इस अध्यन्न में भाग लेने में कोई जोखिम या संभावित नुकसान नही है ।

12. भाग लेने के संभावित लाभ क्या है ?

इस अध्ययन में भाग लेने का कोई लाभ या हानि नहीं है

13. यदि कोई नयी जानकारी उपलब्ध हो जाती है ?

यदि अनुसंधान के दौरान अतिरिक्त जानकारी उपलब्ध हो जाती है तो आपको इनके बारे में बताया जाएगा और आप अपने शोधकर्ता के साथ चर्चा करने के लिए स्वतंत्र हैं, आपका शोधकर्ता आपको बताएगा कि क्या आप अध्ययन को जारी रखना चाहते हैं। यदि आप तय

करते हैं तो वापस लेने, आपका शोधकर्ता आपके वापसी के लिए व्यवस्था करेगा अगर तुम अध्ययन में जारी रखने का निर्णय लेते हैं, तो आपको एक अद्यतन सहमति फॉर्म पर हस्ताक्षर करने के लिए कहा जा सकता है।

14. जब शोध अध्यन्न बंद हो जाता है तो क्या होता है?

अध्यन्न बंद हो जाता है / निर्धारित समय से पहले ख़त्म हो जाता है मरीज / स्वयंसेवक के लिए समझाया जाएगा ।

15. क्या कुछ गलत हो सकता है?

ऐसा होने की कोई संभावना नहीं है

16. इस अध्ययन में मेरे हिस्से को गोपनीय रखा जाएगा?

हाँ, यह गोपनीय रखा जाएगा।

17. शोध अध्ययन के परिणामों का क्या होगा?

परिणाम ऑर्थोडान्टिक्स और डेंटोफेसियल ऑर्थोपेडिक्स दन्त चिकित्सा विज्ञानं के बाबू बनारसी दास कॉलेज लखनऊ के विभाग की कॉपी है । किसी भी रिपोर्ट/प्रकाशन के मामले में आपकी पहचान को गोपनीय रखा जाएगा।

18. जो अनुसंधान का आयोजन किया जाता है?

यह शोध अध्ययन ऑर्थोडैंटिक्स और डेंटोफेसियल विभाग दन्त चिकित्सा विज्ञानं के बाबू बनारसी दास कॉलेज लखनऊ द्वारा आयोजित किया जाता है।

19. क्या अध्ययन ख़त्म हो जाने बाद अध्ययन के परिणामों को उपलब्ध कराया जाएगा ?

हाँ।

20. कौन अध्ययन की समीक्षा किया है?

अध्ययन की समीक्षा गाइड ने की है और ऑर्थोडान्टिक्स और डेंटोफेसियल ऑर्थोपेडिक्स विभाग के प्रमुख ने, संस्था की आईईसी और आईआरसी ने मंजूरी दे दी है, ।

21. अधिक जानकारी के लिए संपर्क

डॉ. दीपक चन्द्रा

पीजी छात्र
ऑर्थोडान्टिक्स और डेंटोफेसियल ऑर्थोपेडिक्स विभाग
बाबू बनारसी दास कॉलेज ऑफ़ डेंटल साइंस
लखनऊ-226028
Email id deepak.c.yadav@gmail.com
Mob- 8544336176

डॉ लक्ष्मी बाला,
सदस्य सचिव आईईसी
बाबू बनारसी दास कॉलेज ऑफ़ डेंटल साइंसेज
लखनऊ- 226028
bbdcods.iec@gmail.com

पीआई के हस्ताक्षर .....।
नाम .....
तारीख__

Babu Banarasi Das College of Dental Sciences

(Babu Banarasi Das University)
BBD City, Faizabad Road, Lucknow – 227105 (INDIA)

Consent Form (English)

Title of the Study: A NEW REGRESSION EQUATION FOR PREDICTION OF WIDTH OF UNERUPTED CANINE AND PREMOLARS OF MAXILLARY ARCH IN NORTH INDIAN POPULATION.

Study Number……..
Subject's Full Name…….
Date of Birth/Age ,
……
Address of the Subject…….
Phone no. and e-mail address……
Qualification ……
Occupation: Student / Self Employed / Service / Housewife/
Other (Please tick as appropriate)
Annual income of the Subject……
Name and of the nominees(s) and his relation to the subject…… (For the purpose of
compensation in case of trial related death).

1. I confirm that I have read and understood the Participant Information Document dated ……..for the above study and have had the opportunity to ask questions. **OR** I have been explained the nature of the study by the Investigator and had the opportunity to ask questions.

2. I understand that my participation in the study is voluntary and given with free will without any duress and that I am free to withdraw at any time, without giving any reason and without my medical care or legal rights being affected.
3. I understand that the sponsor of the project, others working on the Sponsor's behalf, the Ethics Committee and the regulatory authorities will not need my permission to look at my health records both in respect of the current study and any further research that may be conducted in relation to it, even if I withdraw from the trial. However, I understand that my Identity will not be revealed in any information released to third parties or published.
4. I agree not to restrict the use of any data or results that arise from this study provided such a use is only for scientific purpose(s).

Yes [ ] No [ ] Not Applicable [ ]

6. I agree to participate in the above study. I have been explained about the complications and side effects,

if any, and have fully understood them. I have also read and understood the participant/volunteer's

Information document given to me.

Signature (or Thumb impression) of the Subject/Legally Acceptable Representative:……..

Signatory's Name……. Date …….

Signature of the Investigator…… Date……..

Study Investigator's Name..... Date……..

Signature of the witness…… Date……..

Name of the witness……

Received a signed copy of the PID and duly filled consent form

Signature/thumb impression of the subject or legally Date……..

Acceptable representative

APPENDIX-IV

Babu Banarasi Das College of Dental Sciences

(Babu Banarasi Das University)
BBD City, Faizabad Road, Lucknow – 227105 (INDIA)

,

सहमति पत्र

अध्ययन का शीर्षक :- **उत्तर भारत की आबादी में** मैक्सिलरी आर्क की दूध का दांत **कैनाइन तथा प्रिमोलर की चौड़ाई** पूर्वानुमान करने के लीये नया इक्वेषन बनाना

अध्ययन संख्या ....
विषय का पूरा नाम .....
जन्म की तारीख / आयु .....
विषय का पता .....
फोन नंबर। और ई-मेल पता .....
योग्यता .....
व्यवसाय: छात्र / स्वयं कार्यरत / सेवा / गृहिणी / अन्य (कृपया उचित के रूप में चिह्नित करें)
विषय की वार्षिक आय .....
नाम और नामांकित व्यक्ति (नाम) और उनके विषय के संबंध में ..... (प्रयोजन के लिए मुकदमा संबंधित मौत के मामले में मुआवजे)

1. मैं पुष्टि करता हूं कि मैंने प्रतिभागी सूचना दस्तावेज को पढ़ लिया है और समझ लिया है .... इसके बाद के अध्ययन के लिए और सवाल पूछने का अवसर मिला है। या मुझे अन्वेषक द्वारा अध्ययन की प्रकृति समझाई गई है और सवाल पूछने का अवसर मिला है।
2. मैं समझता हूं कि अध्ययन में मेरी भागीदारी स्वैच्छिक है और बिना किसी दबाव के स्वतंत्र इच्छा के साथ दी गई है और किसी भी कारण के बिना किसी भी समय बिना किसी मेडिकल देखभाल या कानूनी अधिकारों को प्रभावित किए बिना किसी भी समय मैं वापस लेने के लिए स्वतंत्र हूं।
3. मैं समझता हूं कि इस परियोजना के प्रायोजक, प्रायोजक की ओर से काम करने वाले अन्य लोग, एथिक्स कमेटी और नियामक प्राधिकरणों को मेरे मौजूदा अध्ययन के संबंध में अपने स्वास्थ्य के रिकार्ड को देखने की मेरी अनुमति की आवश्यकता नहीं है और आगे की शोध इसके संबंध में आयोजित किया जा सकता है, भले ही मैं परीक्षण से वापस ले जाऊं। हालांकि,

मैं समझता हूं कि मेरी पहचान तीसरी पार्टी के लिए जारी किसी भी जानकारी या प्रकाशित में प्रकट नहीं होगी।

4. मैं इस अध्ययन से उत्पन्न किसी भी डेटा या परिणामों के उपयोग को प्रतिबंधित करने के लिए सहमत नहीं हूं एक प्रयोग केवल वैज्ञानिक उद्देश्य (प्रयोजनों) के लिए है
5. भविष्य के अनुसंधान के लिए मैं संग्रहीत नमूने (दांत / ऊतक / रक्त) का उपयोग करने की अनुमति देता हूं हाॅं नही [ ]
6. मैं उपरोक्त अध्ययन में भाग लेने के लिए सहमत हूं। मुझे जटिलताओं और साइड इफेक्ट्स, यदि कोई हो, के बारे में समझाया गया है और उन्हें पूरी तरह से समझा है। मैंने प्रतिभागी /स्वयंसेवक के सूचना दस्तावेज को भी पढ़ा और समझ लिया है

प्रतिनिधि: ....

