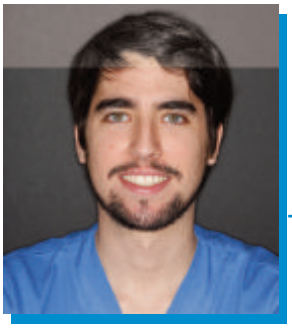

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Original article

Shovel incisors: frequency in orthodontic patients of different ethnic groups

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ABSTRACT

Introduction: Shovel teeth, a structural trait observed with great frequency in native Americans and Chinese, can condition the expression and treatment of malocclusions. The objective of this study is to compare their frequency and degree of expression in the samples of Chinese, Native American and Caucasian patients that had requested treatment in an Orthodontics Unit of the Region of Madrid.

Method: 63 patients of both sexes were selected, between 8 and 56 years of age: 15 were of Asiatic-Mongoloid origin, 15 were Amerindians and 33 Caucasian. The presence and degree of the "shovel" trait was evaluated of the teeth 11 and 12 in the plaster models by means of the Arizona State University Scale. For the statistical analysis, the Chi-square and Fisher association tests were used.

Results: The "shovel" trait was present practically in all the Asiatic-Mongoloid patients (100%) and Amerindians (93.3%), being infrequent in the Caucasians (12.1%) (P<0.0001). The degree of expression of the trait was moderate/severe in 66.6% of the Asiatic—Mongoloid patients, in 71.4% of the Amerindians and only in 25% of the Caucasians.

Conclusions: The "shovel" trait was practically constant in the Asiatic-Mongoloid and Amerindian subjects of our series and rare in the Caucasians. Due to the numeric importance of the population of these ethnic groups in our country, the orthodontist should be familiarised with a trait that can impact the treatments.

KEYWORDS

Shovel teeth; Shovel incisors; Dental morphology; Ethnic groups.

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INTRODUCTION

The study of the numeric and morphological variations of teeth is an important instrument in anthropological research. It allows, among other things, revealing patterns of biological filiation that would explain the finding of common traits among different ethnic groups due to migratory movements of the populations produced thousands of years ago.

The interethnic variations are well demonstrated with respect to the alterations of number, size and morphology of the teeth. For example, it is known that the presence of supernumerary teeth is much more common among Asiatic individuals than among the Caucasians[1,2].

Furthermore, the observation of a morphological dental trait called "shovel tooth" (Figure 1), common in native ethnic groups of the American continent and in the northern regions of Asia, has supported the hypothesis of a common genetic origin for these ethnic groups[3] (Figure 2).

The shovel tooth (ST) received diverse definitions from its first observation at the beginning of the 20th century. Hrdlička defines it as a morphological variation characterised by "prominent marginal crests that can even be joined creating a deep fossa at the level of *the cingulum*"[4]. Although one usually speaks of shovel incisors, all the teeth can show an equivalent morphological variation, in particular the upper first premolars and the lower first molars[5].

As it occurs with other morphological dental variations, the etiopathogenesis of the ST respond to a genetic polymorphism not yet clarified. It involves an allele of the receptor (EDAR)[3] whose mutations have also been related to ectodermal dysplasia, which shows a geographic distribution similar to that of the ST[6].

The analysis of this morphological dental variation has not only anthropological value, but its presence can condition the expression of some malocclusions and require, consequently, modification in the treatment plan, which justifies the interest in this trait for the orthodontist. In this regard, the higher frequency of dental crowding has been reported associated with the ST[7].

In our country in recent years, the immigrant population of Latin American and Chinese origin has increased notably, in such a way that at present these collectives constitute a significant proportion of the patients treated in the majority of the orthodontic visits.

This reality leads us to analyse the frequency of the ST (*shovel teeth*) trait in patients that request treatment in the orthodontics unit where a wide population of individuals with representation of the different ethnic groups that inhabit the Autonomous Region of Madrid are assisted.

