Impact of Mandibular Vertical Height and Bone Density on Patient Satisfaction Following Complete Denture Treatment

Asri Diah Sastrawijaya[1], Lindawati Soetanto Kusdhany[2]*, Farisza Gita[2], Bramma Kiswanjaya[3]

1. Prosthodontic Residency Program, Faculty of Dentistry, Universitas Indonesia, Jakarta, Indonesia.
2. Department of Prosthodontic, Faculty of Dentistry, Universitas Indonesia, Jakarta, Indonesia.
3. Department of Dentomaxillofacial Radiology, Faculty of Dentistry, Universitas Indonesia, Jakarta, Indonesia.

Abstract

We sought to analyze demographic, anatomical, and disease factors affecting patient satisfaction after complete denture treatment.

A cross-sectional study assessed the data of 92 subjects (n = 55 men and 37 women) aged 45 years and older who wore complete dentures constructed at the Dental Teaching Hospital, Faculty of Dentistry, Universitas Indonesia. A validated Indonesian version of the Patient's Denture Assessment (PDA-ID) questionnaire was applied to evaluate their satisfaction at 1 month after complete denture insertion and scores were compared between different patient groups. Vertical height (at both anterior and posterior points) and bone density of the mandible were evaluated via panoramic radiography.

A significant difference (P = .000) was found between the different vertical heights of the mandible (anterior and posterior) and patient satisfaction regarding complete denture treatment. Meanwhile, no significant difference (P = .160) was found between bone density of the mandible and patient satisfaction regarding complete denture treatment. Multivariate analysis containing identified predictive factors revealed that patient satisfaction with complete denture treatment was mostly affected by vertical height of the anterior mandible (P = .000).

Vertical height of the anterior mandible is a key determinant factor influencing patients' satisfaction after complete denture treatment.

Clinical article (J Int Dent Med Res 2020; 13(3): 996-1002)

Keywords: Patient's satisfaction; PDA-ID questionnaire; vertical heights of mandible; bone density of mandible; complete denture.

Received date: 10 January 2020 **Accept date: 15 March 2020**

Introduction

Edentulism is mostly found in the preelderly and elderly populations[1] and is caused by dental caries, periodontal disease, and traumatic injuries.[2] In such a condition, the high demand for conventional complete dentures in the elderly can be attributed to the physiologic changes that occur intraorally. Alveolar bone resorption in the maxilla and mandible is the most common problem impeding the construction of conventional complete dentures[3] as it affects height in the jaw bones.[4] Further, the duration of edentulism and previous denture experience can influence vertical bone heights and bone density and reduce patient satisfaction towards the complete denture treatment.[5,6]

Determining vertical height and bone density in the mandible is key to diagnosing the patient's condition, arranging treatment planning, and predicting their satisfaction regarding complete denture treatment. Alfadda and Canada reported that the stabilization of complete mandibular dentures is the most important factor influencing the level of patient satisfaction following complete denture treatment.[7] Calculations of the vertical height and bone density of the mandible could be done by way of several methods using panoramic radiographs.[8–11]

Separately, the degree of patients' satisfaction with their complete dentures can be evaluated subjectively through the self-assessment method. Komagamine et al. reported on a multidimensional self-assessment

Corresponding author:
Lindawati S. Kusdhany,
Department of Prosthodontics
Faculty of Dentistry, Universitas Indonesia
E-mail: lindawati@ui.ac.id

questionnaire, the Patient's Denture Assessment (PDA-ID), that has since been validated in the Indonesian language by a dental research team from the Faculty of Dentistry, Universitas Indonesia.[12,13] To our knowledge, previous research not explored the relationship between vertical height and bone density of the mandible through panoramic radiography while considering patient satisfaction about complete denture treatment using this questionnaire.

Thus, this study seeks to evaluate the impact of the relationship between vertical height and bone density of the mandible on patient satisfaction with complete dentures in different groups stratified by age, sex, education level, duration of edentulism, and previous denture experience. Furthermore, this study will elucidate the most important factor that influences patients' satisfaction towards complete denture treatment with vertical heights and bone density of mandible, age, sex, education level, duration of edentulism, and denture experiences.

Materials and methods

This cross-sectional study was conducted in the Dental Teaching Hospital, Faculty of Dentistry, the Universitas Indonesia and was approved by the Ethical Committee Faculty of Dentistry, Universitas Indonesia (no. 37/ethical approval/FKGUI/V/2018). A total of 92 complete denture wearers, including 55 men and 37 women, were involved in this study. All of the complete dentures were fabricated by a postgraduate student and an undergraduate student. The subjects were selected using consecutive sampling methods from June 2018 to February 2019.