हस्ताक्षरकर्ता का नाम ..... तारीख .....।

अन्वेषक के हस्ताक्षर ..... दिनांक ....

अध्ययन अन्वेषक का नाम ..... दिनांक ....

गवाह के हस्ताक्षर ..... दिनांक ....

गवाह का नाम .....

पीआईडी की एक हस्ताक्षरित प्रति और विधिवत भरी सहमति फॉर्म प्राप्त किया विषय के हस्ताक्षर / अंगूठे का प्रभाव या कानूनी तौर पर दिनांक ....

स्वीकार्य प्रतिनिधि

Curiginal

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SA	**7. REVIEW OF LITERATURE gayu.docx** Document 7. REVIEW OF LITERATURE gayu.docx (D93182773)	2

Column1	Column2	Column3	Column4	Column5	Column6	Column7	Column8	Column9	Column10	Column11	Column13	Column14	Column12	Column15	Md I+1M	15+14+13	23+24+25	SI	Actual	Moyers	RE
s.no	Name	Age/ gender	15	14	13	23	24	25	31	32	41	42	36	46	228	42	72	146	57	.....	.....
1	Prakhar	18/male	5.07	6.75	7.92	7.89	6.71	5.72	6.01	6.13	5.63	6.1	9.91	9.55	43.33	19.74	20.32	23.87	20.03	22.5	20.2
2	Darshita	23/ Female	5.83	7.14	7.67	7.63	6.67	5.81	5.38	5.8	5.37	5.87	11.29	11.25	44.96	20.64	20.11	22.42	20.375	21.2	20.65
3	Pushpa	20/Female	5.55	6.93	7.33	5.31	5.96	7.06	4.46	5.33	4.62	5.21	10.98	11.04	41.64	19.81	18.33	19.62	19.07	20.4	19.85
4	Ankita devi	19/female	5.1	7.4	7.17	7.2	6.43	4.95	5.17	5.45	5.8	5.9	11.47	11.27	45.06	19.67	18.58	22.32	19.125	21.2	20.67
5	Priya	28/female	5.93	6.15	7.23	7.2	6.4	6.26	4.83	5.25	4.94	5.61	10.89	10.73	42.25	19.31	19.86	20.63	19.585	20.6	20.001
6	Vishwajeet	18/male	6.21	7.02	7.9	7.38	7.49	6.1	6.07	6.25	5.6	6.38	11.32	10.96	46.58	21.13	20.97	24.3	21.05	22.8	21.14
7	Anuj singh	22/male	5.92	6.84	7.7	7.33	6.76	6.28	5.51	5.33	5.51	5.92	10.93	10.61	43.81	20.46	20.37	22.27	20.415	21.5	20.344
8	Tausif	18/male	5.45	6.32	7.79	8.11	6.34	6.03	5.87	6.3	5.6	6.48	10.58	10.66	45.49	19.56	20.48	24.25	20.02	22.5	20.832
9	Samar Singh	18/male	6.46	6.6	7.86	7.53	6.74	5.83	5.26	5.2	5.18	5.42	10.25	9.95	41.26	20.92	20.1	21.06	20.51	21	19.6
10	Sweety	18/female	5.17	6.56	6.74	6.82	6.12	5.89	3.86	4.48	5.25	4.45	10.64	10.32	39	18.47	18.83	18.04	18.65	20.4	19.219
11	Rakesh	18/male	6.33	6.4	7.18	7.24	6.25	5.56	4.97	5.14	5.4	5.35	9.48	9.16	39.5	19.91	19.05	20.86	19.48	20.3	19.095
12	Shalini	16/Female	6.58	6.2	7.65	7.32	6.74	6.11	4.89	5.19	4.57	5.62	10.45	10.42	41.14	20.43	20.17	20.27	20.3	20.6	19.734
13	Pravin kumar	25/male	7.02	6.33	7.61	7.94	5.87	5.21	5.57	6.41	5.81	5.81	11.39	11.39	46.38	20.96	19.02	23.6	19.99	22.3	21.09
14	Poonam yadav	23/Female	6.13	6.25	7.03	6.84	5.87	6.32	5.12	5.17	4.68	5.02	10.6	10.54	41.13	19.41	19.03	19.99	19.22	20.5	19.73
15	Geeta gautam	18/female	4.99	6.8	7.77	7.56	6.42	5.3	4.63	5.85	4.58	5.85	9.6	9.49	40	19.56	19.28	20.91	19.42	20.8	19.46
16	Bilkis bano	24/Female	7	6.3	7.6	7.91	5.84	5.2	5.54	6.4	5.83	5.8	11.4	11.38	46.35	20.9	18.95	23.57	19.925	21.5	20.99
17	Sunny kumar	19/male	6.46	6.6	7.86	7.53	6.74	5.83	5.26	5.2	5.18	5.42	10.25	9.95	41.26	20.92	20.1	21.06	20.51	21	19.605
18	Rizwana	23/Female	5.72	5.83	7.62	7.35	6.18	5.62	5.23	5.89	5.1	5.33	10.79	10.99	43.33	19.17	19.15	21.55	19.16	20.4	20.26
