MIAZEK, Weronika, SMALA, Kamila, PISKÓRZ, Magdalena, RÓŻYŁO-KALINOWSKA, Ingrid & FUTYMA-GĄBKA, Karolina. The Differences in the dentition pattern in monozygotic twins based on panoramic examinations – case report on two pairs of twins. Journal of Education, Health and Sport. 2023;36(1):21-26. eISSN 2391-8306. DOI http://dx.doi.org/10.12775/JEHS.2023.36.01.002
https://apcz.umk.pl/JEHS/article/view/43445
https://zenodo.org/record/7991562

The journal has had 40 points in Ministry of Education and Science of Poland parametric evaluation. Annex to the announcement of the Minister of Education and Science of December 21, 2021. No. 32343.
Has a Journal's Unique Identifier: 201159. Scientific disciplines assigned: Physical Culture Sciences (Field of Medical sciences and health sciences); Health Sciences (Field of Medical Sciences and Health Sciences).
Punkty Ministerialne z 2019 - aktualny rok 40 punktów. Załącznik do komunikatu Ministra Edukacji i Nauki z dnia 21 grudnia 2021 r. Lp. 32343. Posiada Unikatowy Identyfikator Czasopisma: 201159.
Przypisane dyscypliny naukowe: Nauki o kulturze fizycznej (Dziedzina nauk medycznych i nauk o zdrowiu); Nauki o zdrowiu (Dziedzina nauk medycznych i nauk o zdrowiu).

The authors declare that there is no conflict of interests regarding the publication of this paper.
Received: 06.04.2023. Revised: 10.05.2023. Accepted: 31.05.2023. Published: 01.06.2023.

Differences in the dentition pattern in monozygotic twins based on panoramic examinations – case report on two pairs of twins

Weronika Miazek1, Kamila Smala1, Magdalena Piskórz2,

Ingrid Różyło-Kalinowska2, Karolina Futyma-Gąbka2,

1. Student Research Group at the Department of Dental and Maxillofacial Radiodiagnostics, Medical University of Lublin, Poland
2. Department of Dental and Maxillofacial Radiodiagnostics, Medical University of Lublin, Poland

ACKNOWLEDGEMENT/ FUNDING STATEMENT
Not applicable

CONFLICT OF INTEREST

None declared.

ETHICAL APPROVAL

The investigation was conducted in accordance with the Declaration of Helsinki of 1975, and approval by an institutional ethics committee is not required due to the nature of case report.

CONSENT

Consent was obtained from the patient for the publication of this case report in accordance with the journal's patient consent policy.

Abstract

The aim of the study is to present two examples of twins with differences in their dentition revealed with the use of panoramic examinations. The analysis based on panoramic X-rays shows that even though the monozygotic twins share 100% of the genome, their dentitions reveal significant differences.

Key words: epigenetics, zygosity, panoramic X-ray, twins, dentition differences

Introduction

Most of the monozygotic twins are alike. In general it is expected that the monozygotic twin pairs are the same within the congenital defects, chromosomal abnormalities and Mendelian disorders. However, more and more often non-compliances of monozygotic twin pairs are reported [1]. It is quite a unique occurrence that two genetically identical individuals can exhibit a variety of phenotypes due to the impact of environmental factors and epigenetic variances. Monozygotic twins present an unusual model to study the contribution and role of genetic modifications along with the influence of the environment on forming the phenotype [1-6].

The origin of monozygotic twins is attributed to two or more daughter cells of one zygote which undergo non dependent mitotic division. This process leads to separate growth and birth of the two individuals where a considerable phenotypic divergence between them may occur. It is possible that minor defects in the transduction of epigenetic information through further cell divisions can accumulate in the process connected to aging [2, 7]. The differences in the epigenetic patterns of two identical individuals could be explained as an influence of both internal and external factors. Nicotine addiction, physical activity, and diet, inter alia, are external factors that have an impact on epigenetic modifications [2, 8, 9]. The comparisons of pairs of monozygotic twins, which have the same genes but show differences in the phenotypic expression, represent one of the ways in which to explain how, besides the environmental factors, epigenetic factors can influence phenotypic expression [10].

Literature presents cases of monozygotic twins which have different numbers of supernumerary teeth - one of them has a single supernumerary tooth while the other one has two of them [7]. One of the articles also gives a case of two sisters whose cephalometric radiographs parameters exhibit a considerable similarity, which proves a significant impact of hereditary factors on the morphology of the facial skull [11]. However, the differences in mutual arrangement of the upper and lower incisors and their positions relative to the bone base have also been reported. Monozygotic twins also disclose a phenomenon of mirror imaging effect [12-14]. The researchers agree that monozygotic twins normally do not have the same type of cleft palate defect. What is more this abnormality can be present in only one of the twins, too [15].

Aim

The aim of the work is to present two pairs of monozygotic twins with significant differences in the dentition pattern as determined by means of panoramic examinations.

