Relationship Head Posture in Class II Skeletal Malocclusion Against Canal Width Breath and Hyoid Bone Position

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Abstract

Class II skeletal malocclusion is comorbid with an elongated head posture. Balancing the head will involve the skull, spine, mandible, hyoid bone, respiratory tract, muscles, and tongue. The hyoid bone functions to maintain the balance of the head posture. To see the relationship of comorbid skeletal class II malocclusion with head posture, the relationship of the head posture of skeletal class II malocclusion with the width of the respiratory tract, and the relationship of the head posture of skeletal class II malocclusion with the hyoid bone position.

Observational analytical study with a cross-sectional design using a sample of 60 skeletal class II malocclusion cephalograms divided into three subgroups. Skeletal class II malocclusion group with prognathic maxillary and normal mandible, normal maxillary and retrognathic mandible group, prognathic maxillary and retrognathic mandibular group. The cephalogram was traced and then scanned and measurements were taken using the CorelDRAW application.

The chi-square test showed no significant relationship between the skeletal class II malocclusion and the head posture (P> 0.05). There is no significant relationship between the head posture in the skeletal class II malocclusion and the respiratory tract (P> 0.05). There is no meaningful relationship exists between the head posture in the skeletal class II malocclusion with vertical position and angular hyoid bone (P> 0.05). There is a significant relationship in the posture head of skeletal class II malocclusion subgroup prognathic maxillary and retrognathic mandibular with the anteroposterior position of the hyoid bone. The hyoid bone position is more posterior in the skeletal class II malocclusion subgroup prognathic maxillary and retrognathic mandibular.

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Introduction

The human body consists of various well-connected structures that work together and move in harmony so that the body is in a state of balance to protect the body from injury and deformity. Imbalances in body posture can cause injury, pain, and tissue damage.[1-2] Adjusting body posture will have an impact on the ability to carry out daily activities, as well as quality of life.[3]

Head posture has a biomechanical relationship with the neck, grouped into extension and flexion. Extension head posture is a position of the head away from the cervical, while flexion head posture indicates a position of the head bent towards the cervical.[4] Other experts argue that head posture is an angle that measures the position of the head relative to the cervical, formed by the MGP and OP angles, with an average value of $101^0 \pm 5^0$ (normal head posture). If the value is > 106^0, then the head posture is flexed; and if the value is <96^0, then the head posture is extended.[5] The hyoid bone plays a role in maintaining balanced head posture and the airway and is attached to the cervical spine and fascia. A change in the mandible's position can change the hyoid bone's position.[6]

Malocclusion is a common dental and oral health problem with a prevalence of 54% worldwide. Malocclusion is the third largest dental and oral health problem after caries and periodontal disease.[7] Class II skeletal malocclusion is a type of malocclusion caused by maxillary prognathism, mandibular retrognathic, or a combination of both related to the formation of extension of the head posture.[8] Class II

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skeletal malocclusion is often comorbid with obstructive sleep apnea (OSA) because this malocclusion often interferes with airway obstruction and jaw joints).[9-10]

Bjork and Marcotte stated that people with class II malocclusion have an extended head posture.[11] In contrast to Baidas's research, there is no head posture with a skeletal pattern.[12]

Yassaei et al. said that the prognathic mandibula affected the head posture.[13] Komeki et al. concluded that the stance of the extension head caused changes in chest shape and decreased respiratory function.[14] Buyukcavus et al evaluated the respiratory tract cephalometry and the position of the hyoid bone in 221 subjects with skeletal class II malocclusion there was no difference in the width of the respiratory tract between groups and there were significant differences in the position of the hyoid bone in the retrognathic mandibular group.[9]

Based on this background, the author is interested in research to assess the influence of head posture in three subgroups of Class II Skeletal Malocclusion on the respiratory tract's width and the hyoid bone's position.

Materials and methods

This research is an observational analytic study with a cross-sectional design to see the effect of head posture on class II malocclusion with the width of the upper respiratory tract, and the position of the hyoid bone was conducted at the PPDGs Orthodontic Clinic RSGM FKG USU, Sumatera Utara in December 2022 - May 2023.

