fortune Journals

Research Article

FORTUNE JOURNAL OF HEALTH SCIENCES

ISSN: 2644-2906

Oral Function of Junior Japan National Team Candidates in U13, U16, and U19 Badminton Players

Yogetsu Bando[1,2,3] and Mutsumi Takahashi[*,2,3,4]

Abstract

The aim of this study was to clarify the relationship among mastication frequency, occlusal force, and occlusal contact area in terms of the oral function of junior female Japanese national badminton players. The participants were female badminton players nominated as junior Japan representative candidates; U13: 12 players, U16: 25 players, and U19: 26 players. A questionnaire survey was conducted among participants to obtain a chewing score based on the number of times each bite was chewed on a 5-point scale. Pressure-sensitive film was used to measure occlusal force and occlusal contact area. Differences in chewing scores, occlusal contact areas, and occlusal force among participant groups were analyzed. The correlation between chewing scores and occlusal force or occlusal contact area in U13, U16, and U19 was analyzed. No differences in chewing scores were observed among participant groups. The occlusal force and occlusal contact area increased in the order of U13, U16, and U19, and significant differences were observed between U13 and U19, and between U16 and U19, respectively ($P<0.01$, $P<0.05$). In U16 and U19, a significant positive correlation was found between chewing scores and occlusal force ($P<0.01$). A significant positive correlation between chewing scores and occlusal contact area was observed in U16 and U19 ($P<0.05$). The results of this study revealed that the oral function of female badminton players nominated as junior Japan representative candidates improved with age, and that players who chewed more frequently had larger occlusal forces or occlusal contact areas in U16 and U19.

Keywords: Badminton competition; Oral function; Mastication frequency; Occlusal force; Occlusal contact area; Junior Japan Representative Candidate

Introduction

Mastication is an oral activity performed on a daily basis. However, chewing on only one side, chewing with the mouth open, and swallowing without adequate chewing can lead to decreased strength of the tongue and lip muscles, the development of jaw disorders, maxillofacial asymmetry, and imbalanced oral function, all of which can negatively impact quality of life [1,2]. Recent changes in eating habits, including the shift to softer foods and the growing popularity of fast food, are affecting the development of the muscles around the jaw, the growth of the jawbone, and the alignment of the teeth. This is because a bolus can be formed with a small number of mastication, and there is concern that this can lead to a decline in the development of the musculoskeletal system around the jaw.

In the context of sports, there are frequent changes in posture that do not occur in daily life. When the body's direction of motion changes, it works

Affiliation:

[1]Bando Dental Clinic, Ishikawa, Japan

[2]Nippon Badminton Association, Tokyo, Japan

[3]Japan Elementary School Badminton Federation, Tokyo, Japan

[4]Department of Physiology, The Nippon Dental University School of Life Dentistry at Niigata, Japan

***Corresponding author:**
Mutsumi Takahashi, Department of Physiology, The Nippon Dental University School of Life Dentistry at Niigata, Japan.

Citation: Yogetsu Bando, Mutsumi Takahashi. Oral Function of Junior Japan National Team Candidates in U13, U16, and U19 Badminton Players. Fortune Journal of Health Sciences, 8 (2025): 424-429.

Received: May 12, 2025
Accepted: May 19, 2025
Published: May 22, 2025

Bando Y and Takahashi M, Fortune J Health Sci 2025
DOI:10.26502/fjhs.292

to maintain postural stability from external disturbances by seeking a fixation source inside or outside the body [3]. One such source is a stable trunk, and occlusion is involved in sensory input that affects trunk stability [4–6]. For this reason, the relationship between oral function and physical function has been investigated in various sports and events. We previously focused on occlusal contact state, which affects somatosensory input for postural control, and investigated the relationship between the occlusal contact state and physical fitness tests in handball players [5]. The results revealed that scores for tests that involve exertion of muscle power and tests that involve cutting motions were influenced by the state of occlusal contact. In addition, a survey of junior badminton players revealed that the greater the occlusal force, the greater the agility [7]. Furthermore, a study of trampoline gymnasts revealed that the state of occlusal contact affected center-of-gravity sway [6,8].

