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Health and demography in late 19th century Kimberley : a palaeopathological assessment

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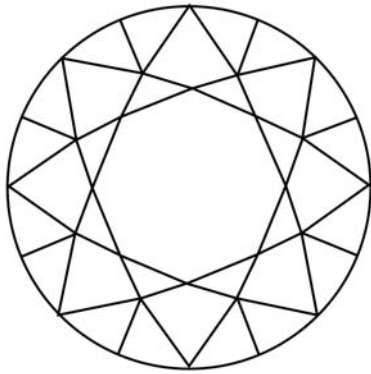
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CHAPTER 8

The High Prevalence of Supernumerary Teeth in Skeletal Remains from a 19th Century Mining Community from Kimberley, South Africa

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A report on the high incidence of supernumerary teeth in skeletal remains from a 19th
century mining community from Kimberley, South Africa

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Kimberley Market Square, 1895
(McGregor Museum Kimberley Photography nr.8681)



Gowie Brothers & Co., Kimberley, 1890s
(McGregor Museum Kimberley Photography nr.954_001)

Abstract

Supernumerary teeth can be described as the presence of more than 20 deciduous or 32 permanent teeth in one individual. This condition occurs in 0.1 - 3.7% of individuals within most populations. The purpose of this study was to examine the prevalence of hyperdontia in a 19th century mining community from Kimberley.

The Sol Plaatje municipality disturbed several unmarked graves outside the fenced Gladstone cemetery in Kimberley, South Africa. The remains belonged to mine workers and other individuals who died in the Kimberley and surrounding hospitals between 1897 and 1900. The well-preserved teeth of 76 adult males and 13 adult females were examined and counted.

Supernumerary teeth were documented in 6.7% (N = 6) of the study population. This is high considering the prevalence of this condition in other population groups. Two of the seven individuals affected by the condition presented with multiple non-syndromal supernumerary teeth.

The Gladstone sample population was primarily composed of migrant workers, and it is proposed that, although several factors may influence the development of supernumerary teeth, the possibility of a genetic relationship between some of these individuals should be considered to be responsible for the high prevalence of hyperdontia in this sample population.

8.1 Introduction

Supernumerary teeth, or hyperdontia, can be recognized by the presence of more than 20 deciduous, or 32 permanent teeth in one individual (Ortner, 2003; Ramsaram *et al.*, 2005; Montenegro *et al.*, 2006; Orhan *et al.*, 2006; Proff *et al.*, 2006; Refoua & Arshad, 2006; Gündüz & Muğlali, 2007). Hyperdontia can develop either due to the retention of deciduous teeth or the development of extra deciduous and permanent teeth resulting from a derangement in the process of organogenesis (Łangowska-Adsmczyk & Karmańska, 2001; Ortner, 2003). The aetiology of these teeth is uncertain, but various causes for their presence such as atavism, dichotomy of the tooth germ, excessive growth of the dental lamina, heredity factors and general diseases have been suggested (Fastlicht, 1943; Brook, 1982; Mason *et al.*, 2000).

The development of extra permanent teeth can be classified as “heterotopic” - teeth developing outside the alveolar region or “normotopic”. The latter includes teeth that develop in the alveolar region and erupt in a relatively normal orientation (Ortner, 2003). Much variation in the morphology of supernumerary teeth has also been described (Fastlicht, 1943; Ashkenazi *et al.*, 2007). These teeth may be normal in shape and size, normal in shape but reduced in size, of conical shape or, lastly, abnormal in shape as well as reduced in size (a denticle) (Fastlicht, 1943).

Single or multiple supernumerary teeth can be unilateral or bilateral (Ramsaram *et al.*, 2005; Orhan *et al.*, 2006; Refoua & Arshad, 2006) and it has been shown that the anterior maxilla and mandibular premolar regions are most commonly affected (Stafne, 1932; Luten, 1967; Mitchell, 1989; Shapira & Kutienic, 1989; Scheiner & Sampson, 1997; Rajab & Hamdan, 2002; Ramsaran *et al.*, 2005). Multiple supernumerary teeth most often affect the mandibular premolar region (Stafne, 1932; Luten, 1967; Shapira & Kutienic, 1989; Yusof, 1990; Rajab & Hamdan, 2002; Ramsaran, 2005).

