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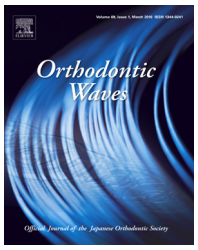

Original article

Prevalence and dimensions of sella turcica bridging in Japanese female orthodontic patients

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ABSTRACT

Purposes: The purposes of this study were to examine the prevalence of sella turcica bridging; to evaluate age-related differences in sella turcica dimensions and the prevalence of sella turcica bridging; and to clarify the associations of sella turcica dimensions and bridging with maxillofacial skeletal patterns and dental anomalies, such as tooth agenesis and impaction, in Japanese female orthodontic patients.

Materials and methods: Lateral cephalograms and panoramic radiographs of 232 Japanese female orthodontic patients, aged 7–35 years, were examined. In addition to conventional cephalometric measurements, sella turcica diameter (STD), interclinoid distance (ICD), and degree of ICL calcification [(STD ICD) to STD ratio] were evaluated.

Results: Sella turcica bridging occurred in 5.6% of all subjects. The mean values of STD, ICD, and degree of ICL calcification were 9.8 mm, 3.9 mm, and 60.0%, respectively. STD and degree of ICL calcification were larger and ICD was smaller in the ≥19-year-old group than in the 7–12-year-old group. No significant difference in sella turcica dimension or bridging prevalence was found in the anteroposterior or vertical skeletal pattern. Subjects with tooth impaction showed shorter ICDs and greater degrees of ICL calcification than did those without tooth impaction.

Conclusions: The prevalence of sella turcica bridging was 5.6%, and STD, ICD and degree of ICL calcification increased with age, in Japanese female orthodontic patients. In addition, sella turcica morphology and bridging were associated with tooth impaction, but not with maxillofacial skeletal deviations.

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1. Introduction

The sella turcica, located on the body of the sphenoid, is composed of a pair of anterior clinoid processes, the tuberculum sellae, the pituitary fossa, and a pair of posterior clinoid processes [1]. It is an important bony structure, used as a cephalometric landmark and reference line, which provides valuable information about craniofacial morphology and tooth position in orthodontic patients, and growth changes and treatment effects during orthodontic treatment.

The sella turcica houses the endocrine pituitary gland, which secretes various hormones. These hormones play important roles in physiological phenomena, including growth, reproduction, gonad function, and water balance [1]. The pituitary gland influences the size and shape of the sella turcica. Some subjects with pathological pituitary glands show abnormal sella turcica morphology [1–3]. For example, an abnormally small sella turcica may be found in subjects with primary pituitary or growth hormone insufficiency, and in those with Sheehan's syndrome [1,2]. In contrast, enlargement of the sella, encountered occasionally by orthodontists [3], may be indicative of pituitary tumors, gigantism, acromegaly, empty sella syndrome (pituitary gland nonfunction), craniopharyngioma, or intrasellar aneurysm [1,2]. Thus, the size and shape of the sella turcica are important not only for orthodontic diagnosis, but also for the recognition of underlying pathological conditions of the pituitary gland and endocrine diseases.

Several cephalometric studies of age-related changes in sella turcica size have been published [4–10]. They indicate that the dimensions of the sella turcica, including the diameter, depth, length, and cross-sectional area, increase with age. However, little is known about age-related changes in dimensions relating to the interclinoid processes. The relationship between sella turcica size and skeletal malocclusion is controversial [9–15]. Some studies have indicated that the length and cross-sectional area of the sella turcica are greater in patients with skeletal Class III malocclusion than in those with other malocclusion types [12–14], whereas other studies have shown no such difference [9,10] or smaller sellae turcicae in patients with skeletal Class III malocclusion [15].

Based on lateral cephalograms, the shape of the sella turcica can be classified into normal and five aberrant types: oblique anterior wall, sella turcica bridge, double contour of the floor, irregularity (notching) in the posterior part of the dorsum sellae, and pyramidal shape of the dorsum sellae [8]. Among these, a sella turcica bridge is one of the most common sella turcica anomalies [8]. A sella turcica bridge, also called an interclinoid taenia and interclinoid osseous bridge, is a phenomenon caused by calcification of the interclinoid ligament (ICL), connecting the anterior and posterior clinoid processes [16–22]. The prevalence of bridging has been studied using dry skulls [16,17], autopsy specimens [18–22], and lateral cephalograms [4,6,8,23–31]. The prevalence of the bridging reported in these studies is highly variable, ranging from 1.54% [20] to 11.1% [8].

Many studies have indicated associations between sella turcica bridging and congenital maxillofacial anomalies, such as tricho-rhino-phalangeal syndrome [32], Gorlin–Goltz syndrome [33], Williams syndrome [34], Rieger syndrome [35,36], Down's syndrome [37], and unilateral cleft lip and palate [38], although it remains unclear whether the bridging is directly associated with these disorders. In addition, sella turcica bridging has been reported to be related closely to skeletal malocclusion [11,23,30,39–41]. A high prevalence of bridging has been reported in patients with dental anomalies, such as palatal canine displacement [27,28,31], tooth impaction [42], congenital absence of the mandibular second premolars [31], and a solitary median maxillary central incisor [43].

Almost all studies concerning the prevalence of the sella turcica bridging and its relationships to head and neck anomalies have been in Caucasians, in Western countries [4,6,11,16,18–21,24–28,30–35,40,43]. To our knowledge, there is no reported clinical information on sella turcica bridging in Japanese subjects, except for a case report on Rieger syndrome [36].

The purposes of this study were: (1) to examine the prevalence of sella turcica bridging; (2) to evaluate age-related differences in sella turcica dimensions and the prevalence of sella turcica bridging; and (3) to clarify the associations of sella turcica dimensions and bridging with maxillofacial skeletal patterns and dental anomalies, such as tooth agenesis and impaction, in Japanese female orthodontic patients.

2. Materials and methods

2.1. *Subjects*

In total, 232 Japanese female subjects, aged 7–35 years, were selected from patients seen between April 2011 and December 2016 at the orthodontic clinic of the Health Sciences University of Hokkaido Hospital. Patients with congenital craniofacial anomalies, such as cleft lip and palate or syndrome, systemic diseases, and severe skeletal deformities that required orthognathic surgery, were excluded.

All procedures performed were in accordance with the ethical standards of the Ethics Committee of the Health Sciences University of Hokkaido and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

2.2. *Sample size determination*

Given the lack of a previous report related to sella turcica dimensions except for sella turcica diameter in skeletal patterns and dental anomalies, sample size was determined based on the power analysis for the one-way ANOVA. With an assumed power of 80%, an effect size of 0.25 (Cohen's medium effect size), and a significance level of 5%, the required total sample size was estimated to be 156.

2.3. *Evaluation of maxillofacial skeleton morphology and dental anomalies*

All cephalograms were traced on acetate paper, and conventional cephalometric measurements were taken by one author (NT). Cephalometric measurements, skeletal and dental, were

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