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ORIGINAL ARTICLE

Dental Occlusion Influences the Standing Balance on an Unstable Platform

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Contradictory results are still reported on the influence of dental occlusion on the balance control. We attempted to determine whether there are differences in balance between opposed dental occlusion (Intercuspal position (ICP)/"Cotton rolls" mandibular position [CR]) for two extreme levels of stability (stable/unstable). Twenty-five subjects were monitored under both dental occlusion and level of stability conditions using an unstable platform Balance System *SD*. The resulting stability index suggests that body balance is significantly better when dental occlusion is set in CR ($p < .001$) in unstable but not in stable conditions. Occlusal traits significantly influencing postural control were Angle Class ($p < .001$), crowding ($p = .006$), midline deviation ($p < .001$), crossbite ($p < .001$), anterior open bite ($p = .05$), and overjet ($p = .01$). It could be concluded that the sensory information linked to the dental occlusion for the balance control comes strongly into effect in unstable conditions.

Keywords: postural control, unstable balance, malocclusal traits, mandibular position

Postural control is a complex function that involves different sensory inputs from the visual, somatosensory and vestibular systems. These sources of sensory information must be integrated at the central nervous system to regulate the orientation and stabilization of the body segments (Lord & Sturnieks, 2005). Recently, it has been proposed that the stomatognathic system may also

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contribute (~2%) to the postural balance regulation (Solovykh, Bugrovetskaya, & Maksimovskaya, 2012).

Over the last few years, a growing interest has focused on the potential correlation between the stomatognathic system and the body posture. However, scientific literature available to date is not conclusive, and results of recent reviews have benchmarked for (Cuccia & Caradonna, 2009; Hanke, Motschall, & Turp, 2007; Moon & Lee, 2011) and against (Manfredini, Castroflorio, Perinetti, & Guarda-Nardini, 2012; Michelotti, Buonocore, Manzo, Pellegrino, & Farella, 2011; Giuseppe Perinetti, Primozic, Manfredini, Di Lenarda, & Contardo, 2013) this clinical correlation.

The neurofunctional organization of the stomatognathic system mainly supports the possible influence of this system on the balance control. The relationship may involve the association between the masticatory and cervical muscles (Pallegama, Ranasinghe, Weerasinghe, & Sitheeque, 2004) throughout feedback of periodontal pressoreceptors that control the elevator mandibular muscles (Bakke, 1993). In addition, the neuronal links of the trigeminal nerve to the vestibular nuclei, which are responsible of the masticatory function and equilibrium control, respectively (Devoize et al., 2010), reinforce the argument for a relationship between the stomatognathic system and balance control. Thus, neurofunctional organization may explain why malocclusal traits altering the masticatory muscles pattern could also influence cervical chains, and presumably result in the reorganization of postural control.

Sensory information seems to contribute differently on the postural balance regulation depending on the conditions of surface area. So when standing on a firm support base, the major source of afferent signals used in the process of balance control comes from somatosensory information; whereas when changing to an unstable support base, the importance of sensory information from the vestibular and visual systems increases (Peterka, 2002). This evidence suggests therefore a higher contribution of other sources of sensory information when more difficult conditions for the balance control are present.

Most literature involving the hypothetical influence of dental occlusion on the balance control have evaluated posturographic parameters in static conditions reporting contrasting conclusions in favor (Bracco, Deregibus, & Piscetta, 2004; Gangloff, Louis, & Perrin, 2000; Sakaguchi et al., 2007) or against (Baldini, Nota, Tripodi, Longoni, & Cozza, 2013; Ferrario, Sforza, Schmitz, & Taroni, 1996; Perinetti, Marsi, Castaldo, & Contardo, 2012). In fact, some criticism on the sensitivity of the force platforms to detect the relationship between dental occlusion and body posture has been recently addressed (Baldini et al., 2013; Perinetti et al., 2012). However, less research has focused on the correlation of dental occlusion and balance control at unstable condition, even though the high sensitivity of the unstable platforms to examine individual responses to translational and angular perturbations (Baloh et al., 1994; Ohlendorf, Riegel, Lin Chung, & Kopp, 2013).