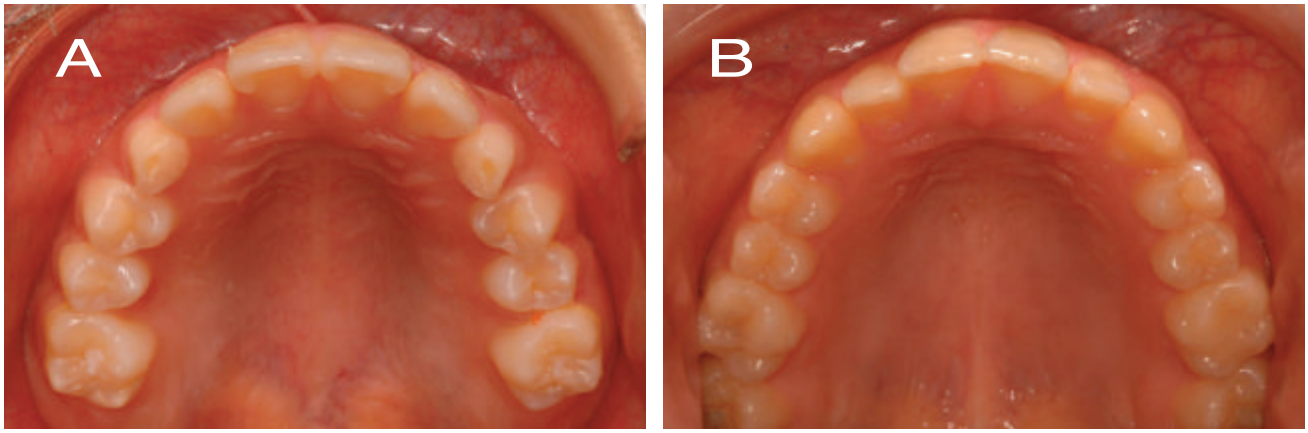

Figure 1. Morphology of "shovel incisors". A) Incisors with "shovel" morphology; B) Incisors without the "shovel" trait.

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Figure 2. The single-race theory of Hrdlička (1908) underscores the facial similarity of the Asiatic-Mongoloid and the Amerindian ethnic groups as a consequence of the migratory flow from Asia towards America in the Pleistocene Epoch, 10,000 years B.C.

OBJECTIVES

To compare the frequency of the morphological dental variation of "shovel incisors" and their degree of expression (mild, moderate or severe) in Asiatic-Mongoloid, Amerindian and Caucasian patients that request treatment in the Orthodontics Unit of the Jiménez Díaz Foundation University Hospital of Madrid.

MATERIALS AND METHODS

A sample of 63 patients of both genders were selected, aged 8 to 56 years that consecutively consulted the Orthodontics Unit of the Jiménez Díaz Foundation: 15 were of Asiatic-Mongoloid origin, 15 Amerindians and 33 Caucasians.

The following exclusión criteria were established: a) presenting any orofacial syndrome, palatal fissure, other congenital morphological and/or numeric alterations of the superior incisors (microdontia/conoid teeth, agenesis, supernumerary teeth); b) traumatisms with loss of substance/restorations of the superior incisors; c) their incomplete eruption and d) consanguinity with another patient included in the sample.

In the plaster models of all the patients, the presence and the degree of expression of the ST trait were evaluated in the teeth 11 and 12 (alternatively 21 and 22). To do this, the Arizona State University Scale (Figure 3) was used, a non-metric, validated visual method, simplifying the six degrees of the original scale into three: 0-2, No ST; 3-4, mild ST, and 5-6, moderate/severe ST[7,8].

The Chi-square and Fisher association tests were used for the statistical analysis.

RESULTS

The ST trait, irrespective of its intensity, was present in practically all the patients of the Asiatic-Mongoloid (100%) and Amerindian (93.3%) ethnic groups, being infrequent in the Caucasians (12.1%) (P<0.0001) (Figure 4).