The purpose of this study was to examine and explain the prevalence of hyperdontia in a 19th century mining community from Kimberley, South Africa.

8.2 Materials and Methods

In April 2003, the Sol Plaatje municipality dug a trench for proposed water lines and disturbed a number of unmarked graves outside the fenced Gladstone cemetery in Kimberley, South Africa. A total of 107 well preserved skeletons was exhumed.

Historical records indicated that the remains were most likely those of black migrant workers who died in the Kimberley and compound hospitals between 1897 and 1900 (Stoney, 1900). The individuals were of low socioeconomic status, malnourished and exposed to a high pathogen load, as could be deducted from the high prevalence of infective and nutritional diseases described in hospital records (Stoney, 1900). Skeletal investigations concurred with these records, with several individuals presenting with lesions indicative of scurvy, treponematosi, tuberculosis, trauma and amputations (van der Merwe, 2007). After death these individuals received paupers' burials, without coffins, in graves mostly containing more than one individual.

Standard anthropometric techniques such as cranial morphology, the width of the pubic angle, morphological changes of the sternal ends of the ribs and discriminant functions were used to determine the age and sex of all individuals exhumed from the trench (De Villiers, 1968; Krogman & İşcan, 1986; Hillson, 1998; Oettlé & Steyn, 2000; Asala, 2001; Franklin *et al.*, 2005). Based on these results, the sample consisted of 86 males, 15 females and 6 individuals of unknown sex. The majority of individuals exhumed were between 20 and 49 years of age at the time of death. Three children, 13 adolescents and four individuals older than 50 years were also found. Due to the fragmentary condition of some skeletons, 10 males and 2 females were excluded from the study. The teeth of 76 adult males and 13 adult females were examined and counted in order to determine whether any extra permanent teeth were present. The results were compared to various other studies.

8.3 Results

Supernumerary teeth were recorded in 6.7% (N = 6) of the individuals in this study population. This is high when considering that prevalences between 0.1 and 3.7% have been recorded for western population groups (Ramsaran *et al.*, 2005; Montenegro *et al.*, 2006, Güdnüz & Muğlali, 2007; Scheiner & Sampson, 1997; Yusof, 1990; Taylor, 1972; Altug-Atac & Erdem, 2007).

Although only one female and five males were affected by hyperdontia, no significant difference ($\chi^2 = 0.023$, p-value > 0.05) could be found in the prevalence of supernumerary teeth between the sexes.



Figure 8.1 Maxillary teeth of a female, 19-23 years (GLD N100.5). An extra premolar is present on right side of maxillary arch.

Three individuals (GLD N100.5, GLD N8.10 and GLD SE12.2) presented with parapremolars (see Table 8.1). Individual GLD N100.5 had a fully developed upper right parapremolar (see Figure 8.1), while GLD SE12.2 had a fully developed lower right parapremolar (see Figure 8.2). Although no crowns were present, roots suggesting rudimentary developed parapremolars/ denticles (see Figure 8.3) were visible next to the upper right second premolar of GLD N8.10.

Two individuals (GLD SE7.7 and GLD SE7.8) presented with rudimentary developed supernumerary molars (denticles). A single rudimentary developed distomolar/denticle was visible behind the upper right third molar in individual GLD SE7.8 (see Figure 8.4). GLD SE7.7 presented with three rudimentary extra molars/denticles (see Figure 8.5). These supernumerary teeth were very similar in morphology and location to that of GLD SE7.8 and GLD 8.10.

Possible multiple impacted teeth were observed in GLD SE11.5. Macroscopic investigation and X-rays revealed that these teeth, embedded in the mandibular body underneath the permanent right second incisor and canine, were most likely at least two premolars (see Figure 8.6).



Figure 8.2 Mandibular teeth of a 20-40 year old male (GLD SE12.2). Extra premolar present on the right.



Figure 8.3 Maxillary teeth of a possible male, 20-24 years old (GLD N8.10). Two rudimentary developed extra premolars present next to second upper right premolar.

Table 8.1 Summary of supernumerary teeth observed in the Gladstone skeletal sample.