The population of this study is a PPGS Orthodontic clinic patient cephalogram RSGM FKG USU at the age of 18 years. The sample in this study was the skeletal class II malocclusion patient cephalogram. The sampling method used is purposive sampling based on the inclusion and exclusion criteria of 60 samples.

The research tools were a tracing box, cephalometric tracing paper (Ortho Organizer, USA), Epson scanner L3150, and CorelDRAW application (Corel Corporation, Ottawa, Canada). The material of this study was lateral cephalometric radiographs of skeletal Class II patients.

The research procedure is data collection with lateral cephalogram before orthodontic treatment, obtained from the medical record data of PPDGs orthodontic clinic patients in FKG USU based on inclusion and exclusion criteria. Tracing is carried out on lateral cephalometry, reference points to determine the SNA, SNB, and ANB points, reference points to determine the head posture, reference point to determine the width of the upper respiratory tract, and the reference point for determining the position of the hyoid bone.

Figure 1. *Tracing* cephalogram.

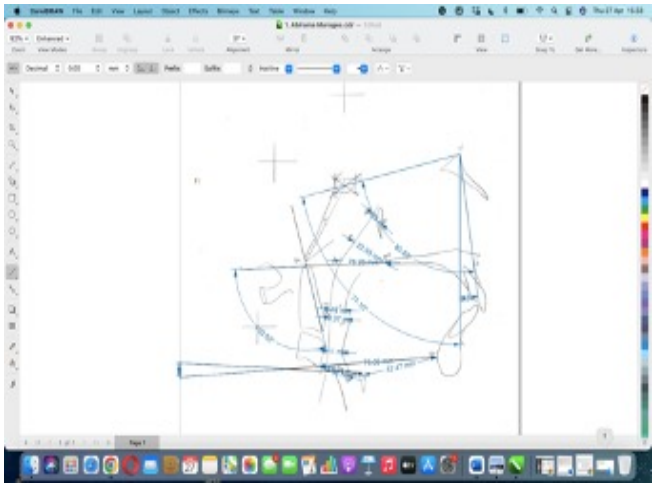

Figure 2. Measurement of SNA Angular, SNB, ANB, Head posture, linear measurement of respiratory tract, as well as linear and angular measurement of hyoid bone position using the CorelDRAW application.

The cephalogram is scanned. Measure angular SNA, SNB, ANB, Head posture, linear measurement of the respiratory tract, linear measurement and angular position of the hyoid bone.

Data collection is carried out. After the measurement results are obtained, then data processing is carried out. Data were analyzed using the SPSS (Statistical Processing Software) program using the chi-square statistical test.

Results

This study was conducted on 60 skeletal class II malocclusion samples consisting of class II malocclusion sample groups with maxillary prognathic and normal mandibular (N = 20), normal maxillary and retrognathic mandibular (N = 20), and the maxillary prognathic and retrognathic mandibular (n = 20) (Figure 3).

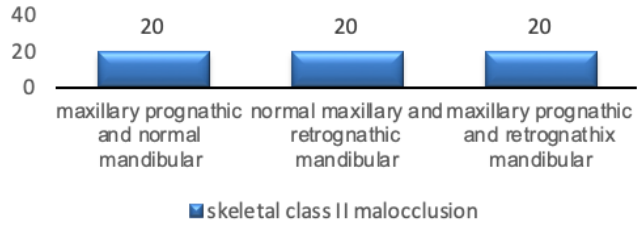

Figure 3. Count of Skeletal Class II Malocclusion.

Relationship between skeletal class II malocclusion subgroup with the head posture

Based on the chi-square statistical test results presented in Table 1 below, there is no relationship between the Class II skeleton malocclusion subgroup and head posture (p=0.0372; p>0.05).

Group	Head posture						Total		p
	Normal		Extension		Flexion				
	F	%	F	%	F	%	F	%	
prognathic maxillary and normal mandibular	9	45	6	30	5	25	20	100	0.373
normal maxillary and retrognathic mandibular	12	63.2	6	31.6	1	5.3	19	100	
prognathic maxillary and retrognathic mandibular	14	66.7	5	23.8	2	9.5	21	100	

Table 1. Relationship between skeletal class ii malocclusion sub-group with the head posture.

Relationship between the head posture and the upper respiratory tract in the skeletal class II malocclusion subgroup

Furthermore, the chi-square statistical test results in Table 2 below show no relationship between normal head posture, extension, and flexion in all skeletal class II malocclusion sub-groups and the width of the respiratory tract.

