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# Relationship between Consanguineous Marriages And Dental Anomalies: A Literature Review

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**Abstract**

Studies have shown that the rate of congenital malformations is 2.5 times higher in parents of consanguineous marriages than in nonconsanguineous marriages due to the increased risk of carriers of the same deleterious gene or defective allele of offspring. In the orofacial region, studies have shown higher incidences of craniofacial syndromes such as hereditary ectodermal dysplasia, and Down syndrome; pigmented lesions like Xeroderma pigmentosum; oral defects such as cleft lip and palate among offspring of consanguineous married parents. Countries with high consanguinity prevalence, such as the Middle East and North Africa, with the highest prevalence of consanguineous marriages in the world, have a prevalence of NSOFC-like or less than European countries with rare consanguineous marriages. Congenital dental anomalies were significantly prevalent in consanguineous marriages with greater incidence in lower socioeconomic groups. A positive correlation between dental anomalies among offspring of consanguineous marriages revealed such prevalence may be attributed to an increased risk of recessive deleterious gene expression or defective allele carried to offspring. The prevalence of consanguineous marriages is still high. Consanguineous marriages are a major risk to the health of offspring to the extent that they can cause various craniofacial abnormalities, orofacial pigmentations, and other abnormal birth defects. They increase the autosomal recessive conditions through the expression of recessive deleterious alleles, especially in the offspring of first-degree cousins. This review focusses and highlights the need and awareness of the possible consequences of consanguineous marriages on dental diseases and recommends further research on the same.

**Keywords**: Consanguineous, Dental anomalies, Dilaceration, Microdontia, Oral and craniofacial defects

## Introduction

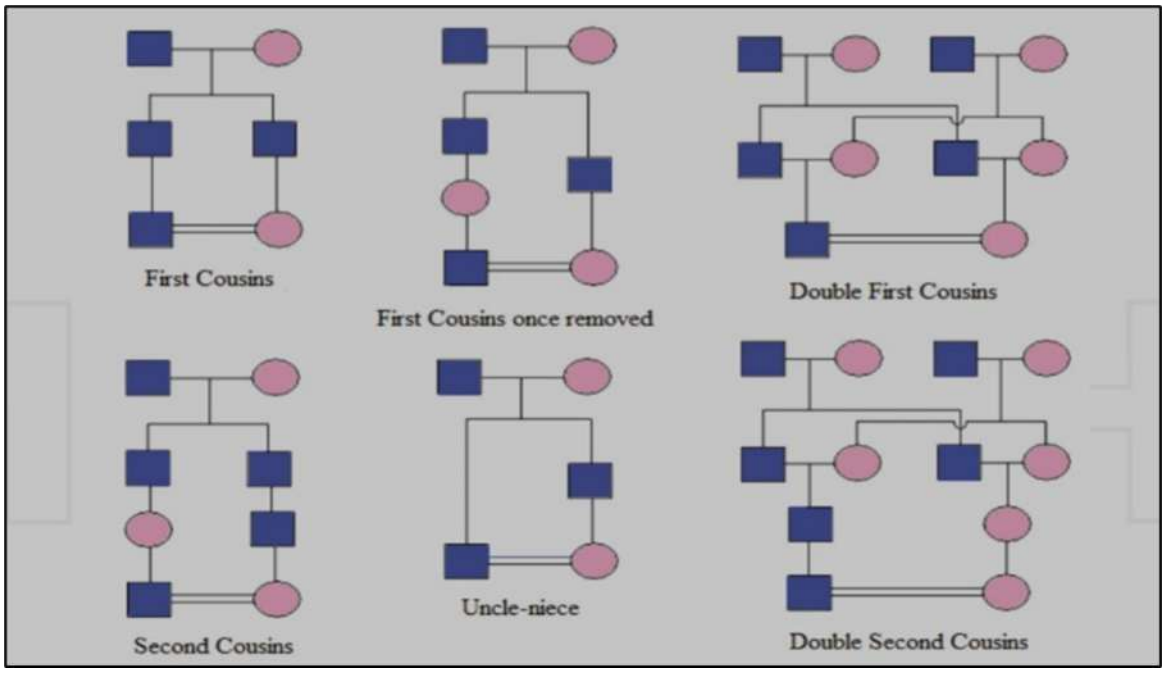
Consanguinity is a derivative of a Latin word that refers to “Con” meaning “Common” and “Sanguineous” meaning “Blood. Pakistan and India are among the countries reporting the highest rate of consanguinity with the incidence of 73% and 5–60%, respectively. It has been estimated recently that 2.34% of total deaths in Pakistan are attributable to congenital anomalies.[1] Studies have shown the rate of congenital malformations is 2.5 times higher in parents of consanguineous marriages than in nonconsanguineous marriages due to the increased risk of carriers of the same deleterious gene or defective allele of offspring.[2] Around the globe consanguineous marriages have been practiced by many societies from time immemorial. Such marriages are favored by different populations usually bound to traditional customs and beliefs and to keep property in a united form within the family.