Case study and Results

Two pairs of monozygotic twins were referred to the Department of Dental and Maxillofacial Radiodiagnostics, Medical University of Lublin. The first pair of twins (Ia and Ib) - males aged 11 and the other pair of twins (IIa and IIb) - males aged 15. Panoramic radiographs (VistaVox S: DURR DENTAL SE, GERMANY) were taken for orthodontic reasons. Radiographs revealed significant differences in dentition patterns between monozygotic each pair of twins.

Also, based on the review and analysis of the available literature from PubMed, Google Scholar, Scopus, other online magazines and open-access literature, differences in dentition patterns of monozygotic twins were analyzed in order to provide statistically and scientifically reliable information.

First pair (Ia and Ib) exhibited differences in the number of teeth, the time of teeth eruption and teeth abnormalities.

The radiograph disclosed that Ia twin had persistent deciduous teeth 74, 75, 85 with a significant delay of eruption of succedaneous teeth 34, 35, 45 whilst the twin Ib had already teeth 34, 35, 45 erupted.

Ia twin had all of the four germs of wisdom teeth while in other twin (Ib) two of them 18 and 28 were missing. Moreover, the radiograph of Ia twin shows rotation of tooth 13, which was not visible in the X-ray of I b twin (Fig. 1, 2).

The second pair of twins had differences in terms of carious lesion prevalence, number of teeth, presence of talon cusps, and the time of germ mineralization.

The panoramic radiograph of IIa twin showed carious lesions of the teeth 17, 16, 27, 37 and 46, whilst the radiograph of IIb twin revealed carious lesion only in tooth 47. The X-ray of the IIa twin showed 30 teeth (absence of tooth 36 –extraction in the past and lack of germ of tooth 48). At the same time the X-ray of IIb twin showed a full dentition, i.e. 32 teeth including the germ of tooth 48. Only in the radiograph of the IIb twin talon cusps were noticeable. Last but not least, IIa twin had a shorter time of germ mineralization, tooth 38 was in F stage according to Demirjan's method, whilst in IIb twin tooth 38 was at D stage of mineralization (Fig. 3, 4).

Discussion

A case where a supplementary tooth has been reported in the region of lower incisors in one of monozygotic twin girls has been described by Pietrzak et al [7]. The tooth had proper structure, and was shaped like the first lower deciduous incisor. Its location was vestibular, slightly out of the dental arch. The other female twin had neither supplementary teeth nor supernumerary ones in the oral cavity [7]. The researchers came across a case in which a monozygotic female twin had distal maxillary teeth located on the right side but the difference concerned the type and location of the supernumerary teeth [16]. In another case described in literature variations concerning interincisal angle (the deviation was 9º), distinctions in position of the lower incisor towards the mandibular base (the deviation was 7º) and the divergences in the nasolabial angle (the deviation was 5º) were determined [11].

Mirror imaging effect has been observed in the study involving oral cavities of monozygotic twins. This effect has been seen in morphology and measurements of the teeth [12]. Mirror imaging effect indicates that certain features occur in a specific pair on the opposite sides of the body, i.e. one of the twins seems to be a mirror image of another [12, 17]. Regarding the differences in shape, number and length of the palatal rugae, both twins showed the same shapes for all palatal rugae, except for the second one on the left side. The lengths of the palatal rugae were almost identical in size for both twins [15].

Regarding caries, it is suggested that at a young age the genetic contribution to susceptibility to the disease is significant, and with age environmental factors contribute to a greater variance in the characteristics of dental caries. Likewise, oral hygiene status did not differ between pairs of twins, regardless of zygosity (monozygotic or dizygotic) [18].

Although twins are genetically indistinguishable at an early age, the older monozygotic twins were studied, the more significant differences in the overall content and genomic distribution of DNA 5-methylcytosine and histone acetylation were observed. That affected their portrait of gene expression [2, 17]. Epigenetic markers were more distinct for monozygotic twins who were older, had different lifestyles, and spent less time together, highlighting the significant role of environmental factors in translating a common genotype into a different phenotype [2]. Arguably, hypodontia or presence of mesiodens concerning monozygotic twins may be due to factors other than differences in DNA methylation or histone acetylation [10, 17]. Slight differences in epigenetic incidents during odontogenesis may account for these noticeable differences [17]. Radiographic studies show that late germ tooth formation is one of the factors associated with the congenital absence of other teeth [10, 19]. Thus, accelerated development within the dentition affecting local signaling events may be associated with discrepancies in the number of supernumerary teeth in genetically susceptible monozygotic twins [10].

Mirror imaging effect may be related to the tendency of dividing the zygote later in embryogenesis, when body symmetry is established [10].

Conclusions

Presented cases indicate that there are dissimilarities in the dentition between individual monozygotic twins visible on panoramic X-rays. The differences presented affect many areas of dentistry, from conservative dentistry (prevalence of dental caries) to orthodontics and oral surgery (tooth rotations, missing teeth). The observed dissimilarities in monozygotic twins show that these disparities may be much greater than one would assume based on the information that they are apparently identical twins.