In recent years, various organizations have been developing programs targeting junior athletes with the aim of strengthening and developing top athletes. The Nippon Badminton Association, a public interest incorporated foundation, is recruiting junior Japan national team players in the U13, U16, and U19 age groups in order to discover and develop players to represent Japan in future international competitions, including the Olympics. In addition, the Japan Elementary School Badminton Federation, an affiliated organization that has jurisdiction over the elementary school division of the Nippon Badminton Association, is conducting activities aimed at junior players in the mixed dentition period, their guardians, managers, coaches, and so on to investigate the relationship between oral function and motor function in order to spread awareness of the necessity of managing oral health, and to train people who can contribute to society in the future [9]. One of our activities is to measure the state of occlusion at competition venues and to share the results, as well as to communicate the necessity of oral care by explaining the role of occlusion during play and to encourage oral care habits, regular checkups, and early treatment.

The purpose of this study was to clarify the relationship among mastication frequency, occlusal force, and occlusal contact area in terms of the oral function of junior female Japanese national badminton players. The null hypothesis was that the mastication frequency of junior badminton players is not related to occlusal force and occlusal contact area.

Materials and Methods

Participants

The participants were female badminton players nominated as junior Japan representative candidates by the Nippon Badminton Association. There were 12 players in the U13 age group (10–12 years old), 25 players in the U16 age group (13–15 years old), and 26 players in the U19 age group (16–18 years old). This study was approved by the Ethics Committee of The Nippon Dental University School of Life Dentistry at Niigata (ECNG-R-326). The details of the study were explained in full to all participants and proxies, and their informed consent was obtained.

Chewing score survey

The number of times the participants chewed their food was determined by a questionnaire survey. In response to the question, “How many times do you chew each bite?”, the participants were instructed to choose from five options: “1–5 times”, “6–10 times”, “11–15 times”, “16–20 times”, and “21 or more times”. The chewing scores were assigned as 1, 2, 3, 4, and 5, in order of least number of chews.

Measurement of oral function

Oral function was measured using a pressure-sensitive film (Dental Prescale, 50H-R type; Fujifilm Co., Ltd. Tokyo, Japan) and evaluated using OCCLUZER (FPD-707; Fujifilm Co., Ltd.) [4,7,8,10]. The Dental Prescale was inserted into the participant’s mouth, and they were instructed to clench with maximum force for 3 s in the intercuspal position (Figure 1). The Dental Prescale was removed from the mouth and analyzed using OCCLUZER. The occlusal contact area, average pressure, and maximum pressure as well as the overall, right-side, and left-side distributions are shown in Figure 2. In this study, the overall occlusal force and occlusal contact area were used for analysis.

Statistical analysis

Statistical analysis was performed using SPSS ver. 17.0 (SPSS Japan Inc., Tokyo, Japan), and a P-value below 0.05 was considered significant. The Shapiro–Wilk test was used to examine the normality of distribution and Levene’s test was used for homogeneity of variance. Normality was observed

Figure 1: Occlusal measurement using a pressure-sensitive film.

Citation: Yogetsu Bando, Mutsumi Takahashi. Oral Function of Junior Japan National Team Candidates in U13, U16, and U19 Badminton Players. Fortune Journal of Health Sciences. 8 (2025): 424-429.

Bando Y and Takahashi M, Fortune J Health Sci 2025
DOI:10.26502/fjhs.292

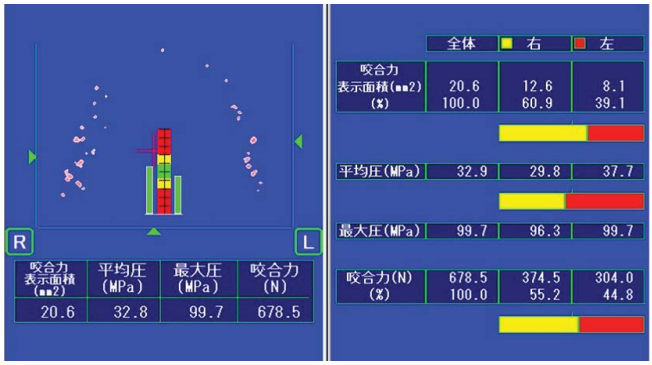

Figure 2: Analysis results of occlusal contact state, using OCCLUZER (FPD-707).

for the occlusal force in the U13, U16, and U19 age groups as well as the occlusal contact area in the U13 age group.

The Kruskal–Wallis test was used to test for differences in chewing scores or occlusal contact areas among participant groups. If significant, the difference between the two samples was tested using the Mann–Whitney test. Differences in occlusal force among participant groups were analyzed using one-way analysis of variance and Bonferroni's multiple comparison test because homoscedasticity was observed.

