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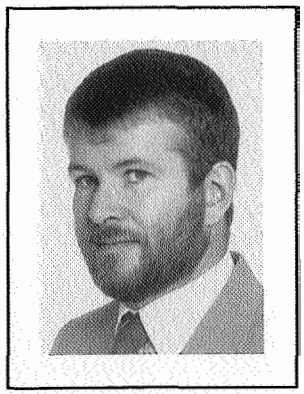

Sex determination by reference to dental plaster casts of young adults

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ABSTRACT: Dental plaster casts of young Caucasians were examined by dentists with the objective of determining the sex of the subjects from whom they were taken. The first hypothesis tested was that dentists cannot distinguish the sexes, and second, that dentists cannot distinguish between the sexes from such an examination. The results of both tests were consistent with chance findings. However, half of the casts were perceived by 75 percent of dentists as being of a specific sex, which suggested that dentists shared some unfounded prejudices. It is concluded that dentists cannot differentiate sex by inspection alone of the general form and presentation of shape and size of dentate arches.

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MeSH words: sex determination; sex characteristics; sex differentiation; dental models; dentists
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INTRODUCTION

The human dentition is known to be the most durable of human remains following death. However, dental morphology has not up to the present been used as a means for determining sex (Ditch and Ross 1972).

Currently, there would appear to be a good deal of controversy as to whether or not sex characteristics of the human dentition can be used reliably for such a purpose (Bronowski and Long 1951; Lunt 1974), although more recent evidence tends towards a positive view (Alvesalo and Kari 1977; Garn, Lewis and Kerewsky 1964, 1966; Garn, Lewis, Swindler et al. 1967; Tanaka 1961).

Criteria used in studies to determine sex from teeth include the stages of mineralisation of teeth (Thompson, Anderson and Popovich 1975), U.V. light photomicrography (Lunt 1974), morphology and occlusion of posterior teeth (Ditch et al. 1972; Garn et al. 1964, 1967; Lunt 1974) and morphology of anterior teeth (Lunt 1967, 1974; Tanzer 1958). It would seem that from a forensic point of view, all possible reliable techniques of sex determination are necessary at times. Any evidence of sexual dimorphism in the overall presentation of the dentition, occlusal relationships, and dental arch shape and size would also be helpful.

Areas of dentistry, other than forensic odontology, may well benefit from additional information relating to sexual dimorphism in the dental tissues. The practice of prosthodontics, for example, is to a large extent directed towards the restoration of lost tissue. An artificial tooth with female characteristics, if such are found to exist, might appear incongruous with its surroundings in the mouth of a male, and vice versa. Likewise sexual differentiation of occlusion and arch form, if such were found to exist, might have important implications in orthodontics in making aesthetic and functional changes.

In order to determine whether it was possible to discern dimorphic presentation in the form and appearance of the dentition and its occlusion and the overall size and shape of the dental arches, which is believed to be sex related, a sample of dental plaster casts was presented to a group of dentists from several dental disciplines to attempt sex determination.

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MATERIALS AND METHODS

Dental plaster casts of upper and lower dentate arches were obtained from a population of Caucasians aged between 17 and 24 years, and an identification code was enscribed on each cast. The males in the population were all dental students and the females were composed of both dental students and dental nurses. None of the subjects had edentulous spaces, removable prosthetic appliances or bridgework of any kind. Some subjects had had premolars and first permanent molars extracted for orthodontic purposes but all spaces created by these extractions had since closed.

Using random numbers a sample of 15 sets of casts (upper and lower) were randomly drawn from those of male subjects, and similarly 15 sets were randomly drawn from those of the female subjects. The total sample of 30 sets were then randomly ordered and numbered in sequence from 1 to 30.

Twenty dentists from several dental disciplines were asked to examine each set of casts with the objective of determining the sex of the subject from whom they were obtained. The information given to each participating dentist was confined to stating that the subjects were all Caucasians, to giving the age range, and to indicating that the sample of casts contained equal number of males and females. Each dentist made the assessment independently and was provided with a form for recording the sex determination of each set of casts. After concluding the assessment, which took approximately 15 minutes, each dentist was asked to write down those characteristics of the casts taken into account while making the sex determination. Following the assessments, the sex determination was checked against the identification code.

The null hypothesis tested, using Fisher's Exact Test (Maxwell 1961) for two by two contingency tables

(the four cells containing totals of males, correct and incorrect and females correct and incorrect) was that possible differences in each dentist's ability to distinguish the casts of male and female subjects and chance findings, and that dentists have no more ability to identify the sex of male subjects than they have to identify the sex of female subjects through an assessment of their dental casts. For instance, supposing a dentist could correctly identify 13 of 15 males and 13 of 15 females, this would indicate the dentist concerned had no difference in ability to distinguish males and females. On the other hand, a dentist who correctly identified 13 of 15 males but only 2 of 15 females indicates a 1 percent significant difference in the ability of that dentist to distinguish the sexes.