19	Shikha tripathi	20/Female	6.04	6.56	6.85	6.9	6.66	6.6	4.45	5.67	6.21	5.56	9.3	10.57	41.76	19.45	20.16	21.89	19.805	21	21.93
20	Amarjeet	18/male	6.21	7.02	7.9	7.38	7.49	6.1	6.07	6.25	5.6	6.38	11.32	10.96	46.58	21.13	20.97	24.3	21.05	22.8	21.148
21	Ruby	20/Female	5.2	6.17	7.75	7.63	6.24	4.88	5.01	5.37	4.75	5.44	11.39	11.14	43.1	19.12	18.75	20.57	18.935	20.6	20.207
22	Shalini	18/female	6.37	6.14	7.75	6.81	6.88	6.47	4.77	5.21	4.36	5.59	10.39	10.22	40.54	20.26	20.16	19.93	20.21	20.5	21.76
23	Rashmi yadav	23/Female	6.28	6.5	7.02	7.21	6.26	6.19	5.01	5.65	4.92	4.97	10.56	10.38	41.49	19.8	19.66	20.55	19.73	20.6	21.852
24	Daksh	20/male	6.59	8.26	9.72	8.75	7.83	7.21	5.62	6.81	5.54	6.81	10.45	11.15	46.38	24.57	23.79	24.78	24.18	23	23.27
25	Yukti singh	21/Female	5.24	6.34	7.83	7.49	6.7	5.85	5.37	5.64	5.43	5.7	10.46	10.6	43.2	19.41	20.04	22.14	19.725	21	20.23
26	Anjali rawat	19/Female	6.46	6.66	7.25	7.07	6.59	5.6	4.95	5.48	5	5.67	9.82	9.98	40.9	20.37	19.26	21.1	19.815	20.8	19.676
27	Raushan	19/male	6.33	6.4	7.18	7.24	6.25	5.56	4.97	5.14	5.4	5.35	9.48	9.16	39.5	19.91	19.05	20.86	19.48	20.8	19.095
28	Rahul singh	22/male	5.94	6.84	7.71	7.33	6.74	6.28	5.52	5.33	5.51	5.91	10.89	10.62	43.78	20.49	20.35	22.27	20.42	21.8	20.336
29	Saurav kumar	21/male	6.28	6.5	7.02	7.21	6.26	6.19	5.01	5.65	4.92	4.97	10.56	10.38	41.49	19.8	19.66	20.55	19.73	20.8	19.67
30	Rajnish	20/male	5.92	6.84	7.7	7.33	6.76	6.28	5.51	5.33	5.51	5.92	10.93	10.61	43.81	20.46	20.37	22.27	20.415	21.8	20.344
31	Geeta gautam	18/female	6.17	6.78	7.46	7.59	6.73	6.28	4.61	5.57	4.5	5.93	9.71	9.46	39.78	20.41	20.6	20.61	20.505	20.6	19.406
32	Rizwana	23/Female	5.44	5.81	7.5	7.31	6.16	5.87	5.04	5.91	5.03	5.85	10.75	10.97	43.55	18.75	19.34	21.83	19.045	21	20.315
33	Bilkis azra	24/Female	7.1	7.01	7.82	7.79	6.02	5.81	5.61	6.25	5.87	6.01	11.33	11.3	46.37	21.93	19.62	23.74	20.775	21.6	20.995
34	Rakesh sahu	22/male	7.11	7.02	7.77	7.74	5.98	5.79	5.57	6.21	5.79	6.02	11.22	11.28	46.09	21.9	19.51	23.59	20.705	22.3	21.006
35	Rupesh singh	21/male	5.92	6.84	7.7	7.33	6.76	6.28	5.51	5.33	5.51	5.92	10.93	10.59	43.79	20.46	20.37	22.27	20.415	21.8	20.339
36	Shivendra singh	19/male	5.95	6.41	7.78	7.57	6.26	6.25	5.52	5.86	5.26	5.6	9.98	9.94	42.16	20.14	20.08	22.24	20.11	21.5	19.866
37	Uma	19/female	6.39	6.99	7.93	7.57	6.6	6.55	5.26	5.89	4.49	5.5	11.05	10.49	42.68	21.31	20.72	21.14	21.015	20.8	20.105
38	Tanuja	18/female	6.61	7.11	7.89	7.74	6.85	6.9	5.31	5.96	5.02	6	11.17	10.35	43.81	21.61	21.49	22.29	21.55	21.2	20.378
39	Akansha verma	20/Female	6.74	7.57	7.76	7.72	7.18	5.84	5.58	6.42	5.55	6.14	10.35	11.24	45.28	22.07	20.74	23.69	21.405	21.5	20.732
40	Ritesh sharma	21/male	6.27	6.49	7.06	7.19	6.24	6.17	5.05	5.61	4.87	4.94	10.51	10.34	41.32	19.82	19.6	20.47	19.71	20.5	19.622
41	Ayaan	19/male	5.52	6.21	7.74	7.61	6.24	4.91	5.03	5.35	4.76	5.46	11.38	11.16	43.14	19.47	18.76	20.6	19.115	20.8	20.15

