

Heterogeneous Occlusal Traits among Monozygotic Twins from the Village of Twins – A Report of 3 Cases.

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ABSTRACT

Research involving twins contributes much to the scientific world as they enable one to understand the complex morphological variations and the phenotypic expressions of various genes. Twin research study design illustrates and explains the relative contribution and interactions of genes and the environmental factors responsible for the development of a particular trait. Quantification of the genetic and environmental contributing factors enables researchers to explore the variations to various physical, behavioural disorders and dental diseases like dental caries, periodontal diseases and malocclusion. Research with monozygotic twins who share the same genetic pool and similar environmental factors estimates the expression of a particular trait by disentangling the shared genetic coding and environmental contributing features. Monozygotic twin pairs may not always be a look alike in resemblance or other features given that fact that the original zygotic genome might be altered due to epigenetic and environmental factors. This case report elaborates three monozygotic twins from a unique village of twins who differ in their occlusal characteristics.

Keywords: Genetics, Kodinhi, Monozygotic twins, Occlusal Traits, Twin study.

INTRODUCTION

Twin research, particularly monozygotic twin research design is a powerful tool to identify and explain the role of genes and environment factors on the expression of a particular trait or disease. By manipulating the environment, researchers can clarify the expression of the same gene under different environmental conditions as in the case of monozygotic twins. To display the multi-factorial inheritance of complex diseases and disorders a multidisciplinary research using twins especially monozygotic (identical) twin are much essential.^[1] The process of twinning is by itself provides insight into the development of human body, any variability seen in the post-natal growth and the environmental influences on the expression of any particular gene.^[2]

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The role of genes in the expression of various phenotypes for normal and abnormal occlusal characteristics and craniofacial growth and development is well established.^[3] Use of twins in

research not only improves the statistical power of a genetic study but also estimates the proportion of variance attributable to gene expression and environmental (shared as well as unshared) influences.^[4] The originally established zygotic genome might get modified due to various factors like the prenatal environment of the mono-chorionic placenta, the post-zygotic divergence of epigenome or different post-natal environments, as a result of which monozygotic (identical) twins may display any actual resemblance to each other.^[5]

This case report illustrates three cases of monozygotic (Identical) twins who share a similar environmental background (Village of Twins) but presented with heterogeneous or non-identical occlusal characteristics.

CASE REPORT

Kodinhi (Village of Twins), a small village in South India made international headlines by its peculiar presence of more than 200 twins. This village is situated in Malappuram District, Kerala, India which houses 2000 families. The rate of twin birth in this particular village is several folds as compared to that of the global average of twin birth.^[6]

An investigation was carried out among the twins of this village, the protocol of which was approved by the University Ethics Committee. After obtaining

consent, the assessment was carried in relation to the following parameters: Anthropometric measures (Height and Weight); Photographic Analysis (Facial Profile and Lateral Profile Form) and Occlusal Characteristics from study models. The widest mesio-distal measurements were recorded for the entire dentition using Digital Vernier Callipers. The following three cases are the twins, which presented with a unique set of findings after an assessment based on the mentioned parameters.

Case I

Monozygotic (Identical) female twin pair aged 15 years [Figure 1] evaluated in terms of anthropometric, photographic and dental cast evaluation revealed the following set of finding:

- Height: One the sibling was higher than the other (Twin A = 159 centimetres; Twin B = 162 centimetres).
- Weight: Twin B (39 kilogrammes) weighed more than Twin A (35.5 kilogrammes).
- Facial form: Twin A had a long and thin facial form while Twin B had a broad and square type facial form.
- Lateral facial profile form: Both had a straight lateral facial profile.
- Occlusal Characteristics:
 - Both had Angle's Class I molar relation.
 - Measurement of dentition showed that Twin B had a lower mesio-distal diameter in relation to maxillary and mandibular central and lateral incisors.
 - The severity of malocclusion was diverse between the two. [Figure 2]
 - Twin A had more severe crowding in relation to maxillary and mandibular anterior tooth segment. [Figure 3]
 - Twin A had increased overjet and overbite as compared to Twin B.
 - Constricted arch form was evident in the anterior segment of both maxilla and mandible in Twin A as compared to Twin B.
 - The most peculiar finding found in both the twins was the presence of completely erupted 3rd molars in relation to both sides of the mandibular arch.