Nr.	Age (years)	Sex	Location	Description of supernumerary tooth/teeth
GLD N100.5	19-23	F	Max.	Parapremolar
GLD N8.10	20-24	M	Max.	Rudimentary parapremolar*
GLD SE7.7	20-25	M	Max.	Three rudimentary developed distomolars and paramolars
GLD SE7.8	35-45	M	Max.	Rudimentary distomolar
GLD SE11.5	20-25	M	Mand.	Three impacted premolars
GLD SE12.2	20-40	M	Mand.	Parapremolar

M=male, F=female, Mand.=Mandibular, Max.=Maxillary

* Only roots present



Figure 8.4 Maxillary teeth of a male, 35-45 years (GLD SE7.8). Rudimentary developed extra molar present behind upper right third molar.

It is also possible that these teeth may in fact be a compound odontome. Should this case be excluded from the study due to this possibility, the prevalence of supernumerary teeth will still be 5.6% in the Gladstone population sample, and accordingly still higher than expected.

As shown in Table 8.1, supernumerary teeth most often occurred in the maxilla, although it was not significantly more affected than the mandible ($\chi^2 = 0.133$, p-value > 0.2). Supernumerary premolars were most commonly



Figure 8.5a Maxillary teeth of a possible male, 20-25 years of age (GLD SE7.7) showing two extra teeth on the left and a probable fourth molar on the right half of maxillary arch. 5b. Lateral view of the supernumerary teeth on the left.

observed, followed by supernumerary molars. No extra incisors or canines were observed. All supernumerary teeth involved the permanent dentition and no extra teeth were observed as a result of retained deciduous teeth.

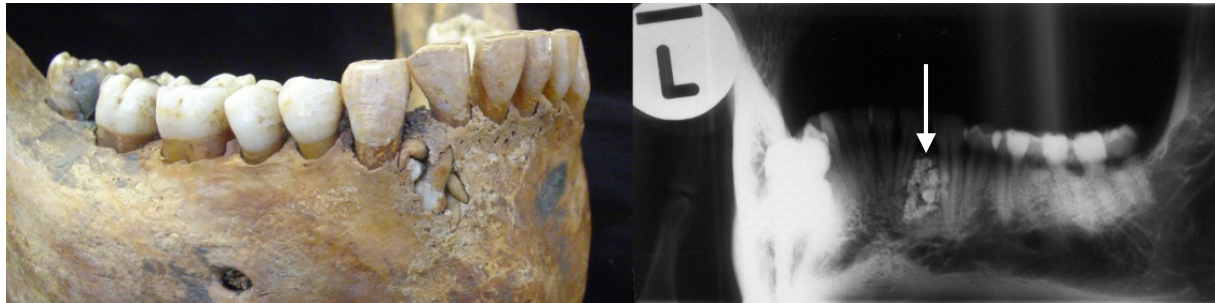


Figure 8.6 Impacted supernumerary teeth/possible odontome. Mandible of a male, 20-25 years (GLD SE11.5). Several extra teeth impacted underneath lateral incisor and canine on right side of mandible (indicated by arrow on x-ray).

8.4 Discussion

It has been reported that males are significantly more affected by supernumerary teeth than females (Scheiner & Sampson, 1997; Ramsara *et al.*, 2005; Montenegro *et al.*, 2006; Orhan *et al.*, 2006; Proff *et al.*, 2006; Refoua & Arshad, 2006). Although only one female and five males were affected by supernumerary tooth development in this population sample, no significant difference between the sexes could be detected. This can most likely be ascribed to the small sample size and poor sex distribution within this sample.

According to previous studies, supernumerary upper central incisors are the most common form of hyperdontia (Stafne, 1932; Luten, 1967; Shapira & Kutienic, 1989; Scheiner & Sampson, 1997; Rajab & Hamdan, 2002). It is interesting to note that none of the supernumerary teeth in the Gladstone population was in the anterior maxilla. All cases recorded in this study involved the premolar and molar regions, making these cases all the more unusual.