42	Anjali rawat	20/Female	5.98	6.51	6.68	6.82	6.44	6.04	5.3	6.12	5.5	5.45	10.23	10.27	42.87	19.17	19.3	22.37	19.235	21.2	20.151
43	Ankita	18/female	6.33	6.03	7.81	7.79	6.66	6.29	5.24	5.44	5.45	5.56	11.3	10.78	43.77	20.17	20.74	21.69	20.455	20.9	20.368
44	Ananta	20/Female	5.77	6.18	6.64	6.6	6.31	6.02	3.99	5.12	4.9	5.17	11.26	10.96	41.4	18.59	18.93	19.18	18.76	20.4	19.797
45	Neelesh	23/male	6.32	6.55	7.1	7.25	6.31	6.21	5.09	5.71	4.98	5.09	10.64	10.46	41.97	19.97	19.77	20.87	19.87	20.5	19.811
46	Gopal	18/male	6.28	7.09	7.95	7.41	7.51	6.11	6.17	6.35	5.64	6.41	11.38	11.02	46.97	21.32	21.03	24.57	21.175	22.8	21.261
47	Neetu	20/Female	5.84	6.3	7.61	7.776	7.33	6.72	5.28	5.73	5.57	5.92	10.65	10.35	43.5	19.75	21.826	22.5	20.788	21.2	20.303
48	Anil pandey	20/male	5.91	6.45	7.93	7.89	6.48	5.69	5.16	5.23	5.26	5.16	10.6	10.73	42.14	20.29	20.06	20.81	20.175	21	19.86
49	Neha	18/female	4.86	5.98	7.24	6.84	6.51	5.48	4.6	5.52	4.98	4.95	10.58	10.5	41.13	18.08	18.83	20.05	18.455	20.5	19.732
50	Reeta sharma	18/female	5.59	6.75	7.95	7.54	6.56	5.52	4.56	5.58	4.74	5.85	9.78	9.3	39.81	20.29	19.62	20.73	19.955	20.8	19.414
51	Eshika	20/Female	5.28	6.24	7.11	7.43	6.4	5.58	5.51	5.55	5.43	5.39	10.24	9.59	41.71	18.63	19.41	21.88	19.02	21	19.872
52	Shilpi tripathi	20/Female	6.03	6.55	6.69	6.67	6.74	5.68	5.38	5.47	5.4	5.61	10.47	10.62	42.95	19.27	19.09	21.86	19.18	21	20.17
53	Anjali rai	18/female	6.56	6.54	7.17	6.8	6.51	5.51	5.13	5.37	5.02	5.72	9.83	9.91	40.98	20.27	18.82	21.24	19.545	20.8	19.696
54	Yukti	21/Female	4.96	6.11	7.66	7.73	6.79	5.15	5.01	5.8	5.32	5.65	10.05	10.63	42.46	18.73	19.67	21.78	19.2	21	20.052
55	Daksh srivastav	18/male	6.82	7.94	9.73	9.02	6.93	6.73	4.72	6.8	5.56	6.86	10.54	10.85	45.33	24.49	22.68	23.94	23.585	22.5	20.785
56	Komal	19/female	5.62	6.61	8.16	7.71	6.74	5.54	4.88	5.99	5.65	5.88	10.9	10.69	43.99	20.39	19.99	22.4	20.19	21.2	20.421
57	Mamta	21/Female	6.27	6.4	8.15	8.17	6.67	5.56	5.31	6.58	5.09	6.47	11.06	10.89	45.4	20.82	20.4	23.45	20.61	21.5	20.761
58	Ratnesh	22/male	7.09	7.01	7.71	7.72	5.97	5.76	5.58	6.23	5.76	6.01	11.18	11.25	46.01	21.81	19.45	23.58	20.63	22.3	20.982
59	Pushkar	24/male	7.4	7.03	7.81	7.78	6.05	5.82	5.58	6.28	5.89	6.05	11.37	11.32	46.49	22.24	19.65	23.8	20.945	22.5	21.122
60	Chandni	20/female	5.77	6.85	7.45	7.01	6.78	6.63	5.12	5.57	4.64	5.62	10.93	10.03	41.91	20.07	20.42	20.95	20.245	20.8	19.92
61	Sarita	19/female	5.01	6.82	6.7	6.81	6.82	5.5	5.2	5.39	4.92	5.67	10.93	9.54	41.65	18.53	19.13	21.18	18.83	20.8	19.857
62	Satyam	18/male	6.77	6.95	8.04	7.82	7.61	6.65	5.45	6.03	5.3	6.19	12.52	12.52	48.01	21.76	22.08	22.97	21.92	22	21.562
63	Pratiksha	18/female	6.28	6.67	7.07	6.9	6.6	6.28	4.7	5.55	4.52	5.51	10.54	10.32	41.14	20.02	19.78	20.28	19.9	20.6	19.734
64	Shivendra	19/male	6.14	6.38	7.79	7.64	6.5	6.12	5.57	5.91	5.33	5.87	10.41	9.87	42.96	20.31	20.26	22.68	20.285	21.8	20.098
65	Preeti	18/female	6.57	6.93	7.41	7.79	6.6	5.73	5.08	6.03	5.3	5.89	11.39	11.53	45.22	20.91	20.12	22.3	20.515	21.2	20.718
66	Uma devi	18/female	6.4	7.01	7.65	7.66	7.73	6.82	5.39	5.38	5.23	5.51	11.03	10.44	42.98	21.06	22.21	21.51	21.635	20.9	20.178
67	Aditya	18/male	6.01	6.9	8.04	8.1	7.05	5.17	5.46	5.9	5.33	5.94	10.47	10.01	43.11	20.95	20.32	22.63	20.635	21.8	20.141
68	Vishnu	18/male	6.38	6.23	7.28	7.57	6.29	5.92	4.72	5.58	4.88	5.73	9.72	9.67	40.3	19.89	19.78	20.91	19.835	21	19.327
69	Sarita kushwaha	21/Female	5.09	6.05	7.13	7.38	5.38	5.58	4.59	5.48	4.93	5.49	10.51	10.52	41.52	18.27	18.34	20.49	18.305	20.6	19.826
70	Kamil	18/male	6.97	7.47	8.25	8.25	7.58	6.97	5.58	5.7	5.67	6.31	11.03	10.84	45.13	22.69	22.8	23.26	22.745	22.3	20.727
71	Ragani	18/female	5.8	6.43	7.68	7.63	6.05	5.59	4.91	5.76	4.98	5.79	9.96	10.36	41.76	19.91	19.27	21.44	19.59	20.9	19.864
72	Vaibhavi	19/female	6.81	7.01	7.45	7.28	6.64	6.79	4.59	5.25	4.55	5.65	10.23	10.13	40.4	21.27	20.71	20.04	20.99	20.5	19.556
73	Sakeena	20/female	6.47	6.85	7.91	6.85	6.33	6.29	5.08	6.23	5.38	5.78	10.03	9.98	42.48	21.23	19.47	22.47	20.35	21.2	20.57
74	Arshad	22/male	6.17	6.83	7.23	7.25	7.52	6.73	5.74	6.2	5.48	6.23	11.64	11.36	46.65	20.23	21.5	23.65	20.865	22.3	21.168
75	Pratibha	18/female	6.69	7.14	7.23	7.28	7.39	6.77	5.88	6.25	6.44	7.89	10.34	10.44	47.24	21.06	21.44	26.46	21.25		
76	Aliya	22/female	5.79	6.76	7.02	6.78	7.25	6.32	4.73	5.56	4.73	5.48	11.03	11.14	42.67	19.57	20.35	20.5	19.96	20.6	20.103
77	Angad	21/male	6.27	6.49	7.06	7.19	6.24	6.17	5.05	5.61	4.87	4.94	10.51	10.34	41.32	19.82	19.6	20.47	19.71	20.8	19.622
78	Shriya	18/female	6.37	6.97	7.91	7.55	6.58	6.53	5.54	5.87	4.47	5.48	10.68	10.48	42.52	21.25	20.66	21.36	20.955	20.9	20.67
79	Shruti	20/female	5.87	6.1	7.58	7.75	7.31	6.7	5.26	5.71	5.55	5.89	10.63	10.45	43.49	19.55	21.76	22.41	20.655	21.2	20.301
80	Rahul kumar	19/male	5.79	6.21	6.68	6.65	6.29	5.98	4.21	5.13	4.87	5.17	11.16	10.96	41.5	18.68	18.92	19.38	18.8	20.3	19.675
81	Pooja	18/female	6.09	6.56	7.92	8.06	6.7	5.95	4.86	5.98	5.01	6.31	10.06	9.86	42.08	20.57	20.71	22.16	20.64	21	19.961
82	Gulshan	18/male	7.22	7.56	7.48	7.35	7	6.67	5.2	6.33	5.31	6.38	11.03	11.11	45.36	22.26	21.02	23.22	21.64	22	20.794
83	Akanssha	19/female	7.03	7.54	7.74	7.64	7.88	7.01	6.1	6.63	6.2	6.53	10.87	10.81	47.14	22.31	22.53	25.46	22.42	22.1	21.18
84	Mansi gaur	20/female	6.64	6.8	7.83	8.03	6.09	6.59	4.86	5.95	5.25	5.96	9.88	9.84	41.74	21.27	20.71	22.02	20.99	21	19.879