Relationship between head posture and hyoid bone position in the skeletal class II malocclusion subgroup

Table 3 shows that there is no significant relationship between the head posture and the position of the hyoid bone in the prognathic maxillary normal mandibular and the normal maxillary retrognathic mandibular, whereas in the prognathic maxillary mandibular retrognathic of the skeletal class II malocclusion sub-group was found a significant relationship of the head posture with position anteroposterior hyoid bone (H-RGN).

Discussion

Based on Figure 3 above, it can be seen that the number of samples for each subgroup of class II skeletal malocclusion in this study was 20 people. Every part of the body is connected to form posture.[15] Posture is good if the body can maintain balance with minimal energy.[16] Organs that play a role in maintaining balance include bones, joints, muscles, nervous system, stomatognathic, oculomotor, and inner ear.[17-18]

The biomechanical relationship of the head and neck forms head posture.[19] Good head posture if the ears and shoulders are aligned.[20] If the horizontal distance from the ear to the shoulder is more than 5 cm, it will cause cervical extension and forward head posture as one of the factors causing the formation of class II malocclusion. Changes that occur in head position can affect muscle activity, proprioception, breathing, and neck pain. Imbalances in the oral cavity also contribute to its inequality.[20-21] This research has received permission from the Health Research Ethics Committee of the University of North Sumatra with Number 36/KEPK/USU/2023.

Based on Table 1, the Class II skeleton malocclusion subgroup has no significant relationship with head posture. The results of this study are based on research conducted by Garg et al., who found no meaningful relationship between head posture and skeletal malocclusion.[22] According to the systematic review and meta-analysis by Peng et al., there is no relationship between head posture and malocclusion.[23] Baidas' research stated that there is no relationship between head posture and skeletal pattern.[12]

The results of this study are not in line with Schwarz's theory that the extension head posture causes class II malocclusion.[23] The results of this study are also different from the research of Tankhiwale et al. in that there is a significant relationship between class II skeletal malocclusion and head posture.[24] According to the Graber classification, the etiology of class II skeletal malocclusion divided into two groups, general and local. This is related to the formation of the head posture. The etiology of skeletal class II malocclusion according to the Graber classification is divided into two groups, etiology general and local etiology. General etiology includes hereditary and congenital defects, environmental factors, metabolic diseases, nutritional provinces, bad habits, posture, and trauma. Local etiology is due to teeth-like anomalies in the amount, size, and shape.[25-26] Most research reports have linked it to mandibular deficiency.[27]

Poor head posture in childhood can impact the direction of craniomandibular growth. However, if the craniomandibular muscles are in sufficient tone, they will be able to balance the posture.[28-30]

Table 2, shows that normal head posture, extension, and flexion in all class II skeletal malocclusion sub-groups do not have a significant relationship with the width of the respiratory tract. This research follows research conducted by Buyukcavus et al. on 221 skeletal class II malocclusion samples, which are divided into three subgroups, including the prognathic maxillary and normal mandibular, normal maxillary and retrognathic mandibular, as well as prognathic maxillary and retrognathic mandibular.[9]

This study's results differ from the Lopatiene et al. research, stating that the subject with the skeletal class ii malocclusion has a narrower upper respiratory tract.[31] This difference is caused by the sample in this study being a patient with a skeletal class II malocclusion with normal breathing. Normal breathing through the nose will make the respiratory tract develop properly.[32]

Based on Table 3, it can be stated that head posture does not have a significant relationship with the position of the hyoid bone in prognathic maxillary normal mandibles and normal maxillary retrognathic mandibles. In contrast, in prognathic retrognathic maxillary mandibles, the skeleton class II malocclusion subgroup found a significant relationship between head posture and the position of the hyoid bone. anteroposterior (H-RGN).