The present study focused on the influence of dental occlusion and specific occlusal traits on the body balance control at extreme levels of stability. The main aim was to test the hypothesis that individual occlusal traits influence postural control and to elucidate if the dental occlusion affects differently to the body balance control according to the stability condition.

Methods

Participants

Twenty-five physically active subjects (15 males, 10 females; age 32.04 ± 6.9 years; height 1.75 ± 0.08 m; body mass 71.96 ± 11.37 kg; BMI 23.36 ± 2.26) with different occlusal traits participated in the study. None of the subjects presented any history of musculoskeletal problems or vestibular impairment. Exclusion criteria were: regular medication, smoking and drinking habits, temporomandibular disorders and pathophysiological factors affecting normal body balance capacity (i.e., scoliosis, neck or spine disorders, regular back pain or discomfort). Table 1 shows the occlusal characteristics of each participant.

Subjects were advised to avoid excitatory substances and physical activity for 72 hr before the test. All the participants gave their written informed consent according to the updated Declaration of Helsinki and the project protocol was approved by the university's ethics review board.

Table 1 Occlusal Traits of the Subjects

Subject ID	ORT	MLD	CRW	DIA	MT	ANGLE	CRB	OPB	OVB	OVJ
1	+	–	–	–	+	III	–	–	–	–
2	+	–	–	+	+	I	–	–	–	–
3	–	+	+	–	–	III	–	+	–	–
4	–	–	–	+	–	I	–	–	–	–
5	–	+	+	–	–	III	+	–	–	–
6	–	+	+	–	–	II	–	–	+	+
7	+	+	+	–	+	III	–	–	–	–
8	–	–	–	–	–	I	–	–	–	+
9	–	–	–	–	–	I	–	–	–	–
10	–	–	–	–	+	III	–	–	–	–
11	–	–	–	–	–	III	–	–	–	–
12	–	–	–	+	+	II	+	–	+	+
13	–	+	–	–	–	III	–	–	–	–
14	+	+	+	–	–	I	–	–	–	–
15	+	–	–	–	–	III	–	+	–	–
16	+	–	–	–	–	I	–	–	–	–
17	–	+	–	–	–	III	–	–	+	–
18	–	+	+	–	–	III	–	–	–	–
19	+	–	–	–	–	III	–	–	–	–
20	+	–	–	–	–	I	–	–	–	–
21	–	–	–	–	–	I	–	–	–	–
22	–	–	–	–	–	II	–	–	–	+
23	–	+	–	–	–	II	+	–	–	+
24	–	–	–	–	–	I	–	–	–	–
25	+	–	–	–	–	I	–	–	–	–

Note. ORT: orthodontic treatment; MLD: midline deviation; CRW: crowding; DIA: diastema; MT: missing teeth; ANGLE: Angle Class; CRB: crossbite; OPB: open bite; OVB: overbite; OVJ: overjet.

Experimental Design

Testing Apparatus. A body balance platform model Balance System *SD* (Biodex, NY, USA) was used to measure postural control. The reliability and applications for clinical testing of the body balance system (BBS) are well documented (Hinman, 2000).

The BBS consists in a circular movable balance platform that provides up to 20° of surface tilt in a 360° arc of motion.. Rather than measuring the deviation of COP during static conditions, this device measures the degree of tilt about each axis during dynamic conditions (Figure 1). The amount of stiffness in the platform is controlled mechanically and ranges from stability level 8 (stiffest) to stability level 1 (loosest), allowing the examiner to objectively measure the ability of a subject to maintain postural stance under both static and dynamic conditions. An LCD screen provides subjects with visual feedback on the situation of their center of mass in relation to the periphery of the platform (Hinman, 2000).