85	Vinita	22/female	6.32	6.72	8.21	8.21	5.94	6.76	5.53	5.95	5.25	5.96	9.88	9.84	42.41	21.25	20.91	22.69	21.08	21.2	20.04
86	Rosy	21/female	7.04	7.31	8.41	7.97	7.42	6.81	5.81	6.01	5.93	6.24	10.44	10.47	44.9	22.76	22.2	23.99	22.48	21.6	20.64
87	Mandeep	25/male	7.19	6.49	7.81	7.93	5.87	5.45	5.65	6.4	5.54	5.85	11.61	11.83	46.88	21.49	19.25	23.44	20.37	22.3	21.235
88	Prakhar singh	23/male	6.98	7.01	7.82	7.79	6.89	6.45	5.61	6.25	5.87	6.29	11.33	11.39	46.74	21.81	21.13	24.02	21.47	22.5	21.194
89	Sakeena bano	18/female	5.6	6.78	7.65	7.56	6.75	5.78	5	6.16	5.11	6.04	10.01	9.89	42.21	20.03	20.09	22.31	20.06	21.2	19.992
90	Arshad	22/male	6.29	6.62	7.11	7.1	6.71	6.35	5.64	6.39	5.72	6.44	11.57	11.46	47.22	20.02	20.16	24.19	20.09	22.5	21.333
91	Pratibha	18/female	6.14	6.94	7.25	7.24	7.49	6.77	5.83	6.08	5.81	6.19	9.69	9.89	43.49	20.33	21.5	23.91	20.915	21.6	20.301
92	Shivam	18/male	6.04	6.21	6.85	6.66	6.43	6.26	5.01	5.48	5.11	5.18	10.19	9.63	40.6	19.1	19.35	20.78	19.225	21	19.414
93	Suraj rai	18/male	6.7	6.92	7.52	7.6	7.19	7.06	5.64	6.01	5.55	6.95	10.19	10.16	44.5	21.14	21.85	24.15	21.495	22.5	20.545
94	Yashishvi	18/female	6.69	7.28	7.93	7.99	7.14	7.04	5.53	6.26	5.56	6.08	10.64	10.34	44.41	21.9	22.17	23.43	22.035	21.5	20.522
95	Shruti kumari	25/female	5.56	6.78	7.37	7.48	6.64	5.85	5.21	5.84	5.03	5.13	10.57	10.04	41.82	19.71	19.97	21.21	19.84	20.8	19.898
96	Shiprita	21/female	5.09	6.05	7.13	7.38	5.38	5.58	4.59	5.49	4.93	5.49	10.51	10.52	41.53	18.27	18.34	20.5	18.305	20.6	19.828
97	Janvi	18/female	5.59	6.77	7.64	7.57	6.77	5.77	4.98	6.14	5.11	6.04	10.04	9.93	42.24	20	20.11	22.27	20.055	21.2	19.999
98	Suchita	22/female	5.72	6.73	6.95	6.88	6.76	5.88	5.37	5.49	5.49	5.27	10.14	10.56	42.32	19.4	19.52	21.62	19.46	20.9	20.019
99	Reeta gupta	18/female	5.53	6.85	7.05	7.85	7.16	6.54	5.76	5.98	5.22	5.76	10.87	10.37	43.96	19.43	21.55	22.72	20.49	21.2	20.414
100	Manisha	21/Female	6.27	6.4	8.15	8.17	6.67	5.56	5.31	6.58	5.09	6.47	11.06	10.89	45.4	20.82	20.4	23.45	20.61	21.5	20.761
101	Prashant	18/male	5.82	5.98	7.71	7.66	7.01	6.84	5.58	6.11	5.57	6.12	11.03	11.02	45.43	19.51	21.51	23.38	20.51	22.3	20.814
102	Vaibhav	24/male	7.11	7.03	7.73	7.74	5.99	5.78	5.61	6.25	5.78	6.03	11.21	11.27	46.15	21.87	19.51	23.67	20.69	22.3	21.023
103	Kaustabh	18/male	6.82	7.94	9.73	9.02	6.93	6.73	4.72	6.8	5.56	6.86	10.54	10.85	45.33	24.49	22.68	23.94	23.585	22.5	20.785
104	Zubair	18/male	6.38	6.23	7.28	7.63	6.05	5.59	4.91	5.76	4.98	5.79	9.96	10.36	41.76	19.89	19.27	21.44	19.58	21.3	19.75
105	Menka	18/female	5.8	6.43	7.68	7.63	6.05	5.59	4.91	5.76	4.98	5.79	9.96	10.36	41.76	19.91	19.27	21.44	19.59	20.9	19.884
106	Advita	23/female	5.79	6.76	7.02	6.78	7.25	6.32	4.73	5.56	4.73	5.48	11.03	11.14	42.67	19.57	20.35	20.5	19.96	20.6	20.103
107	Ranjit	22/male	6.34	6.74	8.22	8.23	5.96	6.78	5.56	5.97	5.27	5.98	9.91	9.87	42.56	21.3	20.97	22.78	21.135	22	20.076
108	Atul mishra	22/male	6.17	6.83	7.23	7.25	7.52	6.73	5.74	6.2	5.48	6.23	11.64	11.36	46.65	20.23	21.5	23.65	20.865	22.3	21.168
109	Anjali	18/female	5.8	6.43	7.68	7.63	6.05	5.59	4.91	5.76	4.98	5.79	9.95	10.36	41.75	19.91	19.27	21.44	19.59	20.9	19.881
110	Monika	18/female	4.99	6.8	7.72	7.56	6.42	5.3	4.63	5.85	4.58	5.85	9.65	9.49	40.05	19.51	19.28	20.91	19.395	20.8	19.472
111	Shobhna	25/female	7.1	7.01	7.82	7.79	6.02	5.81	5.61	6.25	5.87	6.01	11.33	11.3	46.37	21.93	19.62	23.74	20.775	21.6	20.995
112	Shruti	19/female	6.39	6.99	7.93	7.57	6.6	6.55	5.26	5.89	4.49	5.5	11.05	10.49	42.68	21.31	20.72	21.14	21.015	20.8	20.105
113	Vinit	21/male	4.92	5.81	7.29	7.11	4.65	5.13	4.46	5.34	4.48	5.37	10.11	10.28	40.04	18.02	16.89	19.65	17.455	20.3	19.251
114	Akansha	19/Female	6.05	6.43	6.45	6.46	6.41	6.02	5.13	5.28	5.15	5.31	10.3	10.46	41.63	18.93	18.89	20.87	18.91	20.8	19.852
115	Ambali	19/Female	6.85	7.28	7.62	7.86	7.04	6.98	5.27	6.03	5.31	6.17	10.11	10.42	43.31	21.75	21.88	22.78	21.815	21.3	20.257
116	Yogendra	22/male	6.14	7.37	7.4	7.45	6.91	6.36	5.14	6.2	5.51	6.28	10.74	10.36	44.23	20.91	20.72	23.13	20.815	22	20.4667
117	Vipul	22/male	6.35	7.14	7.77	8.01	6.89	5.56	5.44	5.86	5.38	6.13	11.93	10.31	45.05	21.26	20.46	22.81	20.86	22	20.704
118	Priyanka	18/female	5.95	6.82	7.73	7.44	7.76	6.56	6.18	6.49	6.14	5.89	10.48	10.56	45.74	20.5	21.76	24.7	21.13	21.8	20.843
119	Pragya	22/female	6.71	7.46	6.63	6.26	7.02	6.35	6.04	6.15	6.03	6.11	10.58	11.06	45.97	20.8	19.63	24.33	20.215	21.8	20.898
120	Vivek	22/male	6.32	6.09	7.25	7.54	6.49	6.68	4.87	5.43	5.25	5.41	11.34	11.01	43.31	19.66	20.71	20.96	20.185	21	20.199
121	Satyam	18/male	6.71	7.17	7.81	8.07	7.36	6.86	5.85	6.59	5.91	5.98	12.31	12.42	49.06	21.69	22.29	24.33	21.99	22.8	21.867
122	Nishant	19/male	7.03	7.54	7.74	7.64	7.88	7.01	6.1	6.63	6.2	6.53	10.87	10.81	47.14	22.31	22.53	25.46	22.42	23.3	21.31
123	Nitish	18/male	6.3	6.19	7.89	8.06	6.67	6.53	5.46	6.66	5.38	6.3	11.51	11.52	46.83	20.38	21.26	23.8	20.82	22.5	21.22
124	Vijay m.	18/male	7.23	6.89	7.37	7.09	7.25	6.75	5.74	6.75	5.77	6.4	11.3	11.38	47.34	21.49	21.09	24.66	21.29	22.8	21.368
125	Shaheen	18/female	5.61	6.79	7.64	7.54	6.76	5.79	5.01	6.14	5.13	6.06	10.02	9.91	42.27	20.04	20.09	22.34	20.065	21.2	20.007
126	Shazia	18/female	6.43	7.05	8.34	8.1	6.87	6.81	5.55	6.2	5.67	7.2	11.81	11.72	48.15	21.82	21.78	24.62	21.8	21.8	21.424
127	Kajol	21/Female	6.85	6.72	7.48	7.5	6.91	6.48	5.39	5.5	5.41	5.59	9.8	10.3	41.99	21.05	20.89	21.89	20.97	21	21.997