The results of this study follow Buyukcavus et al. that there is no significant difference in the vertical distance of the hyoid bone across class II malocclusion subgroups. Still, there is a substantial relationship between the anteroposterior length of the hyoid bone to the pogonion in the class II malocclusion subgroup and the retrognathic mandible.[9]

Furthermore, the results of this study are also following with Chen et al. In 90 class I and class II skeleton subjects using cone beam computerized tomography (CBCT) to evaluate tongue posture and hyoid bone position, they concluded that class II malocclusion had lower tongue posture, smaller tongue size, and the part of the hyoid bone is more posterior than Skeletal Class I.[33]

The hyoid bone is an integral part of the musculoskeletal apparatus of the craniofacial complex.[34] The position of the hyoid bone reflects the balance of muscles, ligaments, and fascia. Changes in the position of the hyoid bone tend to be related to rotation of the lower jaw and tongue position. In a retrognathic mandible clockwise rotation, and the tongue is more posterior, resulting in a more rearward of the hyoid bone.[35-36]

Conclusions

The following conclusions are drawn from the study:

1. There is no significant relationship between head posture within all subgroups of class II skeletal malocclusion, with an overall value of $p>0.05$.
2. There is no significant relationship between head posture in all subgroups of class II skeletal malocclusion with upper airway width, with an overall value of $p>0.05$.
3. There is a significant relationship between anteroposterior position and head posture in the prognathic maxillary and retrognathic mandible subgroup, with an overall value of $p<0.05$

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Declaration of Interest

The authors report no conflict of interest.

			Posture										
			maxillary prognathic and normal mandibular			Chi-square	maxillary normal and retrognathic mandibular			Chi-square	maxillary prognathic and retrognathic mandibular			Chi-square
			Normal	Extension	Flexion		Normal	Extension	Flexion		Normal	Extension	Flexion	
Respiratory tract	Ad3-tu	1	5	3	4	p = 0,617	6	3	1	P = 1,000	8	2	1	P = 0,259
		2	4	3	1		6	3	0		3	3	0	
		3	0	0	0		1	0	0		2	0	1	
	Ad2-PNS	1	5	5	5	p =0,568	11	3	1	p = 0,557	12	5	1	p = 0,247
		2	3	1	0		1	2	0		0	0	0	
		3	1	0	0		1	1	0		1	0	1	
	Ad1-PNS	1	5	4	5	p =0,125	8	3	1	p = 0,178	11	3	1	p = 0,063
		2	1	2	0		1	2	0		0	2	0	
		3	3	0	0		4	1	0		2	0	1	
	Ve-pVe	1	3	6	4	p =0,083	9	6	0	p = 0,077	11	3	1	p = 0,323
		2	2	0	0		0	0	0		0	1	0	
		3	4	0	1		4	0	1		2	1	1	
	Uv-pUv	1	4	5	1	p =0,199	10	5	1	p = 0,361	10	4	1	p = 0,126
		2	2	1	3		1	0	0		3	1	0	
		3	3	0	1		2	1	0		0	0	1	
	Rl-pRl	1	3	2	3	p =0,093	10	5	1	p = 1,000	8	4	0	p = 0,332
		2	0	3	1		1	0	0		1	0	0	
		3	6	1	1		2	1	0		4	1	2	
	Va-pVa	1	6	4	1	p = 0,274	7	4	0	p = 0,642	6	2	1	p = 0,169
		2	3	2	4		6	2	1		7	1	1	
		3	0	0	0		0	0	0		0	2	0	

Table 2. Relationship Between the Head Posture and the Upper Respiratory Tract in The Skeletal Class II Malocclusion Subgroup.

			Posture										
			maxillary prognathic and normal mandibular			Chi-square	maxillary normal and retrognathic mandibular			Chi-square	maxillary prognathic and retrognathic mandibular			Chi-square
			Normal	Extension	Flexion		Normal	Extension	Flexion		Normal	Extension	Flexion	
Hyoid bone position	C3-RGn	1	4	2	3	p = 0,344	12	3	1	P = 0,257	11	2	1	P = 0,177
		2	0	0	1		0	1	0		0	0	0	
		3	5	4	1		1	2	0		2	3	1	
	C3-H	1	2	4	2	p = 0,188	5	1	1	p = 0,382	5	2	0	p = 0,770
		2	0	0	1		1	2	0		1	0	0	
		3	7	2	2		7	3	0		7	3	2	
	H-RGn	1	8	3	4	p = 0,095	10	6	0	p = 0,168	12	4	0	p = 0,026*
		2	0	0	1		2	0	1		1	0	1	
		3	1	3	0		1	0	0		0	1	1	
	H-H'	1	9	6	4	p = 0,250	12	6	1	p = 1,000	13	4	2	p = 0,350
		2	0	0	0		0	0	0		0	0	0	
		3	0	0	1		1	0	0		0	1	0	
	Sudut hyoid	1	3	3	3	p = 0,165	7	3	0	p = 0,682	5	2	0	p = 0,549
		2	0	3	1		3	1	0		4	1	0	
		3	6	0	1		3	2	1		4	2	2	