The correlation between chewing scores and occlusal force or occlusal contact area in the U13, U16, and U19 age groups was analyzed using Spearman's rank correlation coefficient.

Results

The differences in chewing scores among participant groups are shown in Figure 3. The chewing score for the U13 age group was the highest at 4.1 on average, but no significant differences were observed among the U13, U16, and U19 age groups.

Figure 4 shows the differences in occlusal force among the groups. The occlusal force increased in the order of U13, U16, and U19, and significant differences were observed between the U13 and U19 age groups ($P<0.01$) and between the U16 and U19 age groups ($P<0.05$).

The differences in occlusal contact area among participant groups are shown in Figure 5. The occlusal contact area increased in the order of U13, U16, and U19, and significant differences were observed between the U13 and U19 age groups ($P<0.01$) and between the U16 and U19 age groups ($P<0.05$).

The results of the correlation analysis between chewing scores and occlusal force in the U13, U16, and U19 age groups are shown in Figure 6. No significant correlation was observed between the two for the U13 age group ($R=0.457$, $P=0.135$). For the U16 age group, the higher the chewing score, the higher the occlusal force, with a significant positive correlation observed between the two ($R=0.618$, $P<0.01$). The U19 age group also showed a tendency for occlusal force to increase with increasing chewing score, and a significant positive correlation was observed between the two ($R=0.516$, $P<0.01$).

The results of the correlation analysis between the chewing scores and occlusal contact area in the U13, U16, and U19 age groups are shown in Figure 7. No significant correlation was observed between the two for the U13 age group ($R=0.528$, $P=0.077$). For the U16 age group, the higher the chewing score, the larger the occlusal contact area tended to be, with a significant positive correlation observed between the two ($R=0.484$, $P<0.05$). The tendency for occlusal contact area to increase with increasing chewing score was also seen in the U19 age group, and a significant positive correlation was found between the two ($R=0.488$, $P<0.05$).

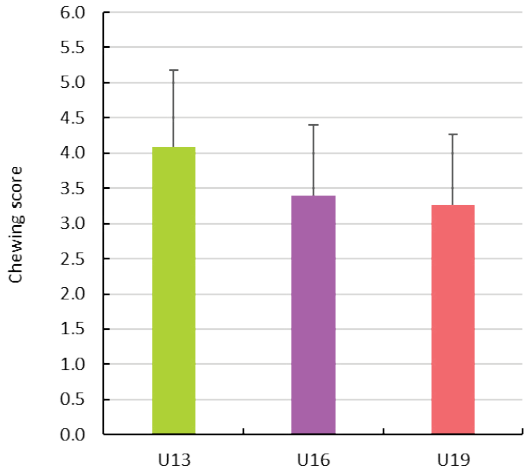

Figure 3: Differences in chewing score among the U13, U16, and U19 age groups.

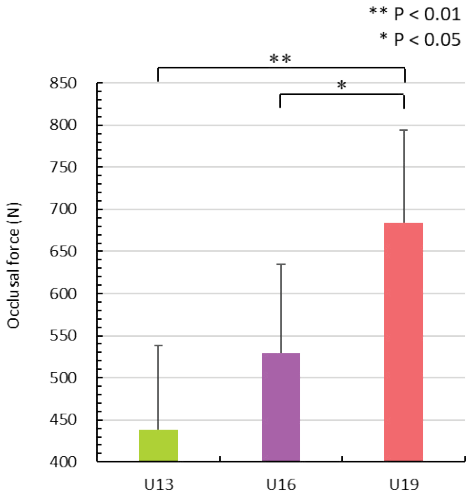

Figure 4: Differences in occlusal force among the U13, U16, and U19 age groups.

Citation: Yogetsu Bando, Mutsumi Takahashi. Oral Function of Junior Japan National Team Candidates in U13, U16, and U19 Badminton Players. Fortune Journal of Health Sciences. 8 (2025): 424-429.