128	Suyash	18/male	7.07	6.68	7.52	7.41	7.01	5.62	4.6	5.41	4.74	5.25	11.1	11.32	42.42	21.27	20.04	20	20.655	20.5	20.043
129	Anamika	20/female	6.99	7.3	7.87	7.66	6.63	6.46	5.75	6.46	5.78	6.6	11.89	11.02	47.5	22.16	20.75	24.59	21.455	21.8	21.267
130	Tanu soni	20/Female	6.39	6.78	8.02	7.89	6.71	6.61	5.74	6.2	5.81	6.32	11.68	11.88	47.63	21.19	21.21	24.07	21.2	21.6	21.298
131	Tanya	19/female	6.54	7.06	7.14	7.19	7.05	6.22	7.92	6.08	5.64	5.89	11.22	10.97	47.72	20.74	20.46	25.53	20.6	22.1	21.32
132	Khushbu	21/female	6.08	6.49	7.21	7.18	6.56	5.86	5.06	5.71	5.25	5.79	10.26	9.89	41.96	19.78	19.6	21.81	19.69	21	19.932
133	Rajeev	18/male	5.62	6.89	7.6	7.9	6.84	5.74	5.34	5.61	5.3	5.67	11.01	10.45	43.38	20.11	20.48	21.92	20.295	21.5	20.22
134	Garima	19/female	6.8	7.21	8.18	7.8	7.43	7.01	5.56	6.23	5.06	5.78	10.85	10.69	44.17	22.19	22.24	22.63	22.215	21.2	20.464
135	Gulshan	18/female	5.9	6.75	7.08	6.98	6.93	6.46	5.47	6.08	5.56	6.22	11.07	11.73	46.13	19.73	20.37	23.33	20.05	21.5	20.937
136	Rishabh raj	20/male	6.06	6.45	6.47	6.48	6.43	6.05	5.15	5.31	5.17	5.33	10.32	10.48	41.76	18.98	18.96	20.96	18.97	21	19.75
137	Devansh	18/male	6.45	7.06	7.71	7.72	7.78	6.87	5.44	5.43	5.29	5.56	11.08	10.49	43.29	21.22	22.37	21.72	21.795	21.3	20.194
138	Sudhanshu	20/male	5.91	6.18	7.63	7.81	7.35	6.75	5.31	5.76	5.61	5.94	10.68	10.51	43.81	19.72	21.91	22.62	20.815	21.8	20.344
139	Subhash	24/male	6.98	6.29	7.55	7.87	5.82	5.17	5.54	6.35	5.77	5.76	11.34	11.35	46.11	20.82	18.86	23.42	19.84	22.3	21.011
140	Gungun	19/female	5.17	6.12	7.71	7.59	6.19	4.83	4.97	5.33	4.71	5.39	11.35	11.09	42.84	19	18.61	20.4	18.805	20.6	20.144
141	Sugandha singh	20/Female	6.45	7.01	8.03	7.98	7.29	6.46	5.07	5.81	5.11	6.15	10.22	10.08	42.44	21.49	21.73	22.14	21.61	21	20.048
142	Akansha singh	18/female	5.95	6.82	7.73	7.44	7.76	6.56	6.18	6.49	6.14	5.89	10.48	10.56	45.74	20.5	21.76	24.7	21.13	21.8	20.843
143	Richa	19/female	4.99	6.8	7.77	7.56	6.42	5.3	4.63	5.85	4.58	5.85	9.6	9.49	40	19.56	19.28	20.91	19.42	20.8	19.46
144	Pankaj	22/male	6.95	6.98	7.79	7.76	6.86	6.42	5.59	6.21	5.84	6.26	11.28	11.35	46.53	21.72	21.04	23.9	21.38	22.5	21.133
145	Bharat singh	24/male	6.47	6.85	7.91	7.85	6.53	6.29	5.48	6.23	5.38	5.78	10.03	9.98	42.88	21.23	20.67	22.87	20.95	20.8	20.075
146	Richa	19/female	4.99	6.83	7.77	7.56	6.42	5.32	4.63	5.85	4.58	5.85	9.61	9.49	40.01	19.59	19.3	20.91	19.445	20.8	19.462
147	Sandeep	22/male	6.14	6.33	7.58	7.48	6.93	7.02	4.66	5.44	5.22	5.45	11.37	11.17	43.31	20.05	21.43	20.77	20.74	21	20.199
148	Jyoti	20/Female	5.23	6.23	7.14	7.39	6.33	5.64	4.75	5.75	4.42	5.62	10.87	10.83	42.24	18.6	19.36	20.54	18.98	20.6	19.999
149	Saurabh	21/male	6.1	7.63	8.4	8.12	7.37	7.26	5.47	6.65	5.49	6.54	10.28	10.01	44.44	22.13	22.75	24.15	22.44	22.5	20.527
150	Anjum yadav	20/male	5.92	6.27	7.02	7.16	6.97	5.75	5.33	5.75	5.19	5.69	9.98	9.78	41.72	19.21	19.88	21.96	19.545	21.5	19.738
151	Upasana	21/female	7.1	7.04	7.62	7.57	6.98	7.04	5.3	5.97	5.16	5.85	11.1	11.38	44.76	21.76	21.59	22.28	21.675	21.2	20.607
152	Rashika	18/female	6.44	6.81	6.56	6.8	6.79	6.27	5.39	5.52	5.55	5.6	10.56	10.37	42.99	19.81	19.86	22.06	19.835	21	20.18
153	Hari om	18/male	5.58	6.33	7.71	7.7	6.35	5.69	5.04	5.39	4.16	5.11	10.16	10.21	40.07	19.62	19.74	19.7	19.68	20.3	19.26
154	Sushma	18/female	6.35	6.8	7.07	7.41	7.66	6.05	4.78	6.01	5.27	5.91	10.85	10.58	43.4	20.22	21.12	21.97	20.67	21	20.351
155	Akash singh	18/male	6.08	7.05	7.73	7.68	7.15	6.02	5.22	5.45	5.2	5.96	10.59	10.68	43.1	20.86	20.85	21.83	20.855	21.5	20.139
156	Komal	20/female	5.7	6.56	7.52	7.14	6.67	5.67	5.67	5.99	5.44	6.09	10.87	10.71	44.77	19.78	19.48	23.19	19.63	21.3	20.609
157	Sarika	21/Female	5.53	6.47	7.84	7.65	6.79	6.44	4.87	5.58	5.24	5.64	11.13	11.03	43.49	19.84	20.88	21.33	20.36	20.9	20.301
158	Om srivastava	19/male	6.51	6.71	7.31	7.12	6.64	5.64	5.01	5.53	5.05	5.72	9.87	10.02	41.2	20.53	19.4	21.31	19.965	21.3	21.768
159	Piyush	20/male	6.24	7.05	7.91	7.67	7.27	6.26	6.01	6.39	5.69	6.26	11.43	11.31	47.09	21.2	21.2	24.35	21.2	22.8	21.296
160	Anshul	18/male	5.34	6.52	7.35	7.21	6.81	4.87	5.5	6.34	5.09	6.03	11.77	11.59	46.32	19.21	18.89	22.96	19.05	22	21.072
161	Moni	18/female	5.64	6.54	7.36	7.35	6.58	5.67	5.91	6.68	4.5	6.3	10.99	10.87	45.25	19.54	19.6	23.39	19.57	21.5	20.725
162	Anushka	18/female	5.2	6.2	6.98	7.41	6.94	5.98	5.12	5.42	5.28	5.68	10.32	10.16	41.98	18.38	20.33	21.5	19.355	20.9	19.937
163	Shivam	18/male	6.59	8.26	9.72	8.75	7.83	7.21	5.62	6.81	5.54	6.81	10.45	11.15	46.38	24.57	23.79	24.78	24.18	22.5	21.09
164	Meenakshi	18/female	5.95	6.56	7.43	7.54	6.12	6.01	5.73	6.11	5.5	6.09	10.61	10.94	44.98	19.94	19.67	23.43	19.805	21.5	20.66
165	Suman	18/female	6.56	6.54	7.17	6.8	6.54	5.51	5.13	5.37	5.02	5.72	9.83	9.91	40.98	20.27	18.85	21.24	19.56	20.8	19.696
166	Anjali	20/female	5.87	6.1	7.58	7.75	7.31	6.7	5.26	5.71	5.55	5.89	10.63	10.45	43.49	19.55	21.76	22.41	20.655	21.2	20.301
167	Abhishek	19/male	6.85	7.96	9.75	9.08	6.95	6.75	4.75	6.81	5.58	6.88	10.56	10.87	45.45	24.56	22.78	24.02	23.67	22.5	20.82
168	Vaishnavi	18/female	6	6.72	7.65	7.66	6.9	6.59	5.2	5.76	5.71	5.85	10.18	10.05	42.75	20.37	21.15	22.52	20.76	21.2	20.122
169	Prashant	18/male	5.72	6.74	7.36	7.41	6.88	6.45	5.22	5.39	5.14	5.73	11.75	11.77	45	19.82	20.74	21.48	20.28	21.3	20.69
170	Preeti	22/female	5.75	6.73	6.98	6.73	7.21	6.28	4.71	5.51	4.69	5.43	10.98	11.09	42.41	19.46	20.22	20.34	19.84	20.6	20.04