The platform provides, as a quantitative data, an overall Stability Index (SI) that represents the variance of foot platform displacement in degrees, from a level platform position, in all motions during a test. The SI takes into account the displacement from level in the following directions: Anterior/Posterior (A/P)-Sagittal Plane, and Medial/Lateral (M/L)-Frontal Plane; and it is calculated using the following equation, where x represents the M/L plane and y the A/P plane:

$$SI = \sqrt{\frac{\sum(0-X)^2 + \sum(0-Y)^2}{number\ of\ samples}}$$

A high number is indicative of a lot of movement during a test, thus it is associated with poor balance capacity, whereas a low SI indicates little body movement and it is associated with a more stable posture during testing (Hinman, 2000).

Figure 1 — BBS platform. This device challenges the individual to maintain his/her balance while standing on a moveable platform that tilts a maximum of 20° (from the horizontal plane) in all directions. During the test the subjects were asked to maintain a stable position while the platform moves in all directions at the selected stiffness level.

In addition to the SI, the system provides data of the percentage of test time the patient spends in four concentric different zones of balance during test. The zones A, B, C and D radiate in concentric circles from the center of foot platform and represent the degrees of foot platform deflection from level to 0–5° (zone A); 6–10° (zone B); 11–15° (zone C); and 16–20° (zone D). The longer the time spent in zone A, the less foot platform deflection and the better body balance ability.

Testing Procedure. Subjects reported to the laboratory on two days separated by 48 hr. The first day was a familiarization session, while the second was the experimental session.

The tests were carried out for two dental occlusion conditions: (i) dental contact, setting dental occlusion in Intercuspal Position (ICP) by asking the subject to clench his/her teeth; and (ii) without dental contact, "Cotton rolls" mandibular position (CR), by using cotton rolls (8mm thick) between the two dental arches placed from the canines to the molars.

Both dental occlusion conditions were tested on an unstable condition by selecting level 2 (L2) and on a stable condition by selecting level 8 (L8) from the eight different levels provided by the platform, according to the protocol used previously by other investigators (Arnold & Schmitz, 1998). The testing protocol consisted of four consecutive trials (L2CR, L2ICP, L8CR and L8ICP) with 30 s of duration each one and a 5 min in between (Arnold & Schmitz, 1998). The order of the dental occlusion and level of stability for the four consecutive trials was randomly assigned. All measurements were performed with subjects standing barefoot with their arms unfolded by their sides and shoulders relaxed. The foot placement was maintained throughout all trials. Once the subject was positioned on the balance platform, a cursor appeared on the display and the subject must correct his/her position to move the cursor to the center point on the grid, where it is assumed to be the most balanced position. After that, the test started and the control screen was covered to avoid visual feedback and the subjects were asked to look a reference point to standardize visual condition for all subjects in all trials (Solow & Sonnesen, 1998).

Occlusal Analysis. The analysis of the oral cavity was recorded by the same dentist with extensive experience in the area of Orthodontics to avoid interexaminer variability. Different occlusal traits were recorded: Angle Classification according to Class I: neutrocclusion, Class II: retrognathism and Class III: prognatism; crowding ≥3 mm; midline deviation; presence of space or gap between two teeth (diastema); missing teeth (excluding third molars); tooth closer to the cheek or to the tongue than its corresponding antagonist (crossbite); incomplete contact between front upper and lower teeth (open bite); extent of vertical overlap of the maxillary central incisors over the mandibular central incisors (overbite); distance between the maxillary anterior teeth and the mandibular anterior teeth in the anterior-posterior axis (overjet ≥4 mm), as well as previous orthodontic treatment.

Statistical Analysis. A two-way repeated measures analysis of variance (ANOVA) with Holm-Sidak correction was carried out to analyze the effect of the dental occlusion (CR/ICP) and the stability conditions (L2/L8) on the stability index. A second two-way repeated-measures ANOVA was performed to test differences in percentage of time in each zone (4 levels) according to the dental occlusion condition.

In addition, the assessment of the influence of occlusal traits on the stability index disregarding of dental occlusion (CR/ICP) and level of stability (L2/L8) was analyzed by nested variance analysis. Four factors were then considered: occlusal trait, level of stability, dental occlusion and subject (random). Three main factors (occlusal trait, level of stability and dental occlusion) and one nested factor (subject) within each level of individual occlusal traits were considered.