Bando Y and Takahashi M, Fortune J Health Sci 2025
DOI:10.26502/fjhs.292

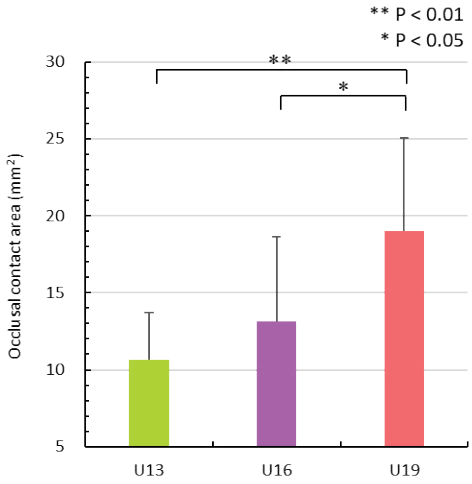

Figure 5: Differences in occlusal contact area among the U13, U16, and U19 age groups.

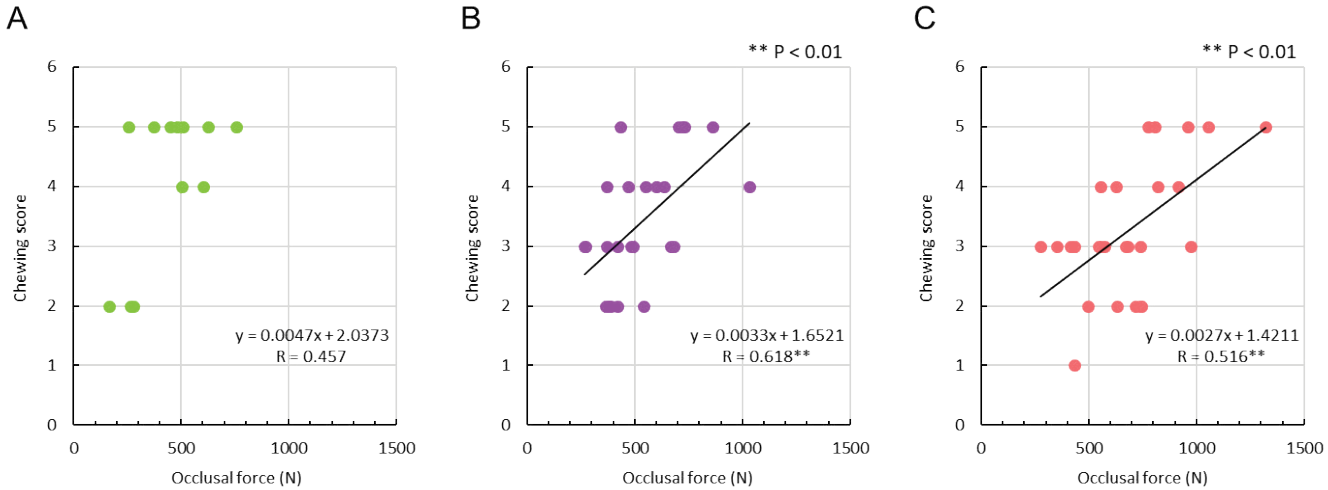

Figure 6: Correlation between occlusal force and chewing score for the U13 (A), U16 (B), and U19 (C) age groups.