171	Sarita	19/female	6.04	6.81	6.84	7.04	7.09	5.91	5.07	6.02	5.04	6.17	11.15	10.17	43.62	19.69	20.04	22.3	19.865	21.2	20.332
172	Renu rai	21/female	6.34	6.87	7.56	7.47	5.95	6.56	5.14	5.92	5.08	5.86	10.87	11.38	44.25	20.77	19.98	22	20.375	21	20.484
173	Sadia	22/female	6.65	7.43	7.57	7.86	7.81	6.9	5.75	5.94	5.78	6.12	11.47	11.91	46.97	21.65	22.57	23.59	22.11	21.5	21.139
174	Ananya	19/female	5.61	6.77	7.63	7.54	6.73	5.81	5.21	6.15	5.15	6.01	10.05	9.91	42.48	20.01	20.08	22.52	20.045	21.2	20.057
175	Shivansh	20/male	6.16	6.41	7.81	7.65	6.51	6.15	5.59	5.95	5.38	5.91	10.45	9.95	43.23	20.38	20.31	22.83	20.345	22	20.176
176	Shipra	20/female	5.86	6.95	7.84	7.64	6.97	6.2	5.48	6.05	5.69	6.13	10.66	10.7	44.71	20.65	20.81	23.35	20.73	21.5	20.595
177	Chandni	25/female	6.88	7.49	7.58	7.87	7.19	6.89	5.57	6.78	5.87	6.64	10.78	10.93	46.57	21.95	21.95	24.86	21.95	21.9	21.043
178	Vaibhav	21/male	6.26	6.51	7.09	7.21	6.26	6.19	5.09	5.63	4.89	4.96	10.53	10.36	41.46	19.86	19.66	20.57	19.76	20.8	19.663
179	Tanu	19/female	6.81	7.36	7.8	7.6	7.07	6.38	5.51	6.23	5.61	6.35	10.8	10.92	45.42	21.97	21.05	23.7	21.51	21.5	20.766
180	Samreen	22/female	7.49	7.81	8.21	7.98	7.17	6.99	5.78	5.88	5.98	6.14	11.24	11.45	46.47	23.51	22.14	23.78	22.825	21.6	21.019
181	Rishabh	24/male	7.24	7.99	8.11	7.81	7.98	7.27	5.81	6.31	5.85	6.39	12.87	13.1	50.33	23.34	23.06	24.36	23.2	22.8	22.235
182	Shivam	20/male	6.29	6.41	8.16	8.18	6.69	5.58	5.34	6.59	5.11	6.49	11.09	10.91	45.53	20.86	20.45	23.53	20.655	22.3	20.843
183	Vivek	22/male	5.76	5.87	7.66	7.39	6.22	5.66	5.27	5.94	5.14	5.37	10.83	10.96	43.51	19.29	19.27	21.72	19.28	21.5	20.257
184	Rabiya	18/female	5.3	7.43	7.19	7.21	6.45	4.97	5.19	5.43	5.69	5.87	11.38	11.41	44.97	19.92	18.63	22.18	19.275	21	20.657
185	Rani singh	21/female	6.59	7.35	6.57	6.22	6.98	6.24	6.01	6.09	6.01	6.11	10.55	10.98	45.75	20.51	19.44	24.22	19.975	21.6	20.84
186	Vasant	24/male	7.09	7.01	7.39	7.43	6.75	6.69	5.63	6.14	5.78	6.15	11.17	11.27	46.14	21.49	20.87	23.7	21.18	22.3	21.02
187	Aakriti	24/female	6.31	6.11	7.23	7.54	6.41	6.57	4.89	5.45	5.27	5.43	11.19	11.23	43.46	19.65	20.52	21.04	20.085	20.8	20.293
188	Aniket	21/male	6.1	7.63	8.4	8.12	7.37	7.26	5.47	6.65	5.49	6.54	10.28	10.01	44.44	22.13	22.75	24.15	22.44	22.5	20.527
189	Sumita	23/male	6.61	7.31	6.66	6.56	7.01	6.41	6.02	6.11	6.01	6.09	10.59	10.58	45.4	20.58	19.98	24.23	20.28	21.6	20.806
190	Akanccha	18/female	5.09	6.33	7.67	7.75	6.41	5.21	4.61	5.83	4.56	5.83	9.59	9.47	39.89	19.09	19.37	20.83	19.23	20.8	19.433
191	Aishwarya	18/female	6.05	6.51	7.88	8.01	6.67	5.91	4.81	5.94	4.98	6.25	10.04	9.85	41.87	20.44	20.59	21.98	20.515	21	19.91
192	Vanshika	18/female	6.65	7.23	7.48	7.35	7.15	5.96	5.4	6.54	5.46	6.28	11.03	10.87	45.58	21.36	20.46	23.68	20.91	21.5	20.804
193	Pooja jaiswal	18/female	6.37	7.39	8.42	8.09	7.24	7.01	5.32	6.26	5.24	6.02	11.1	11.14	45.08	22.18	22.34	22.84	22.26	21.3	20.684
194	Saurav mishra	18/male	6.71	7.26	7.79	7.62	7.08	6.37	5.52	6.24	5.62	6.34	10.81	10.91	45.44	21.76	21.07	23.72	21.415	22.3	20.817
195	Rinka	24/female	5.29	6.05	7	7.01	5.67	5.52	5.01	5.73	4.64	5.16	9.6	9.58	39.72	18.34	18.2	20.54	18.27	20.6	19.392
196	Praveen	24/male	6.88	7.49	7.58	7.87	7.19	6.89	5.57	6.78	5.87	6.64	10.78	10.93	46.57	21.95	21.95	24.86	21.95	23	21.145
197	Sumit mishra	22/male	6.65	7.43	7.57	7.86	7.81	6.9	5.75	5.94	5.78	6.12	11.47	11.91	46.97	21.65	22.57	23.59	22.11	22.3	21.261
198	Anjali	21/Female	5.91	6.11	7.55	7.69	6.14	5.85	4.97	5.96	5.12	6.05	11.53	11.73	45.36	19.57	19.68	22.1	19.625	21	20.751
199	Puneet	20/male	6.81	7.36	7.8	7.6	7.07	6.38	5.51	6.23	5.61	6.35	10.8	10.92	45.42	21.97	21.05	23.7	21.51	22.3	20.811
200	Ranjeet	23/male	5.64	6.77	7.48	7.53	6.65	5.85	5.21	5.87	5.09	5.27	10.69	10.58	42.71	19.89	20.03	21.44	19.96	21.3	20.113
201	Rakesh	24/male	6.38	6.53	7.09	7.22	6.37	6.29	5.09	5.66	5.03	5.54	10.87	10.79	42.98	20	19.88	21.32	19.94	21.3	20.104
202	Sakshi	22/female	6.19	6.78	7.77	7.64	6.62	6.25	5.16	5.79	4.89	5.52	10.87	10.59	42.82	20.74	20.51	21.36	20.625	20.9	20.139
203	Sangeeta	18/female	5.29	6.83	7.77	7.56	6.42	5.32	4.63	5.85	4.54	5.81	9.61	9.49	39.93	19.89	19.3	20.83	19.595	20.8	19.443
204	Ragini	20/female	6.18	6.53	7.07	6.9	6.6	6.28	4.7	5.55	4.52	5.51	10.54	10.36	41.18	19.78	19.78	20.28	19.78	20.6	19.744
205	Shruti	19/female	5.3	6.43	7.19	7.21	6.45	5.25	5.19	5.43	5.24	5.51	10.78	10.89	43.04	18.92	18.91	21.37	18.915	20.9	20.192
206	Sanjeev	24/male	6.16	6.78	7.37	7.48	6.85	6.09	5.21	5.84	5.13	5.74	10.57	10.47	42.96	20.31	20.42	21.92	20.365	21.5	20.098
207	Sujeet	25/male	7.1	7.01	7.82	7.79	6.02	5.81	5.61	6.25	5.87	6.01	11.33	11.3	46.37	21.93	19.62	23.74	20.775	22.3	21.087
208	Samreen	20/female	5.6	6.78	7.65	7.56	6.75	5.78	5	6.16	5.11	6.04	10.01	9.89	42.21	20.03	20.09	22.31	20.06	21.2	19.992
209	Rina	19/female	5.94	6.75	6.83	6.95	6.85	5.93	5.07	5.97	5.04	6.07	10.75	10.85	43.75	19.52	19.73	22.15	19.625	21	20.363
210	Aparna	20/female	5.92	6.27	7.02	7.27	6.38	5.75	5.33	5.75	5.19	5.63	9.98	9.78	41.66	19.21	19.4	21.9	19.305	21	19.86
211	Priyamvada	25/female	7.55	7.63	7.66	7.78	7.01	7.28	4.73	6.28	5.03	6.1	10.38	10.39	42.91	22.84	22.07	22.14	22.455	21	20.161
212	Sangeeta singh	26/female	5.87	6.09	7.63	7.51	6.07	4.87	5.76	6.36	5.36	6.34	10.85	10.81	45.48	19.59	18.45	23.82	19.02	21.6	20.78
213	Kushagra	18/male	6.47	6.97	7.89	7.68	6.78	6.39	5.59	5.91	5.29	5.48	10.71	10.55	43.53	21.33	20.85	22.27	21.09	21.8	20.263

