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ORIGINAL ARTICLE

Association between brain lateralization and mixing ability of chewing side

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KEYWORDS
brain laterality;
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Abstract *Background/purpose:* Previous studies have suggested that functional dominance in one part of the body can be correlated with functional dominance in another part. Thus, the present research aimed to determine whether brain laterality (handedness, footedness, earedness, and eyedness) was related to mixing ability and chewing side preference.
Materials and methods: Fifty-four volunteers who were not undergoing any form of dental treatment took part in this study. Self-defined brain laterality was determined through a questionnaire. The volunteers performed five tasks related to brain laterality, which was identified by the side used to perform three or more of the five tasks. Chewing side preference was determined by observing the main gum location on the occlusal area when volunteers chewed for 30 strokes. Mixing Ability Index (MAI) was measured by analyzing the degree of mixing of two differently colored waxes (height, 3 mm; diameter, 20 mm). Occlusion contact area was measured by taking the maximum intercuspation bite with polysiloxane.
Results: Thirty-nine volunteers (72%) showed significant agreement between brain dominance and chewing preference side. The association between brain dominance and MAI was not significant. The occlusal contact area of the dominant side (mean = 48.2 mm^2) was significantly wider than that of the nondominant side (25.7 mm^2).
Conclusion: Brain laterality can be explained by the side of functional (preference of the hands, eyes, ears, and feet, and survey) has a positive correlation with chewing preference side. MAI between the brain dominant and nondominant sides was not significant. This shows

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that mastication efficiency does not differ between dominant and nondominant sides. So, this study suggests that brain dominance is correlated with chewing preference, but it does not affect efficiency of mastication.

Introduction

The human brain consists of left and right hemispheres, and has laterality. Brain laterality attributes functional dominance to various body functions.[1] Neurophysiologists have reported that the functional dominance of the hands, ears, eyes, and feet are indirect criteria that represent brain laterality.[1] Furthermore, it has been reported that functional dominance in one part of the body can be correlated with functional dominance in another part. For example, a person with right-hand dominance possesses right-sided dominance in the eyes, ears, and feet.[1] The dominance of a certain side of the body causes a unilateral preference, and the preference is expressed by the function of organs through the language of the nervous system. All the organs of the body are innervated, as are the masticatory muscles. Mastication is an important step in digestion. If food particles become smaller by chewing, the particle surface is larger than before. Because a large surface has a chance to encounter the enzyme, chewing ability is related to digestive efficiency.

Many researchers have published studies on the correlation between brain laterality and chewing side preference.[2–5] Nissan et al[3,4] have reported that the side preferences of the hands, eyes, ears, and feet are correlated with chewing side preference. However, many factors, including missing teeth, implant-supported restoration, and complete denture, are not related to chewing side preference.[3,4] Diernberger et al,[6] however, have reported that disorders with accompanying pain, such as temporomandibular joint (TMJ) disorders, could affect chewing side preference.

Meanwhile, masticatory efficiency, which could be one of the causes of chewing side preference, is a complex mechanism controlled by various factors. Masticatory efficiency, which could be defined by the ability to pulverize food debris during mastication, has an association with occlusal contact area, masticatory muscle force, malocclusion, number of functioning teeth, intraoral movement ability, and TMJ disorders.

According to the research published so far, brain laterality exits, and chewing side preference is related to brain laterality.[7] Still, there are insufficient data concerning masticatory efficiency when brain laterality and chewing preference are considered. Research data of occlusal contact area, which could be the cause of masticatory efficiency or attrition, are also scarce.[8]

Thus, the objective of this research was to measure brain laterality using a questionnaire and functional preference tests of the hands, eyes, ears, and feet, and to compare the results to mastication laterality. Moreover, this research was conducted to identify any influence of chewing side preference on masticatory efficiency and occlusal contact area.

Material and methods

Study volunteers

There were 54 volunteers aged 25–35 years, including 38 men (average age, 30.5 ± 5.5 years) and 16 women (average age, 28.0 ± 3.8 years). Exclusion criteria included severe facial asymmetry, cross bite, missing teeth (not restoration), TMJ disorders, and any oral cyst or malignant disease. This study was reviewed and approved by the Institutional Review Board of Pusan National University Dental Hospital (PNUDH-2015-002). Written consent was granted by all study participants.

Brain laterality tests

To measure brain laterality as defined by the most frequently used side of the hands, feet, eyes, and ears, the experimental method suggested by Nissan et al[3,4] was redesigned and reconstructed to fit the location and circumstances of the study. The brain laterality tests were preceded by volunteers indicating their brain laterality through a survey (Table 1).

Questionnaire-reported preference

The volunteers were asked by questionnaire, "Between left and right, which side do you use mainly?" to determine which side they perceived to be dominant.

Table 1 Brain laterality test.

Laterality	Task
Hand	Hand used for making a drawing
	Hand used for erasing a picture
	Hand used for throwing a small rubber ball
Foot	Foot used for kicking a soccer ball
	Foot used for kicking a tennis ball
	Foot used for stepping onto a chair
Eye	Eye used for looking into an opaque bottle
	Eye used for looking into a square box
	Eye used for looking into a camera viewfinder
Ear	Ear used to listening behind a closed door
	Ear used to listening cellular phone
	Ear used for a single wire earpiece

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