These are widely practiced in Asia, North Africa, Switzerland, the Middle East, some parts of China, Japan, and fishermen communities in Europe and America. Consanguineous marriage is widely favored by a large majority of the world's Islamic population. One in two rural marriages in Tamil Nadu and Andhra Pradesh are consanguineous.[3,4] Non-syndromic orofacial clefts (NSOFC), including cleft lip (CL), cleft lip with or without cleft palate (CL6P), and isolated cleft palate (CP), are among the most common birth defects in the world (Mossey and Little, 2009). Although NSOFC is known to be a multifactorial disorder with both genetic and environmental risk factors involved, its etiology is not fully understood. One proposed risk factor is parental consanguinity (Mossey and Castilla, (2003).[5] Orofacial anomalies occur mainly due to disordered embryonic development where there is incomplete fusion of developmental lines in the orofacial region such as the face, palate, tongue, lips, and alveolar process including teeth, jawbones, and the oral mucosa. These developmental anomalies are more likely to be seen in related parents of consanguineous marriage than unrelated parents.[6]

**Types of Consanguineous Marriages**

Consanguinity is a term derived from two Latin words "con" meaning common or of the same and "sanguineous" meaning blood; hence, referring to a relationship between individuals of the same blood.[7] Marriages are divided into four categories: first cousin marriage (father's brother's son, mother's brother's son, father's sister's son, mother's sister's son, parallel cousin from both sides), second cousin marriage, third cousin marriage (marriage from the kin in general) as seen in Picture 1. Moreover, various degrees of consanguinity have been defined in literature and studies have been conducted to assess the degrees and its relationship on general health and further leading to systemic diseases. (Picture 2)[6,7]

**Picture 1 - Degree of relationships in consanguineous marriages**



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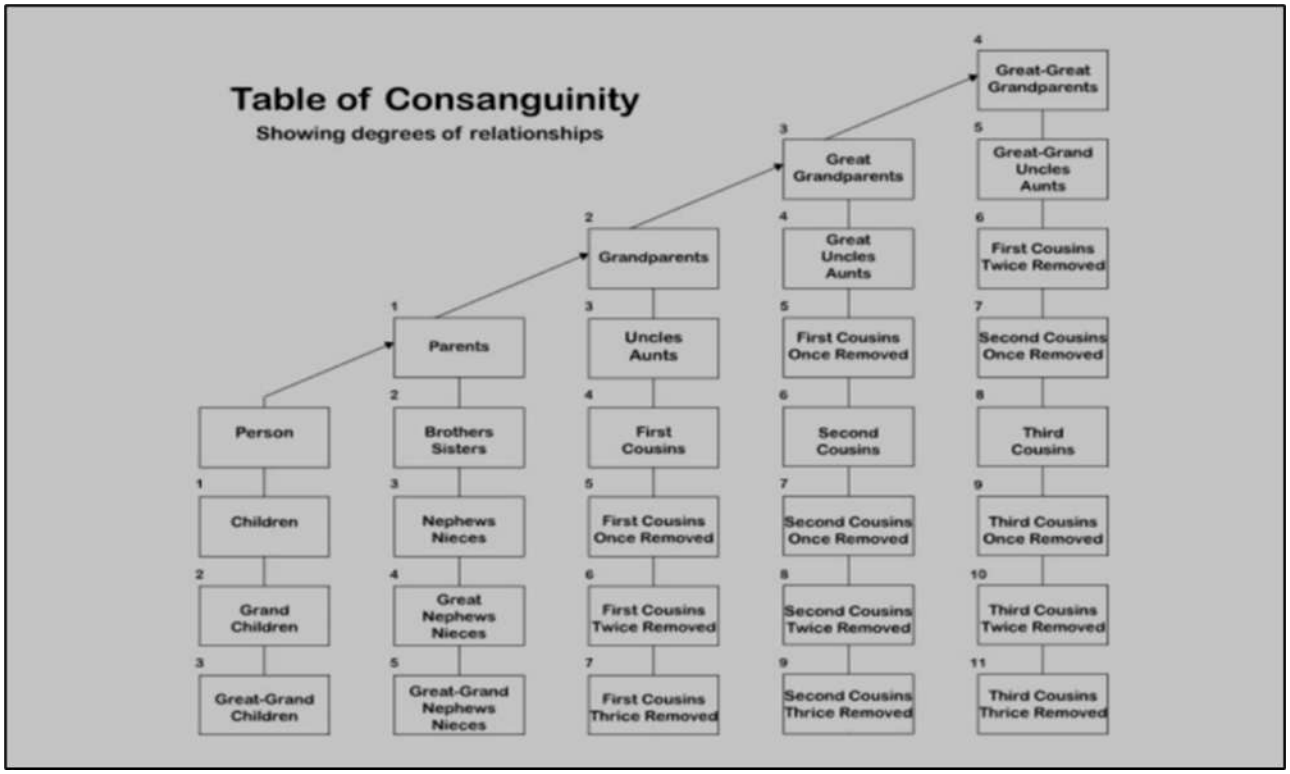
**Picture 2: One legal definition of degrees of consanguinity (The number next to each box in the table indicates the degree of relationships relative to the given person)**