214	Amrita	23/female	6.44	6.84	7.31	7.36	6.97	6.48	5.64	5.01	5.58	4.95	10.41	10.31	41.9	20.59	20.81	21.18	20.7	20.6	19.897
215	Nivedita	25/female	6.87	6.71	7.42	6.99	6.93	6.8	4.64	5.6	4.82	5.64	9.98	9.9	40.58	21	20.72	20.7	20.86	20.8	19.599
216	Rakesh	25/male	5.99	6.71	7.48	7.5	6.25	6.03	5.68	5.4	5.73	5.44	10.55	10.59	43.39	20.18	19.78	22.25	19.98	21.5	20.223
217	Pamila	22/female	6.53	6.59	7.71	7.06	6.68	6.84	5.39	6.01	4.96	6.05	10.89	10.98	44.28	20.83	20.58	22.41	20.705	21.2	20.491
218	Monika	22/female	5.39	6.01	6.95	6.78	6.66	5.41	4.6	5.42	4.62	5.39	10.56	10.42	41.01	18.35	18.85	20.03	18.6	20.5	19.703
219	Rupali	18/female	6.37	6.43	7.26	7.32	6.72	10.44	5.16	6.03	5.49	6.21	10.73	10.63	44.25	20.06	24.48	22.89	22.27	21.3	20.484
220	Sunita	23/female	6.33	6.41	6.85	7.01	7.29	6.48	5.28	5.97	5.2	5.28	11.45	11.42	44.6	19.59	20.78	21.73	20.185	20.9	20.568
221	Shreyashi	18/female	7.15	7.26	7.64	7.58	7.12	6.99	5.37	6.17	5.3	6.15	10.59	11.08	44.66	22.05	21.69	22.99	21.87	21.3	20.583
222	Rishi	17/male	6.42	6.63	7.56	7.58	6.72	6.43	4.84	5.98	4.8	6.11	10.28	10.24	42.25	20.61	20.73	21.73	20.67	21.3	19.892
223	Varsha	19/female	5.3	6.6	7.6	7.67	6.7	6.1	4.51	6.28	5.05	6.27	10.8	10.29	43.2	19.5	20.47	22.11	19.985	21	20.231
224	Pramila	18/female	5.94	6.07	7.57	7.63	6.46	6.06	5.07	5.67	4.92	5.46	10.69	10.67	42.48	19.58	20.15	21.12	19.865	20.8	20.057
225	Navneet	19/male	5.23	6.23	7.14	7.39	6.33	5.64	4.75	5.75	4.62	5.62	10.87	10.83	42.44	18.6	19.36	20.74	18.98	20.8	19.947
226	Shailendra	24/male	6.48	6.54	7.53	7.79	6.68	6.51	5.54	6.35	5.77	6.36	11.34	11.35	46.71	20.55	20.98	24.02	20.765	22.5	21.185
227	Saumya	22/female	4.92	5.81	7.29	7.11	5.65	5.13	4.46	5.34	4.48	5.37	10.11	10.28	40.04	18.02	17.89	19.65	17.955	20.4	19.469
228	Kuldeep yadav	21/male	5.74	6.03	7.65	7.51	5.81	5.65	5.32	5.85	5.23	5.87	10.57	10.67	43.51	19.42	18.97	22.27	19.195	21.8	20.257
229	Divya	18/female	6.52	6.61	7.82	7.74	6.35	6.42	5.41	5.94	5.22	5.86	10.81	10.92	44.16	20.95	20.51	22.43	20.73	21.2	20.462
230	Harshit	22/male	6.19	6.59	7.98	8.08	6.31	6.36	5.16	5.65	5.22	5.69	11.8	10.79	44.31	20.76	20.75	21.72	20.755	21.3	20.489
231	Shama	22/female	6.58	7.13	7.73	7.83	7.2	6.38	5.18	6.26	5.24	6.24	11.04	11.13	45.09	21.44	21.41	22.92	21.425	21.3	20.686
232	Kamal	19/male	5.57	6.33	7.25	7.33	6.29	5.61	4.58	4.81	4.59	5.34	10.84	10.63	40.79	19.15	19.23	19.32	19.19	20.3	19.469
233	Ratnesh	18/male	5.34	6.71	8.29	7.98	6.79	5.79	5.57	5.89	5.85	5.97	10.48	10.45	44.21	20.34	20.56	23.28	20.45	22.3	20.46
234	Priti	18/female	5.65	6.14	7.88	7.91	6.42	6.12	5.5	6.04	5.52	6.06	11.34	11.08	45.54	19.67	20.45	23.12	20.06	21.3	20.795
235	Vikash singh	25/male	6.42	7.09	7.97	8.35	7.11	6.41	5.07	5.67	4.92	5.46	10.66	10.65	42.43	21.48	21.87	21.12	21.675	21	19.944
236	Saurabh	25/male	6.8	7.17	7.23	7.39	7.35	7.2	5.18	6.23	5.28	6.37	11.29	11.15	45.5	21.2	21.94	23.06	21.57	22	20.835
237	Navda sharma	23/female	6.46	7.29	8.72	8.34	6.7	6.38	5.58	6.23	5.95	6.1	11.19	10.78	45.83	22.47	21.42	23.86	21.945	21.6	20.865
238	Shivam	22/male	6.82	6.95	7.82	7.86	6.55	5.77	5.23	5.86	5.29	5.73	10.66	10.09	42.86	21.59	20.18	22.11	20.885	21.5	20.069
239	Archana	21/female	6.74	6.86	7.62	7.47	6.67	6.73	5.12	5.92	5.44	5.68	10.26	10.58	43	21.22	20.87	22.16	21.045	21	20.183
240	Nitesh	20/male	6.46	7.26	7.69	7.34	7.68	6.23	5.93	6.59	5.87	6.83	11.27	11.13	47.62	21.41	21.25	25.22	21.33	23	21.449
241	Akram	19/male	5.98	6.33	6.99	7.25	6.46	6.19	5.94	6.13	6.05	6.17	11.56	11.28	47.13	19.3	19.9	24.29	19.6	22.8	21.307
242	Ankur	22/male	6.63	6.85	7.66	7.45	7.01	6.95	5.01	5.98	5.45	6.02	11.28	11.04	44.78	21.14	21.41	22.46	21.275	21.8	20.626
243	Rakhi	23/female	5.4	6.18	6.69	6.39	6.12	5.9	4.56	5.17	4.6	5.41	9.68	9.75	39.17	18.27	18.41	19.74	18.34	20.4	19.259
244	Amar	23/male	6.7	6.87	7.94	7.91	6.84	6.64	5.19	6.16	5.69	6.48	12.35	12.35	48.22	21.51	21.39	23.52	21.45	22.3	21.623
245	Chand	20/male	6.16	6.85	7.96	8.02	6.96	6.46	5.55	6.28	5.65	6.43	10.88	10.36	45.15	20.97	21.44	23.91	21.205	22.5	20.733
246	Sempi	21/female	6.32	6.49	7.3	7.08	6.15	5.92	5.23	5.69	5.46	5.63	9.65	9.88	41.54	20.11	19.15	22.01	19.63	21	19.831
247	Utkarsh	18/male	5.72	6.88	7.61	7.89	6.87	5.73	5.35	5.66	5.35	5.61	11.05	10.89	43.91	20.21	20.49	21.97	20.35	21.5	20.373
248	Sangeeta	23/female	5.9	6.34	7.3	7.37	6.42	5.91	5.19	5.83	5.19	5.58	10.8	11.08	43.67	19.54	19.7	21.79	19.62	20.9	20.344
249	Diksha pandey	18/female	5.2	6.17	7.75	7.63	6.14	5.08	5.01	5.37	4.92	5.34	11.39	11.14	43.17	19.12	18.85	20.64	18.985	20.6	20.223
250	Alpana	25/female	5.75	6.01	7.06	7.19	5.88	5.79	4.48	5.23	4.53	5.27	10.36	10.48	40.35	18.82	18.86	19.51	18.84	20.4	19.544
251	Aashi	18/female	6.13	6.56	7.43	7.34	6.12	6.01	5.73	6.11	5.5	6.09	10.81	10.76	45	20.12	19.47	23.43	19.795	21.5	20.665
252	Monu patel	19/male	6.16	6.27	7.12	7.27	6.38	6.25	5.33	5.75	5.19	5.63	10.18	10.05	42.13	19.55	19.9	21.9	19.725	21.5	19.857