The second null hypothesis tested using the Binomial Test was that dentists do not have the ability to distinguish between males and females through the assessment of their dental casts, and that any apparent ability to do so is a chance finding. This may be illustrated by referring back again to the example in which the dentist correctly identified the sex in 26 of 30 cases; the probability to this being a chance finding is less than 0·2 percent. The other dentist could only correctly identify the sex of 15 cases in 30 for which the probability of this happening is 50 percent.

RESULTS

The highest correct level of sex determination, 12 out of 15 males, in either of the sex categories, and the lowest level in either category, 4 out of 15 females, were both achieved by dentist number 13 (*Table 1*). The difference in the ability of this dentist, who on the one hand could apparently distinguish the sex of a majority of the males, but on the other hand failed to distinguish the sex of a majority of the females, was not a characteristic of the other dentists. For eleven of them, the numerical differences between their correct assessments for both sexes were 1 or 0. The other differences ranged from 2 to 4. But even the difference of 8 noted in the case of dentist number 13 was not significant, and thus our first null hypothesis had not been rejected.

Table 1
Number of correct assessments of each dentist in determining sex from dental casts

Dentist number	Dental casts of male subjects (N=15)	Dental casts of female subjects (N=15)
1	9	8
2	11	7
3	10	8
4	11	10
5	9	9
6	6	6
7	8	11
8	7	7
9	10	9
10	7	10
11	10	9
12	11	7
13	12	4
14	11	9
15	6	6
16	7	7
17	9	8
18	10	8
19	8	10
20	9	7

Table 2
Distribution of the correct assessments (male and female combined) by dentists in determining sex from dental casts

Correct assessment totals	Number of dentists
12	1
14	2
16	2
17	3
18	7
19	3
20	1
21	1
Total:	20

It was also found that dentists could not distinguish between the male and female casts. *Table 2* presents the combined male and female correct assessment scores in a frequency distribution. One dentist correctly assessed 21 of 30 casts; his score being equal to the critical value at the 5 percent confidence level. The other dentists achieved total correct scores below this value, and thus the second null hypothesis had not been rejected.

A variety of reasons were given by the dentists when outlining how their determinations were carried out. Nearly all recorded that it was guesswork or intuition, while the main objective criteria noted by 75 percent of the dentists related to tooth and dental arch size. Anterior and posterior upper dental arch widths were measured using dividers. The anterior measurement was taken as the distance between the contact points of the canines and first premolars, and posteriorly, between the most distal aspect of the crowns of the second molars, and if third molars were present, the distance between the contact point of the second and third molars was taken. Measurements were not taken of posterior width in casts with missing premolars. The difference in mean anterior arch width between males and females of 0·25 mm and of the mean posterior width of 1·89 mm, were not significant.

DISCUSSION

The dentists were unable to distinguish the sexes of subjects through assessing dental plaster casts of their dentitions, nor were they able to distinguish between the sexes of the subjects by the same methods. In other words, there was no statistical evidence found to demonstrate sexual dimorphism in fully dentate arches of young adults.

Although the dentists did not have the ability to determine sex of subjects through assessing their dental casts, they did appear to share some preconceptions in making their assessments, as half of the casts were perceived to be a specific sex by at least 15 out of the 20 dentists, and in three cases there was unanimity of opinion. We independently arranged these cases by inspection according to size and found that the largest ones were those perceived to be of males and the smallest ones were perceived to be of females. The in-between range contained a mixture of perceived sexes. Among those perceived to be females, none had missing premolars while there were three cases among those perceived to be males who had had extractions of premolars for orthodontic reasons.

When the differences of the arch widths between perceived males and perceived females were analysed, the

mean anterior arch difference of 2·92 mm was found to be significant at the 5 percent confidence level using a single tail Student's 't' Test (t=2·28, df=12), as was the mean posterior difference of 3·67 mm (t=1·81, df=10). The implication here is that if the dentists consciously determined that small arches were female, and large arches male, then they did in fact have the ability to distinguish between larger than average dental arches, and smaller than average ones. Nevertheless, the analysis of the measurement of the arch widths of the true males and females, already referred to, shows there is no basis for adopting this criterion.

It is already known that in large samples statistical proof exists in relation to tooth size being greater in males than in females (Garn et al. 1964), but as the width in sex variation is far greater than the between sex variation, this proof has no indicator at the individual level.

While dentists felt they were guessing in their efforts to determine sex, and apart from relying upon size differences as their best guide, they shared other prejudices as well. For instance, the most unattractive dentition, characterised by large upper anterior teeth with gingival recession, was seen by all dentists as being male, as was the case with the cast showing a severe malocclusion. In another case, where the upper central incisors were broad and square and where the canines were large and pointed, this was also seen to be male. On the other hand, the casts which had the smallest teeth were seen to be female and the most attractive more rounded dentition was seen to be of a female. Of the 15 sets of casts perceived by most observers to be one sex or the other the perceptions proved correct in one out of nine cases.

CONCLUSIONS

It is concluded that dentists cannot differentiate sex by inspection alone of the general presentation of form and appearance of human dentate dental arches. This applies to the consideration of several individuals in, or of a group, or to the consideration of a single individual.

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