Case II

Assessment of 10-year-old monozygotic (Identical) male twin pair [Figure 4] revealed the following findings:

- Height: Twin B (133 centimetres) was higher than his sibling (Twin A = 129 centimetres).
- Weight: One weighed more than the other (Twin A = 27.1 kilogrammes; Twin B = 28.2 kilogrammes).



Figure 1: Facial photographs of Case I.

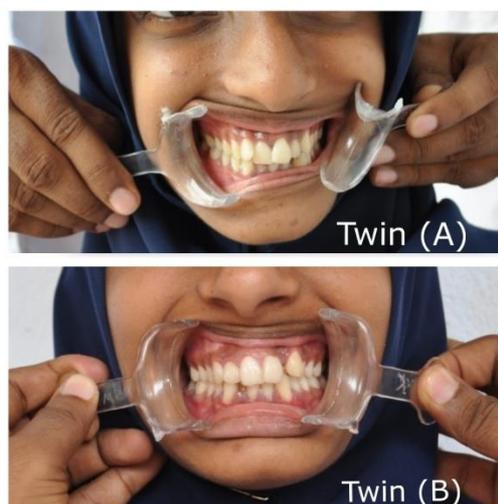


Figure 2: Facial view of dentition and occlusal status of Case I.



Figure 3: Occlusal photographs of maxillary and mandibular arch of Case I.

- Facial form: Both had a near similar facial form (Broad and square).
- Lateral facial profile form: Straight profile form was noted in both.
- Occlusal Characteristics:
 - Angle's Class I molar relation was seen in both.
 - Measurement of dentition showed that Twin B had higher mesio-distal values as compared to Twin A.
 - Malocclusion severity differed between the two. [Figure 5]
 - Twin A had a more constricted arch form especially in the anterior segment as compared to Twin B. [Figure 6]
 - Mild openbite was evident in Twin A, which was absent in the case of Twin B who had a normal transverse horizontal and vertical relation.
- The rate of tooth eruption was faster in Twin B when compared with Twin A.
- Caries statuses seen in both the twins were near similar.



Figure 4: Facial photographs of Case II.

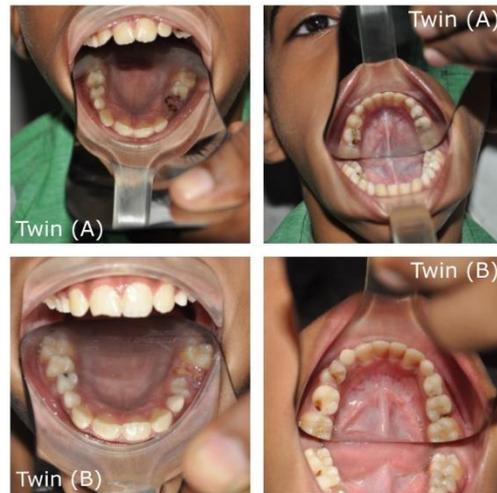


Figure 5: Occlusal photographs of maxillary and mandibular arch of Case II.

Case III

The following findings can be summarized after the assessment of a female monozygotic (identical) twin pair aged 13 years. [Figure 7]

