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Palate size and shape in schizophrenia

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ABSTRACT

The palate is considered typical of the structures in which schizophrenia-related minor physical anomalies may occur. In this study, we aimed to compare the dimensions and form of palate in patients with schizophrenia with nonpsychiatric controls in a blinded manner. Dental stone casts of 127 patients with schizophrenia and 127 controls were prepared from impressions of the maxillary dental arch. Palate dimensions were measured on the stone casts using a digital caliper and palatometer. Palate length did not differ significantly between the groups, but there was a significant difference in palate width and depth, which were significantly higher in the schizophrenia group. As a result of using multivariate analysis for assessing independent risk factors affecting patients with schizophrenia, furrowed palate shape, palate width, and ellipsoid maxillary dental arch shape were found to be significant. This study also revealed that patients with schizophrenia demonstrate certain gender-related predilections in the differences of palate parameters compared to same-sex controls. As the palate develops in conjunction with both the face and brain, our study findings can significantly contribute to the assumption that there might be structural abnormalities of the palate that could represent specific markers of embryological dysmorphogenesis underlying schizophrenia.

1. Introduction

The neurodevelopmental hypothesis of schizophrenia suggests that genetic and epigenetic mechanisms may mediate early brain development and increase the risk of developing schizophrenia in the affected individual (Féron et al., 2011). Minor physical anomalies (MPAs) are assumed to be phenotypic abnormalities of developmental abnormality (Compton and Walker, 2009). These comprised a range of subtle abnormalities of development of morphological structures present in the eyes, ears, mouth, head, hands, and feet without significant cosmetic and clinical impact (Ismail et al., 1998). Therefore, assessment of the physical developmental anomalies in the early developmental period may offer the potential clues of these neurodevelopmental disorders such as schizophrenia (Lane et al., 1997; McGrath et al., 2002; Elizarraras-Rivas et al., 2003). Craniofacial anomalies seem to be the predominant physical anomalies differentiating patients with schizophrenia from other patient groups most precisely (Waddington et al., 1999). The presence of dentofacial deformities will provide evidence for defects of early stages of brain development. In a recent study performed on MPAs in patients with schizophrenia and their siblings, it was concluded that in contrast to the other MPAs, palate and tongue anomalies were prevalent only in patients with schizophrenia, and the study did not reveal any relationship between affected patients and their siblings (Aksoy-Poyraz et al., 2011). Higher MPA scores in the mouth region and especially for palate may be markers of developmental defects contributing also to the development of schizophrenia (Compton and Walker, 2009). The palate is a part of a bony structure that includes the bones at which the base of the temporal lobe sits (Diewert et al., 1993). Primary palate formation involves a sequence of local cellular changes that are closely associated with craniofacial growth that takes place within during this critical developmental period (Diewert and Wang, 1992). While previous studies have indicated a high and narrow palate in schizophrenia, they have been carried out with subjective assessment without quantitative measurements and performed by examiners not blinded to diagnosis (Guy et al., 1983; Green et al., 1989; Lane et al., 1997; Waddington et al., 1999). To the best of our knowledge, only one study that performed a quantitative assessment of the palatal dimensions in a blinded manner showed that 28 patients with schizophrenia had significantly wider palates than the 25 healthy controls (Kirkpatrick et al., 2007). In this study, we aimed to

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perform a quantitative assessment and comparison of palate dimensions between patients with schizophrenia and non-psychiatric controls in a blinded manner. In addition, we carried out a qualitative comparison of the prevalence of individual types of palatal vault and maxillary dental arch form between the two groups.

2. Method

2.1. Setting and sample

This study was approved by the Ethics Committee in Bakirkoy Training and Research Hospital for Psychiatry, Neurology and Neurosurgery, and all participants provided written informed consent. The schizophrenic group included 127 (65 men and 62 women) stable outpatients who met Diagnostic and Statistical Manuel of Mental Disorders (DSM-IV-TR, American Psychiatric Association, 2000) criteria for diagnosis, during the period from January 2014 through October 2014. Patients with a diagnosis of any concurrent DSM-IV Axis I disorder other than schizophrenia were excluded. The nonpsychiatric control group comprised 127 patients (65 men and 62 women) who had been admitted to the general outpatient department of a public oral and dental hospital. Personal history of these disorders was assessed with the Structured Clinical Interview for DSM-IV Axis I disorders (First et al., 2002). Family history was assessed by using an informal assessment technique of participants' verbal responses to several questions. The controls who had a confirmed personal or family history (in first- and second-degree relatives) of psychotic or mood disorders were excluded. Mehtap Delice conducted the interviews and assessments of patients. All patients included in this study were adults with an age range of 18–50 years. Furthermore, all of them had intact permanent dentition from the left second permanent molar to the right second permanent molar. Patients with a history of neurological disorder, history of drug or alcohol abuse, any medical condition that might affect cerebral functioning, any signs of mental retardation, somatic disorders with neurological components, and a history of craniofacial trauma with orthodontic treatment were excluded in both groups. Both the patient and control groups were of Turkish origin, to avoid eventual confounding because of the lack of ethnic and racial references of palate parameters; patients with non-Turkish parental or grandparental ethnic group were excluded.