References

1. Zwijnenburg PJG, Meijers-Heijboer HEJ, Boomsma D. Identical but not the same: The value of discordant monozygotic twins in genetic research. Am J Med Genet Part B. 2010; 153B:1134–1149. DOI:10.1002/ajmg.b.31091.
2. Fraga MF, Ballestar E, Paz MF et al. Epigenetic differences arise during the lifetime of monozygotic twins. Proc Natl Acad Sci USA. 2005; 102(30): 106-10609. DOI:10.1073/pnas.0500398102.
3. Bouchard C, Lesage R, Lortie G et al. Aerobic performance in brothers, dizygotic and monozygotic twins. Med Sci Sports Exerc. 1986; 18(6): 639-646.
4. Petronis A, Gottesman I, Kan P et al. Monozygotic Twins Exhibit Numerous Epigenetic Differences: Clues to Twin Discordance? Schizophr Bull. 2003; 29(1): 169–178. DOI:10.1093/oxfordjournals.schbul.a006988.
5. Kato T, Iwamoto K, Kakiuchi C et al. Genetic or epigenetic difference causing discordance between monozygotic twins as a clue to molecular basis of mental disorders. Mol Psychiatry. 2005; 10: 622–630. DOI:10.1038/sj.mp.4001662.
6. Machin G. Non-identical monozygotic twins, intermediate twin types, zygosity testing, and the non-random nature of monozygotic twinning: A review. Am J Med Genet Part C Semin Med Genet. 2009; 151C: 110–127. DOI:10.1002/ajmg.c.30212.
7. Pietrzak J, Maślanko M, Pels E et al. The supplemental tooth in one of monozygotic twingirls-case report. Forum Ortod. 2014; 10: 47-53.
8. Jaenisch R, Bird A. Epigenetic regulation of gene expression: how the genome integrates intrinsic and environmental signals. Nat Genet. 2003; 33: 245-254. DOI:10.1038/ng1089.
9. Bjornsson HT, Fallin MD, Feinberg AP. An integrated epigenetic and genetic approach to common human disease. Trends Genet. 2004; 20(8): 350-358. DOI:10.1016/j.tig.2004.06.009
10. Townsend G, Richards L, Hughes T, Pinkerton S, Schwerdt W. Epigenetic influences may explain dental differences in monozygotic twin pairs. Aust Dent J. 2005; 50(2): 95-100. DOI:10.1111/j.1834-7819.2005.tb00347.x.
11. Niedziela A, Polek A, Szyper-Szczurowska J. Orthodontic assessment of the similarities and differences in monozygotic twins-case analysis. Forum Ortod. 2013; 9: 205-216.
12. Piekoszewska-Ziętek P, Turska-Szybka A, Olczak-Kowalczyk D. State of Dentition Among Twins Considering the Influence of Genetic and Environmental Factors: The Systematic Review of the Literature. Dent Med Probl. 2016; 53(4): 510-523. DOI:10.17219/dmp/64077.
13. Hughes TE, Townsend GC, Pinkerton SK et al. The teeth and faces of twins: providing insights into dentofacial development and oral health for practicing oral health professionals. Aust Dent J. 2014; 59: 101-116. DOI:10.1111/adj.12101.
14. Kabban M, Fearne J, Jovanovski V et al. Tooth size and morphology in twins. Int J Paediatr Dent. 2001; 11(5): 333-339. DOI:10.1046/j.0960-7439.2001.00289.x.
15. Taneva E, Evans C, Viana G. 3D Evaluation of Palatal Rugae in Identical Twins. Case Rep Dent. 2017; 2017: 2648312. DOI:10.1155/2017/2648312.
16. Ratson T, Peretz B. Non-syndromic multiple hyperdontia in monozygotic twin sisters: a report of two cases. J Dent Child (Chic). 2014; 81(1): 50-53.
17. Townsend G, Hughes T, Luciano M et al. Genetic and environmental influences on human dental variation: A critical evaluation of studies involving twins. Arch Oral Bid. 2009; 54(1): 45-51. DOI:10.1016/j.archoralbio.2008.06.009.
18. Subramaniam P, Girish Badu KL, Vardhana B. Assessment of dental caries and oral hygiene status among twins. J Forensic Sci Med. 2018; (1)4: 18-22. DOI: 10.4103/jfsm.jfsm_58_17.
19. Baba-Kawano S, Toyoshima Y, Regalado L et al. Relationship between congenitally missing lower third molars and late formation of tooth germs. Angle Orthod. 2002; 72(2): 112-117. DOI:10.1043/0003-3219(2002)072<0112:RBCMLT>2.0.CO;2.

Figures

Fig. 1. Panoramic radiograph of twin Ia

Fig. 2. Panoramic radiograph of twin Ib.

Fig. 3. Panoramic radiograph of twin IIa.

Fig. 4. Panoramic radiograph of twin IIb.