This design included both crossed and nested factor. The subject factor is nested in occlusal traits; because we have completely different subjects for each occlusal traits. Occlusal traits factor is then a unit to which we apply one of the two levels of stability factor, because one occlusal trait from each subject occurs with both levels of stability. Thus occlusal traits and stability level factor are crossed and subject and stability level factor are crossed to. Similarly, occlusal traits and dental occlusion factor are crossed and subject and dental occlusion are crossed to. For each dental occlusion factor we apply one of the two levels of stabiliy factor. Thus dental occlusion and level of stability factor are crossed.

If we let occlusal traits, stability level, dental occlusion and subject be factors A, B, C and D, then an appropriate model for the responses can be expressed according to the following equation, where α, β, and γ represent continuous values for A, B and C factors:

$$y_{ijklm} = \mu + \alpha_i + \beta_j + \gamma_k + D_{l(i)} + e_{ijkl}$$

i,j,k = 1,2. l = 1,. . . ,

$$D \sim N(0, \sigma_D), \quad e_{ijkl} \sim N(0, \sigma^2)$$

Statistical significance was fixed at $\alpha = .05$ for all inferences and the null equality hypothesis was rejected below that value.

Data analysis and plotting was carried out by means of SigmaPlot version 11 (SYSTAT Software Inc, San Jose, CA, USA). Data are presented as mean ± *SD*.

Results

Effect of Dental Occlusion on the Stability Index

For both dental occlusion conditions the stability index was higher for L2 when compared with L8 (4.5 ± 2.41 vs. 2.04 ± 0.61, $p < .001$ for CR and 5.51 ± 2.73 vs. 2.35 ± 0.66, $p < .001$ for ICP). The effect of dental occlusion on the Stability Index showed a marked dependence according to the level tested (Figure 2). For the L2, the Stability Index was lower when dental occlusion was set in CR than in ICP ($p < .001$). At the L8 a tendency of better stability in CR when compared with ICP was detected ($p = .06$).

Percentage of Time in Zones

Overall, the percentage of time spent in zone A (0–5°) was significantly greater than that of the other three zones for L2 and L8 regardless of the dental occlusion ($p < .001$).

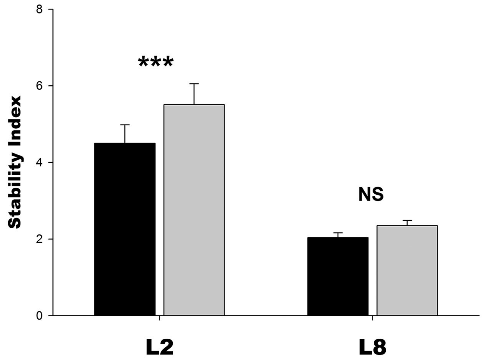

Figure 2 — Stability index for L2 and L8 when comparing dental occlusion in "Cotton rolls" mandibular position (black bars) and Intercuspal position (gray bars). Values are represented as Mean ± *SE* ($n = 25$). Asterisk indicates statistically significant differences for $p < .001$; NS: Nonsignificant differences.

Dental occlusion influenced on the percentage of time spent by the subjects in each zone (Figure 3). At unstable level, the percentage of time in zone A was significantly greater ($p < .001$) when dental occlusion was set in CR (79.56 ± 22.19%) than in ICP (71 ± 24%). Whereas the percentage of time spent in zone B was significantly greater ($p < .001$) when dental occlusion was set in ICP (20.36 ± 15.68%) than in CR (14.2 ± 12.9%). No statistically significant differences were found between CR and ICP for the time spent in zones C ($p = .31$) and D ($p = .49$).

At stable level, the dental occlusion condition did not influence the percentage of time remained by subjects in the four concentric zones ($p = 1.00$). So, for both CR and ICP conditions, the time spent in zone A (CR, 100%; ICP, 99.9 ± 0.28%) was significantly greater than that spent on the other zones ($p < .001$).