2.2. Procedures

Dental impressions and casts were made by using the standard methods for clinical dental practice in both the groups. Irreversible hydrocolloid impressions of the maxillary dental arches were obtained and the casts were prepared with dental stone. The same trained assessor (Ozlem Gurbuz, prosthodontist) performed all of the measurements. The casts were examined by the assessor who was blinded to the group membership of the patients. A second assessor (Gamze Mandali, prosthodontist), who was blinded to diagnosis, conducted reliability studies under the same conditions. A total of 30 randomly selected study models of the study groups were examined and measured by the second assessor separately using the same protocols.

The palatal dimensions were assessed as the following: the palatal width was measured by using digital caliper as the minimum distance between points of the upper first permanent molars at the cervical aspect of the mesiopalatal cusps at the junction of the tooth and gingival margins. The palatal length was measured by using a digital caliper from the anterior point (defined as the intersection of the mid-sagittal plane with a line passing over the widest point of the incisive papilla) to the posterior point (defined as the intersection of the mid-sagittal plane with a plane passing through the most distal points of the upper first permanent molars). The palatal depth was measured by using a palatometer as a vertical distance on the midpoint of the linear distance between the mesiolingual cusps of the maxillary first permanent molars and the highest point of the vault of the palate in the midline (Riquelme and Green, 1970). On the basis of the cross-sectional view of the palatal vault at the deepest point on the maxillary stone casts, the palatal vault shape was classified as follows: 1 – normal or round; 2 – furrowed; and 3 – shelf-like or stair (Skrinjaric et al., 2004). The maxillary dental arch form was classified into four categories: 1 – parabolic, 2 – ellipsoid, 3 – hypsiloid, and 4 – pointed or hyperbolic (Skrinjaric et al., 2004). Palate forms and dental arch shape were chosen by the examiner (Ozlem Gurbuz) according to the best-fit method.

2.3. Data analysis

NCSS (Number Cruncher Statistical System) 2007 and PASS (Power Analysis and Sample Size) 2008 Statistical Software (Utah, USA) were used for statistical analyses. During the evaluation of the study data, regarding the comparisons of descriptive statistical methods (mean, standard deviation, median, frequency, and ratio), independent samples *t*-test was used to compare the groups for normally distributed variables and Pearson's chi-square test and Yates' continuity correction test were used for qualitative data. In multivariate analyses, backward stepwise logistic regression analysis and multivariate analysis of variance (MANOVA) were applied with a confidence interval of 95%. Statistical significance was set at $p < 0.05$. The interexaminer reliability was measured using a Kappa test to determine agreement between measurements.

3. Results

In univariate assessment, care was taken to make sure that the groups resembled each other in their homogeneity. Table 1 presents the demographic characteristics and palatal parameters of patients with schizophrenia and controls. No difference was found regarding age and gender distribution ($p > 0.05$). The interexaminer reliability was measured by using a Kappa test to determine agreement between measurement: *Cohen's K* coefficients for concordance between categorical and ordinal scores were all > 0.75, and intraclass correlation coefficients for continuous

Table 1
Clinical and demographic characteristics of subjects with schizophrenia.and normal controls.

	Control ($n=127$)	Schizophrenia ($n=127$)
Age ($m \pm sd$)	34.06 ± 5.93	34.22 ± 6.76
Gender *n* (%)		
Male	65 (51.2)	65 (51.2)
Female	62 (48.8)	62 (48.8)
Palate dimensions ($m \pm sd$)		
Palate width	34.04 ± 2.88	35.09 ± 3.56
Palate length	33.32 ± 3.20	34.01 ± 3.09
Palate depth	21.57 ± 2.02	22.11 ± 2.26
Maxillary arch form *n* (%)		
Normal or parabolic	54 (42.5)	34 (26.8)
Ellipsoid	30 (23.6)	52 (40.9)
U-shaped or hypsiloid	28 (22.0)	24 (18.9)
Pointed or hyperbolic	15 (11.8)	17 (13.4)
Palate vault shape *n* (%)		
Round or normal	91 (71.7)	66 (52.0)
Furrowed	15 (11.8)	38 (29.9)
Shelf-like or stair	21 (16.5)	23 (18.1)