Table 3. Relationship between head posture and hyoid bone position in the skeletal class II malocclusion subgroup.
*p <0,05 significant

References

1. Sofyanti E, Boel T, Satria D. Special investigation of developmental of mandibular asymmetry and imbalance body posture: A literature review. Macedonian Journal of Medical Sciences. 2020;8:107–11.
2. Bazert C, Gouzland T, El Okeily M. Integrating posture into orthodontic–surgical treatment. J Dentofac Anomalies Orthod. 2016;19(307):1-19.
3. Heydari Z, Sheikhhoseini R, Shahrbanian S, Piri H. Establishing minimal clinically important difference for effectiveness of corrective exercises on craniovertebral and shoulder angles among students with forward head posture: a clinical trial study. BMC Pediatr. 2022;22(1):1–11.
4. Sandoval C, Díaz A, Manríquez G. Relationship between craniocervical posture and skeletal class: A statistical multivariate approach for studying Class II and Class III malocclusions. Cranio - J Craniomandib Pract. 2021;39(2):133–40.

5. Di Giacomo P, Ferrara V, Accivile E, Ferrato G, Polimeni A, Di Paolo C. Relationship between cervical spine and skeletal class II in subjects with and without temporomandibular disorders. Pain Res Manag. 2018;2018:1-7.
6. Soheilifar S, Ali Momeni M. Cephalometric comparison of the position of the hyoid bone in class I and class II patients. 2017;12(1):1-4.
7. Anastasia Wilar L, M Rattu AJ, Wayan Mariati N. Kebutuhan perawatan orthodonsi berdasarkan index of orthodontic treatment need pada siswa SMP Negeri 1 Tareran. Jurnal e-Gigi. 2014;2(2).
8. Lombardo G, Vena F, Negri P, Pagano S, Barilotti C, Paglia L, et al. Worldwide prevalence of malocclusion in the different stages of dentition: A systematic review and meta-analysis. Eur J Paediatr Dent. 2020;21(2):115–22.
9. Kocakara BMH. Cephalometric evaluation of nasopharyngeal airway and hyoid bone position in subgroups of class ii malocclusions.-ODOVTOS Int. J Dent Sc. 2021;23(1):155–67.
10. Rathi S, Gilani R, Kamble R, Bhandwalkar S. Temporomandibular joint disorder and airway in class ii malocclusion: a review. 2022;14(10): 1-7.
11. Hedayati Z, Paknahad M, Zorriasatine F. Comparison of natural head position in different anteroposterior malocclusions. J Dent (Tehran). 2013;10(3):210–20.
12. Baidas LF. Relationship between head posture and anterior-posterior skeletal patterns in a group of female patients. Saudi Med J. 2014;35(1):72–80.
13. Yassaei S, Ezoddini F, Sasani A, Kordi S. Original article cephalometric association of mandibular size/length to the natural head position. Int J Med Invest. 2019;8(4);51-62.
14. Koseki T, Kakizaki F, Hayashi S, Nishida N, Itoh M. Effect of forward head posture on thoracic shape and respiratory function. J Phys Ther Sci. 2019;31(1):63–8.
15. Barassi G, Simone ED, Galasso P, Cristiani S, Supplizi M, Kontochristos L, et al. Posture and health: are the biomechanical postural evaluation and the postural evaluation questionnaire comparable to and predictive of the digitized biometrics examination? Int. J. Environ. Res. Public Health. 2021;18(3507):1-9.
16. Carini F, Margherita M, Chiara C, Salvatore P, Massimo M, Provvidenza D, et al. Posture and posturology, anatomical and physiological profiles: overview and current state of art. Acta Biomed. 2017;88(1):11-6.
17. Hermann M, Engelke K, Ebert R, Deubert SM, Maximilian R, Ziouti F< et al. Interactions between muscle and bone—where physics meets biology. Biomolecules. 2020;10(432):1-30.