Occlusal traits and Stability Index

Table 2 shows an overview of the Stability Index when grouping the data according to the experimental design and considering the different occlusal traits of the subjects. The nested variance analysis revealed that crowding, midline deviation, crossbite, anterior open bite, and overjet influenced the stability index. Normal probability of residuals was checked. An overall influence of the Angle Class on stability index was detected. People with Angle Class I showed a better balance ability when compared with Class II and a tendency toward better stability when compared with Class III. Diastema and missing teeth showed a tendency. Neither orthodontic treatment nor overbite had influence on the stability index.

Discussion

The present study compared stability index on unstable platform under opposing dental occlusion (CR/ICP) for two extreme levels of stability (stable/unstable). The

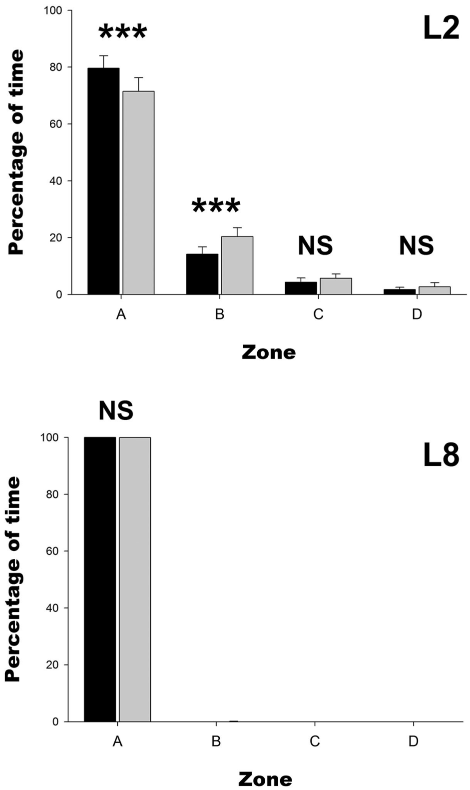

Figure 3 — Percentage of time in each zone when comparing dental occlusion in "Cotton rolls" mandibular position (black bars) and Intercuspal position (gray bars) during testing at L2 and L8. Values are represented as Mean ± *SE* ($n = 25$). Asterisk indicates statistically significant differences for $p < .001$; NS: Nonsignificant differences.

main findings were that: (i) the body balance was significantly better when dental occlusion was set in CR in unstable conditions, and (ii) occlusal traits significantly influencing postural control under experimental conditions were: Angle Class, crowding, midline deviation, crossbite, anterior open bite and overjet.

Our results showed that dental occlusion differentially contributed to the postural control, with no effect in the most stable condition but an improvement in unstable condition when dental occlusion was set in CR ($p < .001$). Specifically, we observed that the percentage of time spent by the subjects in zone A (0–5°) was greater for the CR than for the ICP condition, thus indicating very little movement from the level platform when testing in CR. Whereas for the ICP condition, the percentage of time spent in zone B (6–10°) was significantly greater than for the CR condition. This is likely to be responsible for significant differences in the stability index between ICP and CR, as the longer the time spent in zones B, C and D, the higher degrees of deflection of the foot platform and hence, the worst balance

Table 2 Stability Index for All Tested Conditions with Attention to the Examined Occlusal Traits (Mean ± *SD*)