It has been shown that a single supernumerary tooth is found more often than two or multiple extra teeth (Orhan *et al.*, 2006). In this study, two individuals (2.2%) had multiple supernumerary teeth (see Figure 8.2). This was remarkable, as it was reported that usually only 1% of the population presents with multiple extra teeth (Orhan *et al.*, 2006). Individual GLD SE7.7 had three extra hypoplastic molars and individual GLD SE11.5 had several impacted teeth in the mandibular body (see Figure 8.6). It should be mentioned here that the feature observed in GLD SE11.5 may also be a compound odontome. An

odontome can be defined as a ‘non-neoplastic, developmental anomaly or malformation that contains fully formed enamel and dentine’ (Soames & Southern, 1988. pp.212). Although several clinical studies describing odontomes have been published, very few palaeopathological cases have been reported - one being a compound odontome from medieval Canterbury, Kent (Anderson & Andrews, 1993).

Unfortunately, the supernumerary teeth/odontome could not be removed from the mandible due to ethical constraints and no further x-ray examination could be done to allow better visualization of the feature. For the purpose of this study, this dental anomaly was counted as a supernumerary tooth. But, even with the exclusion of this case, the prevalence of supernumerary teeth within this population will still be higher than has been reported in any other study.

Results indicated that the number of individuals affected by supernumerary teeth in the Gladstone population was higher than what would be expected. Brown (1990) and Zhu *et al.* (1996) noted that there is a slightly higher prevalence of supernumerary teeth among sub-Saharan and Asian populations, ranging between 2.7% and 3.4% (Taylor, 1972; Brown, 1990; Montenegro *et al.*, 2006). Although it can be expected that most, if not all individuals in this sample were sub-Saharan descendents, this does not seem like a plausible explanation for the higher prevalence.

Another reason for the high frequency of hyperdontia, especially in cases with multiple supernumerary teeth, can be the presence of syndromes. Besides the variation in tooth number amongst the ‘normal’ population, multiple supernumerary teeth generally occur as part of a pathological syndrome such as a cleft lip and palate, Gardner’s syndrome, cleidocranialis dysplasia, Fabry-Anderson syndrome and Ehler-Danlos syndrome (Montenegro *et al.*, 2006; Orhan *et al.*, 2006; Proff *et al.*, 2006; Refoua & Arshad, 2006; Gündüz & Muğlali, 2007).

It has been shown that multiple supernumerary teeth are rarely seen without being associated with systemic conditions or syndromes (Orhan *et al.*, 2006; Gündüz & Muğlali, 2007). However, no skeletal lesions indicative of the conditions mentioned were observed in the Gladstone sample.

It should be kept in mind that since this sample population comes from the Kimberley and other surrounding hospitals, they will have a selection towards a higher prevalence of pathology and trauma. This is especially true when interpreting the prevalence of fractures, amputations and infectious diseases, since all of these conditions are reasons for

hospitalization. Since hyperdontia in itself would not lead to hospitalization, and no syndromes which could lead to hospitalization of patients who would be more prone to developing supernumerary teeth were detected, it can be assumed that the frequency of this condition in the sample is representative of the once living population the sample came from.

The Gladstone sample most likely came from a larger migrant working population, with the majority being young men. It was clearly stated in historical documents that men travelled to Kimberley in search of work, and that they would normally return to their home village once their contracts expired (Roberts, 1976). In cases where multiple supernumerary teeth do occur without relation to another disorder, it has been shown to have a strong familial occurrence (Brook, 1982; Fastlicht, 1943; Becker *et al.*, 1982; Marya & Kumar, 1998; Łangowska-Adamczyk & Karmańska, 2001; Batra *et al.*, 2005; Orhan *et al.*, 2006; Refoua & Arshad, 2006). It is thus possible that the high prevalence of supernumerary teeth in this sample indicates that some of the individuals were genetically related. The morphological similarity of the supernumerary teeth, as was seen in individuals GLD N8.10, GLD SE7.7 and GLD SE7.8, supports possible genetic connections between the individuals in this sample. A possible genetic relationship between some of the individuals affected with hyperdontia in this sample may also explain the unusual distribution of these teeth, with all affecting the premolar and molar regions and no individuals presenting with the commonly observed upper anterior supernumerary teeth.

In summary, six individuals (6.7%) from a 19th century skeletal population were found to have had extra teeth. Most of these occurred in the form of extra premolars, but two with supernumerary molars were also found. Although it is possible that this is just a random occurrence, or that the syndromes responsible for these supernumerary teeth could not be detected from skeletal remains alone, the possibility of a genetic relationship between some of these individuals should be considered as likely.

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