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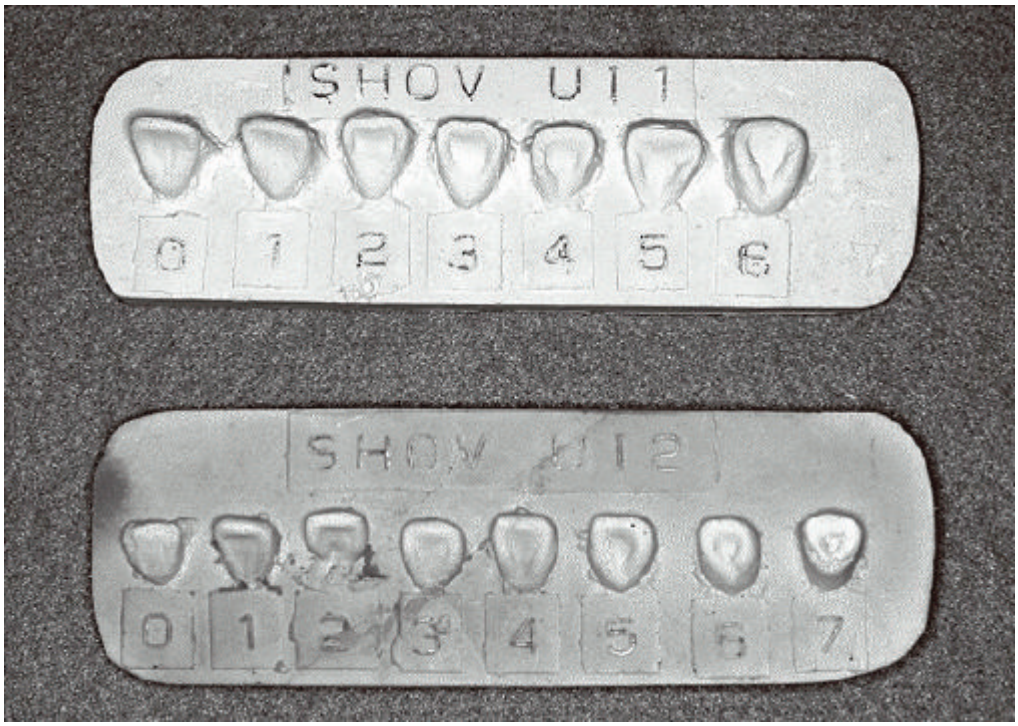

Figure 3. Template used to evaluate the presence and degree of expression of the "shovel" morphology. Method developed by the Arizona State University.

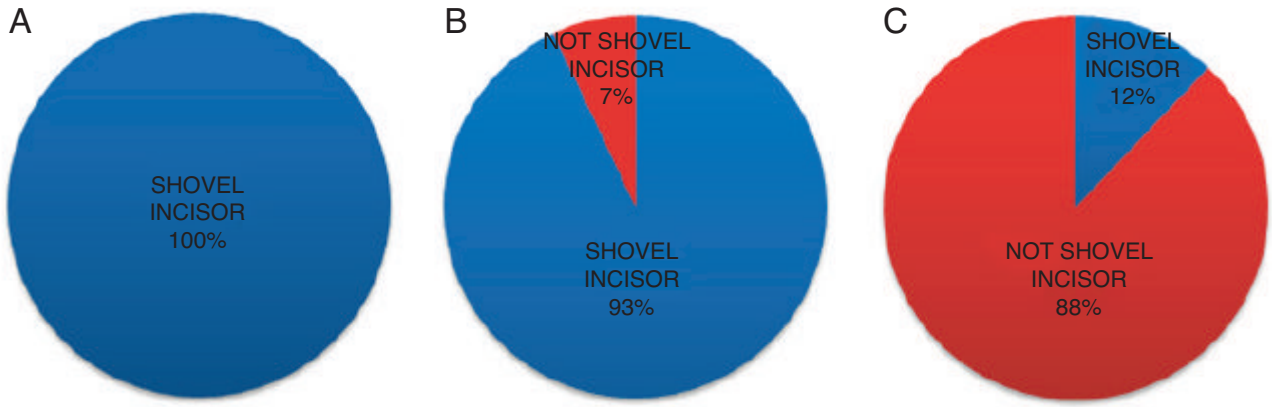

Figure 4. Proportion of the "shovel incisor" trait in the three evaluated ethnic groups. A) Asiatic-Mongoloid; B) Amerindian; C) Caucasian.

As regards the degree of expression of the trait, in the Asiatic-Mongoloid patients it was mild in 33.3% and moderate/severe in 66.6%; in the Amerindians it was mild in 28.6% and moderate/severe in 71.4% and, finally, in the Caucasians it was mild in 75% and moderate/severe in 25%. These interethnic differences regarding degree were not significant.

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DISCUSSION

Our findings confirm the presence of the morphological ST variation in the populations of Amerindians and Asiatic-Mongoloid residents of the Autonomous Region of Madrid analysed in our sample.

The evaluation of this morphological trait as a marker of the interethnic genetic variations has been used in research since the beginning of the last century. However, one must point out that the conclusions of some of them, due to their deficient methodology, are, at the very least, debatable.