- Height and Weight: Both had near similar anthropometric measurements (Height: Twin A = 143 centimetres and Twin B = 144 centimetres; Weight: Twin A = 32.7 kilogrammes, Twin B = 33.4 kilogrammes).
- Facial form: Twin A had a broad and square type facial form while Twin B had a long and thin type of facial form.
- Lateral facial profile form: Convex lateral profile was recorded for both.
- Occlusal Characteristics:
 - Twin A had Angle's Class I molar relation on both sides, whereas Twin B had an End-on molar relation on the right side and Angle's Class I molar relation on the left side.
 - Measurements of dentition showed that both had near similar mesio-distal diameters.
 - Both had midline diastema, but the extend of spacing between teeth was more evident in Twin A. [Figure 8]
 - Right unilateral posterior crossbite was noted only in Twin A.
 - Lower arch was comparatively more expanded in case of Twin A, particularly in the posterior segment.
 - Both had near similar arch forms. [Figure 9]
- Tooth eruption rate was faster in Twin B when compared with Twin A.
- Dental caries status differed between the two. Twin A had multiple teeth with dental



Figure 5: Facial view of dentition and occlusal status of Case II.

caries whereas Twin B was comparatively caries-free.



Figure 7: Facial photographs of Case III.

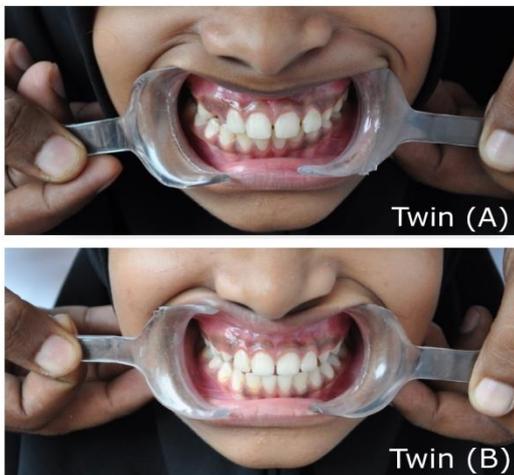


Figure 8: Facial view of dentition and occlusal status of Case III.



Figure 9: Occlusal photographs of maxillary and mandibular arch of Case III.

DISCUSSION

A monozygotic twin model is a valuable tool in research as well as practice because it evaluates twins to determine the underlying causes of variation for a particular trait. In dentistry, this model has profound implications in exploring the differences to oro-facial structures as observed by the oral health professionals.^[7] Genetic studies using teeth serves a great value in exploring the nature and time of developmental disturbances during the formative years of life as the embryonic development of dentition starts from the fourth week of in-utero life till the time of physical maturity of a human.^[2] Any deviation from the normal size of the tooth is a result of the multi-factorial genetic inheritance and the influence of environmental factors.^[8] Twin studies have established the role of genetic expression as well as environmental factors which influence the development of dental anomalies. Considering the polygenic nature of the development of dental characteristics, it is highly likely any one gene or one environmental factor be responsible for a specific dental anomaly.^[9,10]

In all the three cases mentioned it was seen that one among the twin differed from the others in terms of malocclusion (Case I = Increased overjet and crowding; Case II = Openbite and Case III = Overbite) and also in the arch form as well as the rate of the eruption. Sakuda M et al (1973) had reported one such case of monozygotic twin sisters in which one had crossbite while the other had a normal overbite.^[11] Varela M et al (2011) reported of nine-year-old twin girls in which one had hypodontia in relation to two permanent teeth while the other had only one.^[12] A study among 164 pairs of twins on the occlusal traits by Potter RH et al (1981) concluded that environmental covariance was larger for monozygotic twins with respect to crossbite.^[13]

Evidence obtained from twin studies have established the contribution of the genetic contribution to dental diseases like dental caries, periodontal diseases and malocclusion but still the linkage of any particular gene responsible for it still remains a question.^[14,15] Although twin studies provide valuable insight into the basic molecular as well as biological processes, it also clarifies the role of genetic factors responsible for oral diseases and disorders.

CONCLUSION

The study of dentition offers much of a stable model for the investigation of developmental mechanisms to the time of maturation because once formed teeth hardly get remodelled unless it is affected by extraneous factors. This enables the researcher to assess the developmental disturbances affecting pre-

as well as post-natal morphologic processes. This case report illustrates three cases of monozygotic (identical) twins exhibiting heterogeneous occlusal characteristics despite sharing the same environment. These three cases present a puzzling fact, which needs further investigation especially in this unique village of twins.

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