**Dental anomalies**

Literature published states that the dental anomalies can have different etiologies and thus present different clinical appearances. Based on different etiologies the dental anomalies can be classified as:

a. Genetic defects - The most common genetic craniofacial deformity is clefting of the lip and/or palate, a defect estimated by the NIDCR to occur once in every 500 births.[8] Dentinogenesis imperfecta type II (DGI-II), another genetic defect, causes severely discolored teeth that break easily. Amelogenesis imperfecta produces only a soft, thin layer of tooth enamel.

b. Anomalies related to number of teeth: Anodontia, Partial anodontia (Hypodontia or oligodontia) and Total anodontia.

c. Depending on their positioning in the dental arch, they are classified as follows: Mesio-dens: located between the 2 central incisors Primary teeth, the morphology of the supernumerary teeth is usually similar to teeth or conical but it has 4 common shapes in permanent teeth; Conical, Tuberculate, Supplemental and Odontome.[9,10]

d. Anomalies in the size of teeth:[9] Macrodontia, Microdontia

e. Anomalies related to the shape of teeth:[9] – Gemination, Fusion, Concrescence, Dilaceration, Talons cusp, Dens in dente, Dens evaginatus, Taurodontism, Hypercementosis Segemented roots.

f. Anomalies in the eruption of teeth:[9] - Premature eruption, Delayed eruption, Multiple unerupted and embedded teeth, Impacted teeth and Ankylosed deciduous teeth

**Relationship between consanguineous marriages and dental anomalies**



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A cross-sectional analytical multicentered study was carried out at Foundation University College of Dentistry from September 2021 to November 2021 in Pakistan by Beenish Abbas. The thorough analysis in this study elaborated that the prevalence of consanguineous marriage was found to be in 210 (70.7%) participants with significant relevance with congenital dental anomalies (p-value <0.001).[11]

**Table 1: Showing the relation between consanguineous marriages and dental anomalies.**

TABLE 1: Association of consanguineous marriages and dental anomalies.

| Dental anomaly | *N* (%) |
|---|---|
| Goldenhar syndrome (dental malocclusion) | 1 (0.3) |
| Ligneous periodontitis | 2 (0.7) |
| Bardet–Biedl syndrome | 2 (0.7) |
| SJ syndrome | 2 (0.7) |
| Marfan syndrome | 2 (0.7) |
| Arrested root development | 3 (1.0) |
| Concrescence | 3 (1.0) |
| Macrodontia | 3 (1.0) |
| Mitochondrial leukodystrophy | 3 (1.0) |
| Oligodontia | 3 (1.0) |
| Supernumerary teeth | 3 (1.0) |
| Supplemental teeth | 3 (1.0) |
| Dens in dente | 3 (1.0) |
| Accessory roots | 6 (2.0) |
| Xeroderma pigmentosa (periodontitis and maxillary enamel hypoplasia) | 6 (2.0) |
| Germination | 6 (2.0) |
| Down syndrome | 7 (2.4) |
| Ectopic eruption | 8 (2.7) |
| Genetic hypoplasia | 8 (2.7) |
| Congenital rubella syndrome | 9 (3.0) |
| Dens evaginatus | 9 (3.0) |
| Fusion | 9 (3.0) |
| Talon's cusp | 9 (3.0) |
| Microcephaly (enamel defects and microdents) | 12 (4.0) |
| Microdontia | 12 (4.0) |
| Cerebral palsy | 13 (4.4) |
| Delayed eruption | 15 (5.1) |
| Hypodontia | 21 (7.1) |
| Taurodontism | 30 (10.1) |
| Root dilaceration | 30 (10.1) |
| Hyperdontia | 54 (18.2) |

*Significant *p* value <0.001 (dental anomaly vs. consanguineous marriage).