18. Belloso AJB, Jimenez MC, Dominguez MEC, Gonzalez AFG, Reyes AD, Arrasco MP. Influence of dental malocclusion on body posture and foot posture in children: a cross-sectional study. Healthcare 8(485):1-10.
19. Aroeira RMC, Furlan RMMM, Pertence AEM, Casas EBL, Greco M. Relationship between head posture and lumbar curve in a sitting position: a biomechanical study. Fisioter Mov. 2017;30(3):453-61.
20. Xu L, Hwang B, Kim T. The effect of postural correction and visual feedback on muscle activity and head position change during overhead arm lift test in subjects with forward head posture. 2019;31(3):151–6.
21. Szczygieł E, Fudacz N, Golec J, Golec E. The impact of the position of the head on the functioning of the human body: A systematic review. Int J Occup Med Environ Health. 2020;33(5):559–68.
22. Garg AK, Tikku T, Khanna R, Pratap R, Srivastava K, Verma SL. Is head posture and malocclusion related?. J Contemp Orthod. 2019;3(3):38
23. Peng H, Liu W, Yang L, Zhong W, Yin Y, Gao X, et al. Does head and cervical posture correlate to malocclusion? A systematic review and meta-analysis. PLoS One. 2022;17(10):1–16.
24. Tankhiwale A, Rahalkar JS, Agarkar S, Deshmukh S, Manerikar R. Relationship between extended head posture and malocclusion. Indian Journal of Orthodontics and Dentofacial Research. 2018;4(1):35-40.
25. Shaughnessy T, Shire LH. Etiology of class II malocclusions. Pediatr Dent. 1988;10(4):336–8.
26. Lone IM, Zohud O, Midlej K, Proff P, Watted N, Iraqi FA. Skeletal class II malocclusion: from clinical treatment strategies to the roadmap in identifying the genetic bases of development in humans with the support of the collaborative cross mouse population. J. Clin. Med. 2023;12(5148):1-23.
27. Al-Dumaini A.A., Halboub E., Alhammadi M.S., Ishaq R.A.R., Youssef M. A Novel Approach for Treatment of Skeletal Class II Malocclusion: Miniplates-Based Skeletal Anchorage. Am. J. Orthod. Dentofac. Orthop. 2018;153:239–47.
28. Alexa VT, Fratila AD, Szuhanek C, Jumanca D, Lalescu D, Galuscan A. Cephalometric assessment regarding craniocervical posture in orthodontic patients. Scientific Reports. 2022;12(21729):1-15.
29. Pruneda JFM. Dental malocclusion and its relationship with body posture: A new research challenge in stomatology. Bol Med Hosp Infant Mex. 2013;70(5):341–3.
30. Kale B, Buyukcavus MH. Effect of craniofacial growth pattern on head posture. JDI. 2020;27(3):144-50.
31. Lopatienė K, Šidlauskas A, Vasiliauskas A, Čečytė L, Švalkauskienė V, Šidlauskas M. Relationship between malocclusion, soft tissue profile, and pharyngeal airways: A cephalometric study. Vol. 52, Medicina. 2016;52:307–14.
32. Page DC, Mahony D. The airway, breathing, and orthodontics. Todays FDA. 2010;22(2):43–7.
33. Chen W, st al. Evaluation of the position and morphology of tongue and hyoid bone in skeletal class II malocclusion based on cone beam computed tomography. BMC Oral Health. 2021;21(475):1-7.
34. Tekale DN, Vakil KK, Nagmode SL, Vakil JK. Hyoid bone position and head posture comparison in skeletal class I and class II subjects: A retrospective cephalometric study. APOS Trends in Orthodontics . 2014;4(3):53-9.
35. Pradeep S, Venkatasubramanian P, Parameswaran R, Vijayalakshmi D. Quantitative analysis of body posture and its correlation with cervical posture in various malocclusions. Res Sq. 2021;1–29.
36. Lubis HF, Nainggolan LI, Marwan A. Relationship between the nasopharyngeal width and hyoid bone position in skeletal malocclusion. Journal of International Dental and Medical Research. 2020;13(2):607-13.