	N	L2CR	L2ICP	L8CR	L8ICP	*p*-value	
Angle I	10	3.5 ± 1.4	4.5 ± 1.7	1.9 ± 0.5	2.1 ± 0.7	.002[a]	
Angle II	4	6.7 ± 1.7	7.6 ± 2.8	2.5 ± 0.25	2.9 ± 0.6	.3[b]	<.001
Angle III	11	4.6 ± 2.9	5.6 ± 3.2	1.8 ± 0.6	2.2 ± 0.6	.08[c]	
Orthodontics	9	3.6 ± 1.6	4.3 ± 1.6	1.9 ± 0.4	1.9 ± 0.42		.67
No Orthodontics	16	5.1 ± 2.7	6.1 ± 3.0	1.9 ± 0.6	2.5 ± 0.8		
Crowding	6	5.1 ± 3.1	5.8 ± 4.0	2.2 ± 0.6	2.3 ± 0.7		.006
No crowding	19	4.4 ± 2.2	5.4 ± 2.3	1.9 ± 0.5	2.3 ± 0.7		
Midline deviation	9	5.5 ± 3.3	6.2 ± 3.9	2.1 ± 0.6	2.5 ± 0.7		<.001
No midline deviation	16	4.0 ± 1.5	5.1 ± 1.8	1.9 ± 0.5	2.2 ± 0.7		
Diastema	3	6.5 ± 2.7	8.0 ± 3.5	2.4 ± 0.5	3.3 ± 0.4		.06
No diastema	22	4.3 ± 2.3	5.1 ± 2.5	1.9 ± 0.5	2.1 ± 0.6		
Missing teeth	5	4.5 ± 1.8	6.2 ± 2.6	2.0 ± 0.6	2.2 ± 0.6		.07
No missing teeth	20	4.5 ± 2.5	5.4 ± 2.8	2.0 ± 0.6	2.3 ± 0.7		
Crossbite	3	9.0 ± 2.2	11.2 ± 2.2	2.8 ± 0.1	3.3 ± 0.4		<.001
No crossbite	22	4.0 ± 1.7	4.7 ± 1.7	1.8 ± 0.5	2.1 ± 0.6		
Anterior open bite	2	4.6 ± 1.3	4.8 ± 1.6	1.9 ± 0.7	1.8 ± 0.1		.05
No anterior open bite	23	4.5 ± 2.5	5.6 ± 2.8	2.0 ± 0.6	2.3 ± 0.7		
Overbite	3	4.7 ± 2.7	5.5 ± 3.7	2.0 ± 1.0	2.4 ± 0.4		.16
No overbite	22	4.5 ± 2.4	5.5 ± 2.7	1.9 ± 0.5	2.2 ± 0.7		
Overjet	5	6.2 ± 1.9	7.6 ± 2.4	2.4 ± 0.4	2.9 ± 0.5		.01
No overjet	20	4.1 ± 2.4	5.0 ± 2.6	1.8 ± 0.5	2.1 ± 0.7		

Note. Superscripts indicate *p* value according the following schema: a: Angle I vs Angle II; b: Angle II vs Angle III; c: Angle I vs Angle III. *N:* sample size.