A cross-sectional study was conducted among the south Indian population by Dr. M R C Rajeswari.12,13 This study included a total of 116 participants ranging from 18 to 60 years of age. Sixty-four (41 Females,23 Males) out of 116 participants (55.17%) showed positive consanguinity (Group A) comprising 32 (50%) individuals with anomaly, and 32 (50%) were presented without any anomaly. Among the 52 participants in Group B (30 Females, 22 Males), 20 (38.4%) presented with anomaly and 32 (61.5%) without any anomaly.[12]

**GRAPH- 1: Graph showing the frequency distribution of dental anomalies among female and male populations.**

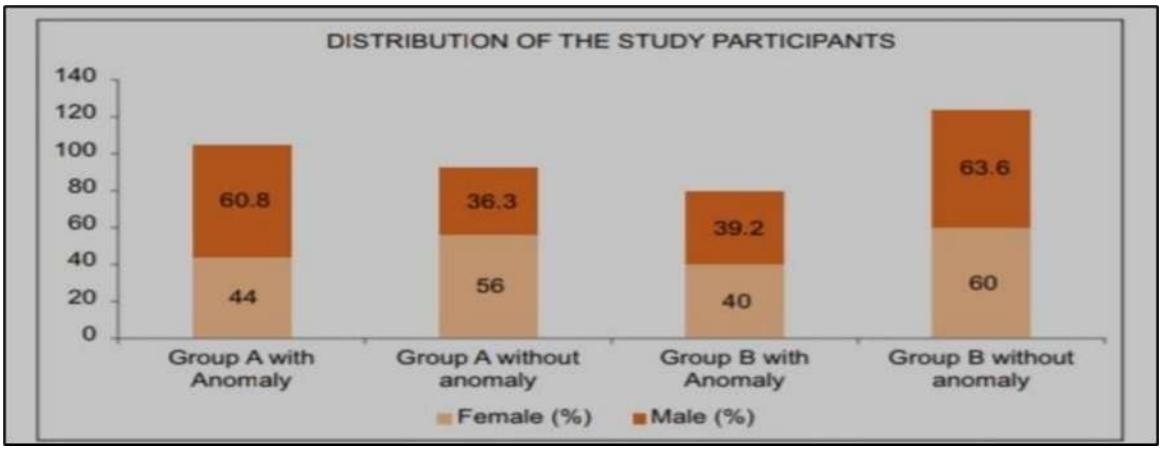




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**TABLE 2: Showing distribution of all participants based on group and subtypes for groups, n (%) and the statistical analysis.**

| Group | Subtypes of groups | Gender | Anomaly present, *n* (%) | Anomaly absent, *n* (%) | $\chi^2$ | *P* | Overall *P* value |
|---|---|---|---|---|---|---|---|
| Group A | Type 1 | Female | 12 (66.6) | 18 (78.2) | 6.071 | 0.00204* | 0.0213* |
| | | Male | 9 (64.2) | 6 (66.7) | | | |
| | Type 3 | Female | 6 (33.3) | 5 (21.7) | 0.1202 | 0.72879 | |
| | | Male | 5 (35.8) | 3 (33.3) | | | |
| Group B | Female | - | 12 (40) | 18 (60) | 0.0709 | 0.79001 | |
| | Male | - | 8 (36.3) | 14 (63.6) | | | |

*$P<0.05$, statistically significant. Group A: Consanguineous marriage, Group B: Nonconsanguineous marriage, Type 1: First cousin, Type 3: Maternal related, $\chi^2$: Chi-square test

An exploratory study of consanguinity and developmental dental anomalies was conducted by Saima Y Khan.[14,15] Multivariate logistic regression showed that non-syndromic supernumerary teeth in fathers (p =.009); fusion in mothers (p = 0.002); fusion (p <0.001), non-syndromic supernumerary teeth (p<0.001), and microdontia (p = 0.002) in respondents were significantly associated with consanguinity.[14]