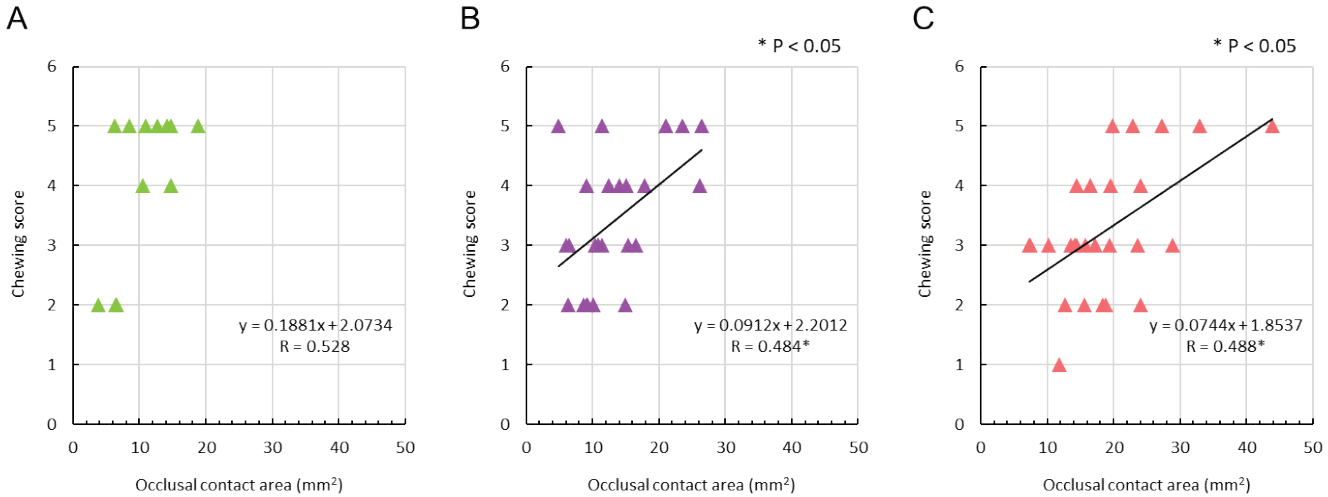

Figure 7: Correlation between occlusal contact area and chewing score for the U13 (A) U16 (B), and U19 (C) age groups.

Citation: Yogetsu Bando, Mutsumi Takahashi. Oral Function of Junior Japan National Team Candidates in U13, U16, and U19 Badminton Players. Fortune Journal of Health Sciences. 8 (2025): 424-429.

Bando Y and Takahashi M, Fortune J Health Sci 2025
DOI:10.26502/fjhs.292

Discussion

The results of this study showed a significant positive correlation between chewing frequency and occlusal force or occlusal contact area in U16 and U19 female badminton players selected as candidates for the Japan junior national team. Therefore, the null hypothesis was rejected.

In Japan, dental examinations for candidates for Japan's Olympic team began at the 1988 Seoul Games, and candidate athletes are presently required to undergo medical checks in three departments before being dispatched: internal medicine, orthopedics, and dentistry. The mouth is the entrance to the digestive system and is an essential organ for nutritional intake, which has a great influence on an athlete's conditioning, but its management tends to be neglected [7]. In a questionnaire survey of elementary school badminton players at a national tournament, several players were found to have dental caries that went untreated despite being detected during school health checkups. Most of the players explained that they did not have enough time to visit the dentist. Some players reported that they had toothaches but ignored the pain while playing. Junior athletes have characteristics that distinguish them from athletes in other age groups. They are in a period of development, including the oral and maxillofacial system, which may affect future sports performance, and they are at a stage where it is possible to instill and program proper oral care, dietary, and lifestyle habits [4,7]. It is believed that having regular dental checkups, receiving treatment early, and developing a habit of maintaining oral hygiene from an early age will lead to the healthy development of dentition and occlusion, and ultimately have a significant impact on a child's future athletic career. However, due to the fact that they are forced to lead an irregular lifestyle due to practices, training camps, and expeditions, there is an undeniable tendency for young student athletes to neglect oral care, which is an important aspect of health management. Oral problems such as toothaches not only prevent athletes from performing at their best during competitions but also contribute to various problems such as deficiencies in nutritional intake, which is essential for maintaining physical function, as well as a decline in immunity due to mental stress [11].

The participants in this study were Japan Junior National Team candidate players in the U13 age group (10–12 years old), the U16 age group (13–15 years old), and the U19 age group (16–18 years old). Players in the U13 age group are in the mixed dentition period, when the second molars, which have a significant impact on chewing ability, have not yet erupted or are in the process of erupting. The U16 age group includes individuals whose second molar apex is incomplete, whereas players in the U19 age group are in the stage where the second molar apex is complete and occlusal contacts and support are stable within the range of individual normal occlusion [12]. The average chewing score was 4.1, 3.4, and 3.3 for the U13, U16, and U19 age groups, respectively, and there was no significant difference between age groups, although the U13 age group tended to have higher values. Meanwhile, the occlusal force and occlusal contact area increased in the order of U13, U16, and U19, reflecting the stability of the occlusal support area or occlusal contact state. The chewing score in this study did not take into account masticatory efficiency, but it functions as an index for subjectively evaluating the number of times of mastication from predation to swallowing. The chewing score tended to be high in the U13 age group, likely because a large number of chewing cycles were required to form a bolus due to the unstable occlusal contact of the molars.