Thus, Arkövi in 1903 studied 223 superior lateral incisors in 169 skulls of subjects of multiple origins, from the Roman period to the contemporary age of the author. However, this sample, very heterogeneous, included a large proportion of European subjects and a merely testimonial representation of individuals from Africa and New Zealand. This author, with a methodology lacking scientific foundation, reached the conclusion that the shovel-teeth morphology would show a progressive chronological increment. He argued that in his sample the ST trait was practically absent in the Roman skulls and affected 70% of those pertaining to the Hungarian population of the 19th century and 94% of those corresponding to the same population at the beginning of the 20th century[4]. This finding, if correct, would have an explanation outside the purely evolutionary realm, since it cannot be expected that a morphological change in an anatomical structure will be expressed in such a short period of time. Furthermore, the analysis of the scarce number of Maori and Negroid individuals in his sample led Arkövi to another even more surprising conclusion: the existence of a relation between the presence of the ST trait in the most culturally evolved populations and its absence in the most primitive.

In the classic study of Hrdlička[4], conducted a few years later (1920) using a degree of methodological rigor and a strong bibliographical support, the frequency of the ST trait in better defined populations was analysed. This author observed that the trait was not very common among the white and Negroid Americans, and it occurred in a third of the Hawaiians and in almost all of the Eskimos, Amerindians and in oriental ethnic groups. These findings can be considered quite similar to those of our study, even taking into account that this was done only on three ethnic groups (Caucasians, Amerindians and Asiatic-Mongoloids) compared to the numerous groups evaluated in the Hrdlička study. A fact to highlight is that Hrdlička found the ST trait in nearly 100% of the Japanese subjects of his study, a population not represented in ours.

More recently, several authors have studied the ST trait in native populations of the American continent, with all of them verifying its great frequency in these ethnic groups. Therefore, Dalberg, in 1947 in a study made on Pima Indians, a population of Indians native to Arizona (U.S.A.) and Sonora (Mexico), found that 90% of the subjects presented the morphological variation[9]. In turn, Devoto et al., in 1968, observed it in 100% of the individuals of a sample of Araucanians from northwest Argentina[10], and Bollini et al., in 2004 observed it in 85% of a sample of pre-Colombian skulls of less than 1500 years of antiquity coming from a region of the Argentine Pampas[11]. All these figures are quite compatible with those obtained in our subsample of Amerindian individuals.

Outside the American continent, Moorrees detected the trait in 65% of the individuals in a sample of Aleutians, inhabitants of some Pacific islands located between the southeast of Alaska and the Russian peninsula of Kamchatka[12].

The finding of the ST trait in different ethnic groups with origin in more distant places, located even on different continents, leads to analysing the responsible migratory movements of the populations in these locations. Specifically, the population of the American continent, among whose native Amerindians the ST trait is particularly frequent, has been explained by various theories (Figure 5).

In 1879, the paleontologist Ameghino defended the native origin of the American inhabitants, based on

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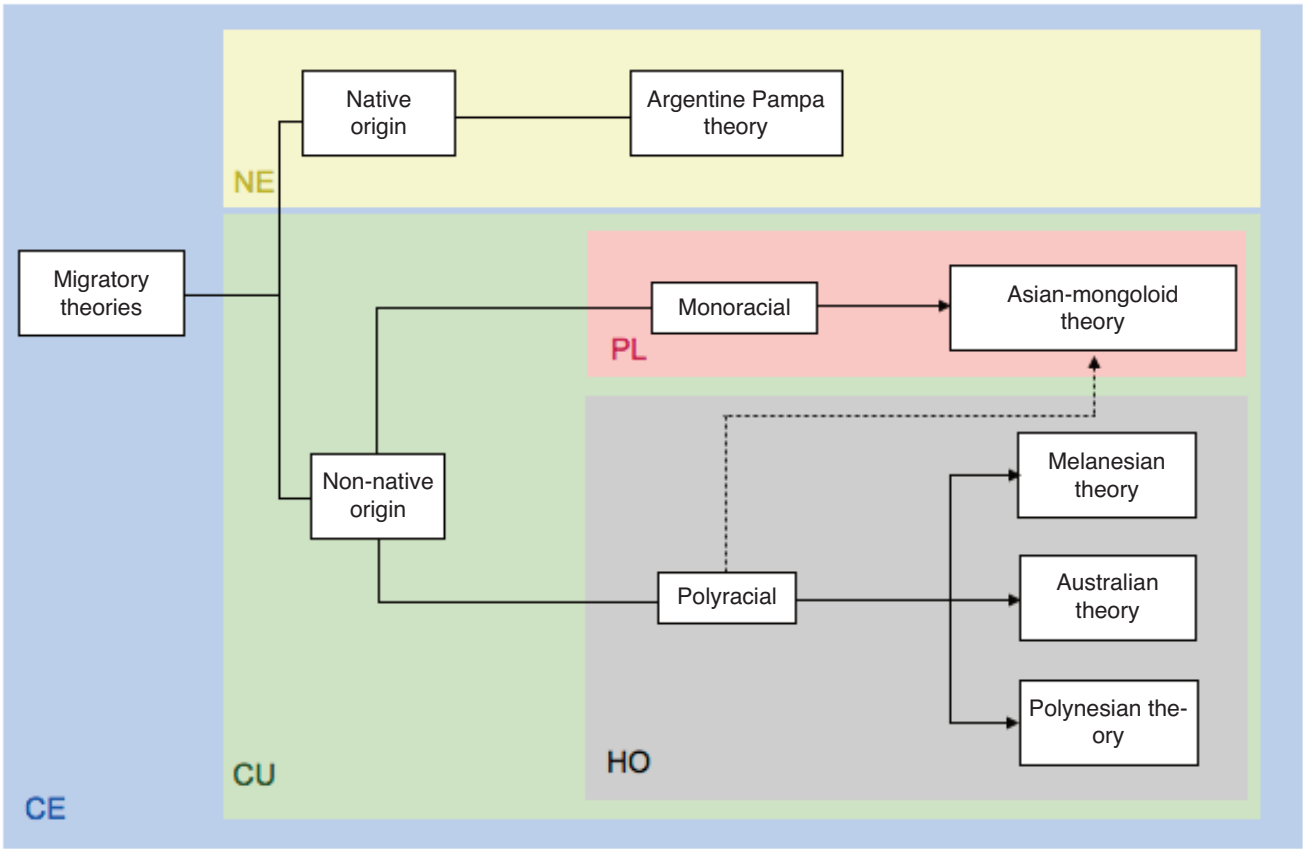