control. The cotton rolls placed between the two arches distributed the occlusal load onto several teeth reducing the precision of proprioceptive periodontal information (Ferrario, Sforza, Schmitz, & Taroni, 1996). Thus, this condition minimized the impact of incongruous occlusal contacts which could explain the better stability achieved in the CR mandibular position.. Our findings support the hypothesis of a relationship between postural control and the stomatognathic system. Previous experimental evidences of trigeminal nerve influences on the neck movements and cervical muscles activity (Alstermark, Pinter, Sasaki, & Tantisira, 1992; Devoize et al., 2010), eye and head movements (Pinganaud, Bourcier, Buisseret-Delmas, & Buisseret, 1999) and postural control (Delfini, Diagne, Angaut, Buisseret, & Buisseret-Delmas, 2000) have been reported. Our results reinforce the hypothesis that the sensory information of the trigeminal nerve might have an effect on the postural control regulation. In contrast, at the most stable level, the subjects remained the 100% of the time testing in zone A and no differences in balance control were observed between both dental occlusion conditions. This finding appears to support Tardieu's contention that dental occlusion impaired body balance in unstable but not in stable conditions (Tardieu et al., 2009). Thus, the greater influence of dental occlusion on balance control in unstable conditions may be related to a reorganization of sensory information for balance control when standing on a unstable support base. Evidences for a different contribution of the sensory information for the balance control have been reported when changing the firm support base to an unstable one (Peterka, 2002). Moreover, the activity of the jaw-closing muscles appears to be different during vigorous exercise in comparison when at rest. In this context, Miles et al. described that not only the visco-elasticity of the soft tissues in the masticatory system but also the stretch reflex in the jaw-closing muscles play a role in the maintenance and the restoration of natural jaw position when it is perturbed by strong movements of the body (Miles, Flavel, & Nordstrom, 2004a; Miles, Flavel, & Nordstrom, 2004b). Regarding the influence of occlusal characteristics on balance, our findings indicate that only a selection of occlusal traits influenced negatively on the balance control. In particular, dental crowding ≥3 mm, overjet ≥4 mm, crossbite, midline deviation, anterior open bite and Angle Class. However, these results must be interpreted with some caution because of the small sample size of subjects with each of these occlusal traits. Similarly, a study by Perinetti et al. showed that overjet and midline deviation significantly influenced postural control. In addition, but in contrast to our results, they also found significant correlation for overbite and they found no significant differences in balance control between CR and ICP (Giuseppe Perinetti et al., 2010). However, the tests were performed in static conditions, thus the differences in experimental design may explain these contradictory results. A possible explanation for the impairment in balance control observed in presence of the above mentioned occlusal traits may arise from the contention that dental occlusion could induce altered head and neck posture or disturbance in the muscle activity that presumably might alter the equilibrioception. In this respect, overjet has been correlated to a more flexed head position and backward bend of the spine (Huggare & Harkness, 1993), dental crowding to a more extended head position (Pachi, Turla, & Checchi, 2009) and open bite to influence the stress distribution in the spine (Motoyoshi, Shimazaki, Hosoi, Wada, & Namura, 2003) and gait (Saccucci et al., 2011). Similarly, crossbite has been suggested to alter the functional pattern of the masticatory muscle activity (Ferrario, Sforza, & Serrao, 1999). In addition, a recent review pointed out an increased risk of suffering crossbite and midline deviation in children affected by idiopathic scoliosis (Ben-Bassat, Yitschaky, Kaplan, & Brin, 2006) probably indicating a relationship between these occusal traits and the spine. Angle Class II also influenced negatively on the balance control. It is widely accepted that the Angle Class I is related with a greater balance in the masticatory muscles, while

Class II has been correlated with alterations in the head posture and the masticatory muscles activity (Gadotti, Berzin, & Biasotto-Gonzalez, 2005). Thus, neuroanatomical connections between masticatory and cervical muscles activity may presumably result in the postural imbalance observed in our study. The differences in balance between Class I and Class II subjects corroborate this possibility. In addition, Class II has been correlated to cervical hyperlordosis (Huggare, 1998) and weak body posture (Ben-Bassat et al., 2006) that also reinforces our findings of weak balance control in Angle Class II subjects. By contrast, in accordance with our results, Angle Class III has not been correlated with changes in postural control (Lippold, Van den Bos, Hohoff, Danesh, & Ehmer, 2003). The other occlusal traits examined weakly influenced on the postural control. It would be reasonable to expect that subjects with previous orthodontic treatment presumably achieved better postural control because of occlusal traits should have been corrected by treatment. Surprisingly, note that 56% of the subjects with previous orthodontic treatment presented some occlusal traits of those which negatively influenced on balance control. Thus, this could be the reason why orthodontic treatment did not affect significantly the body balance ability in our study.

Although without irrefutable evidences of a nonspecific effect, here we report that dental occlusion conditioned postural stability under unstable conditions. Our findings provide experimental support for the positive results of some commonly applied techniques in the field of chiropractic and osteopathy. The applications of scientific methods in the study of some of this kind of interventions can be a promising field for new experimental research. Further studies are needed also on the effects of corrective orthodontics on postural stability.

Conclusion

Occlusal perturbation might modify the sensorial inputs for balance control in people with dental malocclusion. In addition, the stability condition seems to strengthen the influence of dental occlusion on balance, as the CR condition only influenced balance in unstable conditions. Therefore, we speculate that the afferent signals from dental occlusion may contribute most effectively in the process of balance control at more pronounced instability conditions. Future investigations should focus on the effects of different dental malocclusion or different conditions of stability analyses.

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