The pressure-sensitive film used to evaluate oral function calculates the occlusal force as the product of the contact area of the upper and lower teeth and the average pressure [4,7,8,10]. Because the occlusal contact area increases with the eruption of molars with occlusal surfaces, it is thought that participants in the U13 group had a small occlusal contact area and therefore a small occlusal force. In the U13 group, no significant correlation was observed between chewing score and occlusal force or occlusal contact area, which is presumably due in part to the fact that this age group takes longer to form a food bolus. For the U16 and U19 groups, a significant positive correlation was observed between the chewing score and either occlusal force or occlusal contact area. This is evidence that chewing food well on a daily basis leads to the development of healthy oral function. In other words, because there was no significant difference in chewing scores between participant groups, and the correlation coefficients for U13 were relatively high at 0.457 and 0.528, respectively, it can be inferred that the participants in this study have chewing habits that can be expected to contribute to the development of healthy oral function. Although knowledge of medical science is known to contribute to improving the international competitiveness of junior athletes, information regarding dental conditioning remains insufficiently disseminated. Considering that occlusion is related to postural stability and motor function [4,10,13–15], it is necessary to inform not only athletes but also their parents and others involved in the sport that the development of occlusion from a young age is likely to have a significant impact on future competitive skills.

The main limitations of this study are the small number of participants in the U13 group and the use of an arbitrary method for determining the chewing score. In the future, it will be necessary to increase the number of participants over time and also to conduct research on the relationship with physical function. Through these additional investigations, we hope to clarify the basis for how managing the health of the oral and maxillofacial area and the development of occlusion lead to safe and secure sports and improved competitive ability.

Bando Y and Takahashi M, Fortune J Health Sci 2025
DOI:10.26502/fjhs.292

Conclusion

The results of this study revealed that the oral function of female badminton players nominated as junior Japan representative candidates improved with age, and that players who chewed more frequently had larger occlusal forces or occlusal contact areas in the U16 and U19 age groups.

Data Availability

The datasets collected and/or analyzed during the current study are available from the corresponding author on reasonable request.

Acknowledgments

This work was supported by JSPS KAKENHI Grant Number JP23K10617.

Conflicts of interest statement

The authors have no conflicts of interest relevant to this article.

References

1. Ishino Y. The role of MFT as oral rehabilitation. J Jpn Assoc Adult Orthd 13 (2006): 124-135.
2. Takeuchi M. Guide to muscle function. Tokyo, Japan, Sunashobo (2012): 6-28
3. Boroojerdi B, Battaglia F, Muellbacher W, et al. Voluntary teeth clenching facilitates human motor system excitability. Clin Neurophysiol 111 (2000): 988-993.
4. Takahashi M, Bando Y. Relationship between occlusal balance and agility in Japanese elite female junior badminton players. Int J Sports Dent 11 (2018): 34-42.
5. Takahashi M, Bando Y, Kitaoka K, et al. Effect of wearing a mouthguard on physical ability is dependent on occlusal contact state: a study involving elite level female handball players. Dent Res Oral Health 6 (2023): 88-94.
6. Takahashi M, Bando Y, Fukui T, et al. Light clenching differentially affects balance ability according to occlusal contact stability. Appl Sci 14 (2024): 10314.
7. Bando Y, Takahashi M, Kitayama Y. Relationship between oral function and motor ability of top Japanese junior badminton players: part 1 examination of occlusal force by Dental Prescale. J Sports Dent 21 (2018): 23-30.
8. Bando Y, Takahashi M, Fukui T, et al. Relationship between occlusal state and posture control function of trampoline gymnasts. J Sports Dent 23 (2019): 14-20.
9. Japan Elementary School Badminton Federation Regulations: (2025).
10. Takahashi M, Bando Y, Fukui T, et al. Equalization of the occlusal state by wearing a mouthguard contributes to improving postural control function. Appl Sci 13 (2023): 4342.
11. Bando Y. Official textbook of badminton. Tokyo, Japan, Baseball magazine sha (2016): 132-145.
12. Massler M, Schour I. Growth of the child and the calcification pattern of the teeth, Am J Orthod Oral Surg 32 (1946): 495-517.
13. Takahashi M, Bando Y, Fukui T, et al. Straight jump landing position of trampoline gymnasts with stable occlusal balance reflects standing postural control function. Appl Sci 13 (2023): 6689.
14. Takahashi M, Bando Y, Fukui T, et al. Influence of occlusion on flight time in trampoline competition. Int J Dent Oral Health 9 (2023): 405.
15. Marini I, Gatto MR, Bartolucci ML, et al. Effects of experimental occlusal interference on body posture: an optoelectronic stereophotogrammetric analysis. J Oral Rehabil 40 (2013): 509-518.

Citation: Yogetsu Bando, Mutsumi Takahashi. Oral Function of Junior Japan National Team Candidates in U13, U16, and U19 Badminton Players. Fortune Journal of Health Sciences. 8 (2025): 424-429.