Figure 5. Representation of the different theories of the settlement of America, as well as the authors that posed them, framed within the corresponding Era, Period and Epoch. CE: Cenozoic or Tertiary Era; NE: Neogene Period; CU Quaternary Period; PL Pleistocene Epoch and HO: Holocene Epoch.

the appearance of human remains in the Neogene period in a region of the Argentine Pampas (Homo Pampeanus).

In 1908, Hrdlička[4] posed his single-race theory, according to which there existed migratory currents through the Bering Strait during the last ice age, in the Pleistocene, 10,000 years B.C. Therefore a common Amerindian-Asiatic-Mongoloid core would arise, which would explain the anthropologic-somatic similarities among these ethnic groups.

Later on, Rivet proposed that the settlement of Americans had been produced from multiple ethnic groups in the Holocene Epoch, 5,000 years B.C. In this way it complements the proposal expressed by Hrdlička, defending a multiracial origin with starting points in Polynesia, Melanesia and Australia. The Australian origin was also defended by the Portuguese, Correia. Furthermore, more recent theories mention the migrations coming from Europe, which would be added to the population movements through the Pacific Ocean[13].

All these theories, in short, justify the finding of a certain trait such as the ST in populations linked by this remote common origin (in our case the Amerindians and Asiatic-Mongoloid individuals) and its much lower frequency of other regions with a different origin (in our case, the Caucasian subjects). It would also be interesting to compare the frequency of the ST trait in Spaniards, which reached 25% in our sample, with that of Anglo-Saxon Caucasians, taking into account that the mixture between Spaniards and Amerindians was very significant after the discovery of America, contrary to that which took place between the Native Americans and the Anglo-Saxons.

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Some authors have detected a certain sexual dimorphism of the ST trait with a higher frequency in women[3], a fact that we could not transfer to our series in which the variation affected the majority of the subjects, both males and females.

In reference to the severity of the ST trait's expression, Hrdlička, without using any metric scale, distinguished four degrees in a subjective, visual manner: shovel, semi-shovel, trace shovel and absence of shovel. According to this classification, he found in his series a clear predominance of the semi-shovel expression in white and black American individuals, while in the Chinese and Japanese the accentuated form of the trait was much more frequent[4]. These findings only coincide in part with ours since in our series, the ST trait, evaluated with a validated metric scale, appeared with greater frequency in its more accentuated expression in the Amerindians and in the Asiatic-Mongoloids. In the low proportion of Caucasian subjects that showed the morphological variation, it was much more frequently mild.

CONCLUSIONS

The ST trait was practically constant in the Asiatic-Mongoloid subjects and Amerindians of our series and rare in the Caucasians.

The degree of expression of the trait was more frequently moderate-severe in the individuals of these ethnic groups.

Due to the numeric importance of the population of Chinese or Latin American population in our country, the orthodontist should be familiarised with a trait that could have an impact on the treatments.

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