**TABLE 3: Distribution of dental anomalies between consanguineous and non-consanguineous group.**

| *Developmental anomalies* | | *Nonconsanguineous (n =1600)* No. | % | *Consanguineous (n = 400)* No. | % | *Fisher's exact test/pearson chi-square* | *df* | *p value* |
|---|---|---|---|---|---|---|---|---|
| Mother | | | | | | | | |
| Fusion | No | 1598 | 99.9% | 386 | 96.5% | Fisher's exact test | | 0.000* |
| | Yes | 2 | 0.1% | 4 | 3.5% | | | |
| Gemination | No | 1600 | 100% | 400 | 100% | N.A | N.A | N.A |
| | Yes | 0 | 0% | 0 | 0% | | | |
| Nonsyndromic supernumerary teeth | No | 1600 | 100% | 390 | 97.5% | Fisher's exact test | | 0.000* |
| | Yes | 0 | 0% | 10 | 2.5% | | | |
| Microdontia | No | 1600 | 100% | 394 | 98.5% | Fisher's exact test | | 0.002* |
| | Yes | 0 | 0% | 6 | 1.5% | | | |
| Father | | | | | | | | |
| Fusion | No | 1600 | 100% | 392 | 98% | Fisher's exact test | | 0.000* |
| | Yes | 0 | 0% | 8 | 2% | | | |
| Gemination | No | 1600 | 100% | 396 | 96% | Fisher's exact test | | 0.002* |
| | Yes | 0 | 0% | 4 | 1% | | | |
| Nonsyndromic supernumerary teeth | No | 1578 | 98.6% | 388 | 97.0% | Fisher's exact test | | 0.310 |
| | Yes | 22 | 1.4% | 12 | 3.0% | | | |
| Microdontia | No | 1592 | 99.5% | 400 | 100% | Fisher's exact test | | 0.370 |
| | Yes | 8 | 0.5% | 0 | 0% | | | |
| Respondent | | | | | | | | |
| Fusion | No | 1586 | 99.1% | 382 | 95.5% | Fisher's exact test | | 0.000* |
| | Yes | 14 | 0.9% | 18 | 4.5% | | | |
| Gemination | No | 1600 | 100% | 393 | 98.2% | Fisher's exact test | | 0.000* |
| | Yes | 0 | 0% | 7 | 1.8% | | | |
| Nonsyndromic supernumerary teeth | No | 1578 | 98.6% | 370 | 92.5% | Fisher's exact test | | 0.000* |
| | Yes | 22 | 1.4% | 30 | 7.5% | | | |
| Microdontia | No | 1594 | 99.6% | 392 | 98.0% | Fisher's exact test | | 0.002* |
| | Yes | 6 | 0.4% | 8 | 1.2% | | | |

*Figures in bold depict statistically significant values; *p*: value of probability

## Importance of Paediatric Dentist in counselling

Dentists can play an active role along with the geneticist in premarital counselling and patient education. This voluntary action will help to create awareness amongst patients that not only medical conditions but dental conditions too have an association with consanguinity. Early diagnosis of the patients based on a pedigree chart can improve the treatment outcome.[15]

## Summary and Conclusion

Our literature review confirms a positive and true correlation of nonsyndromic supernumerary teeth, fusion, and microdontia in parents with consanguineous marriage and their children. It can be



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stated from our review findings that a collaboration between dental professionals and geneticists is needed to explore the underlying genetic factors, to create a pedigree chart of the family and to impart premarital counseling, education, and awareness amongst patients that not only medical conditions but dental conditions too have an association with consanguinity. Early diagnosis of the patients based on a pedigree chart can improve the treatment outcome.[16,17]

Congenital dental anomalies were significantly prevalent in consanguineous marriages with greater incidence in the lower socioeconomic groups. Consanguineous marriages have the propensity to transmute population conformation.[18] Consanguineous marriages are the key determinants in the prevalence of several craniofacial abnormalities with an increased risk for congenital orofacial, dental malformations and autosomal recessive disorders due to higher expression of the recessive deleterious gene or defective allele carried to the offspring with some increased consequential postnatal mortality in the progenies of first-cousin marriages.[17,18] In countries like India where traditional beliefs especially in rural areas are relatively high, increasing public awareness toward hostile effects of consanguinity by health care service providers associated with regulatory guidelines for screening consanguineous partners and their offspring are obligatory to ensure a better quality of life. Developmental dental anomalies and self-reported systemic diseases are significantly higher in individuals born from consanguineous marriage.[19,20]

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