The inclusion criteria were as follows: (1) conventional complete denture wearers on both jaws; (2) having the ability to communicate and come to the Dental Teaching Hospital, Faculty of Dentistry, Universitas Indonesia at 1 month after insertion; (3) having complete denture treatment period not more than 12 months (from the first visit until 1 month control visit); (4) aged 45 years or older; and (5) having good quality of panoramic radiographs (i.e., no gross distortion and with good contrast). Conversely, the exclusion criteria were as follows: (1) unwilling to sign the informed consent form and participate in this study and (2) having a history of a systemic disorder such as diabetes.

The consecutive sampling method was selected for this study because it is relatively simple and is also one of the best options among the nonprobability sampling methods. With this approach, all patients who visit the Dental Teaching Hospital, Faculty of Dentistry, Universitas Indonesia and meet the inclusion criteria are selected as participants for this study. At 1 month after insertion of the new complete dentures constructed for participants in this study, all participants provided their informed consent for study inclusion, then completed the questionnaire.

Patient satisfaction was measured with the PDA-ID questionnaire. This questionnaire was used because it has been previously validated in the Indonesian language. Furthermore, PDA-ID is a multidimensional self-assessment specific to dentures that can evaluate both positive and negative denture-related effects. This questionnaire consists of 22 questions, divided into six major aspects: function, aesthetics, speech, lower denture, expectations, upper denture, and importance (Table 1). During the questionnaire, each question item is measured using a visual analog scale (VAS) consisting of a horizontal 100-mm line anchored by words representing the worst situation at the left extremity of the scale and words representing the best situation at the right extremity. In this manner, the total value for all 22 questions ranges from 0 to 2,200 points for each participant.[12,13]

Ninety-two conventional panoramic radiographs of the subjects were used to measure vertical heights of the mandible (at anterior and posterior sites) according to the method of Xie et al. and to measure bone density of the mandible according to the Mandibular Cortical Index (MCI) approach.[4,14,15] Measurements were performed at two different times by two observers within a 1-month interval. Then, intraobserver and interobserver reliability testing was conducted to minimize the degree of bias between the two operators. A digital caliper, calibrated with gauge block steel, was used to complete the measurements on the conventional panoramic radiographs.

According to the method of Xie et al., vertical height of mandibular bone was classified (1) at the anterior site (refer to X line) and (2) at the posterior site (refer to Y and Z lines) (Figure 1), where X is the vertical distance from the

alveolar crest to the lower border in the midline and while Y and Z indicate distances from the alveolar crest to the lower border of mandible at 34% and 53% of the length of the mandibular body and perpendicular to the tangent line of the mandibular border.[4,14] The cutoffs for the reference line of the X, Y, and Z lines classified as normal bone height were greater than 35.64 mm, greater than 33.55 mm, and greater than 28.25 mm, accordingly. According to the MCI method, the variable of bone density was modified and classified as follows: (1) normal density/C1 and C2, where the endosteal margin of the cortex mandible was even and sharp on both sides, or (2) low density/C3, where the endosteal margin showed semilunar defects (lacunar resorption) or was clearly porous on1or both sides (Figure 2).[15] According to the study of Ariyanti, patient satisfaction could be classified as either satisfied or not using the cutoff of 1,971 points, where greater than 1,971 points indicates satisfaction and equal to less than 1,971 points indicates dissatisfaction.[13]

Patients were classified by age into those 45 to 60 years old and those ≥ 60 years old and by sex as either male or female. The education-level groups included basic and advanced, respectively. According to the study of Atwood and Tallgren, the duration of edentulousness was classified as either 12 months or less or greater than 12 months. This classification was done due to fact that most bone loss occurs in the first year after extraction.[5] Finally, considering the study of Turker et al, the previous denture experience group was modified and stratified into three categories as follows: (1) experience of more than 3 years, (ii) experience of 3 years or less, and (3) no prior experience using dentures before. The previous denture experience group was stratified in this manner due to the existence of participants with no experience in using dentures before.[16]

Statistical analysis was performed using the Statistical Package for the Social Sciences software program (IBM Corp., Armonk, NY, USA). Statistical significance was set at $P < .05$. The chi-squared test with continuity correction and the Mann–Whitney U test were employed to analyze the relationship between vertical height and bone density of the mandible, sociodemographic factors (i.e., age, sex, education level), duration of edentulism, and previous denture experience and the impact of such on the patients' satisfaction with complete denture treatment. A logistic regression test to analyze the most important factor affecting patient satisfaction with complete denture treatment was also completed.

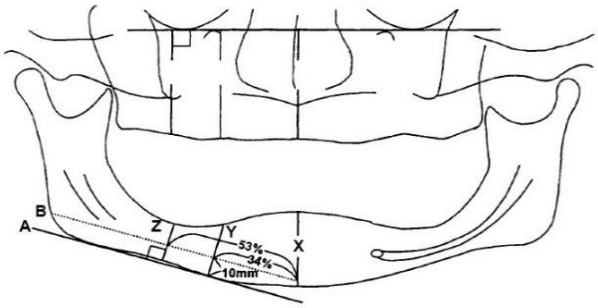

Figure 1. Method for measurement of vertical height of the mandibule according to Xie et al.[4]

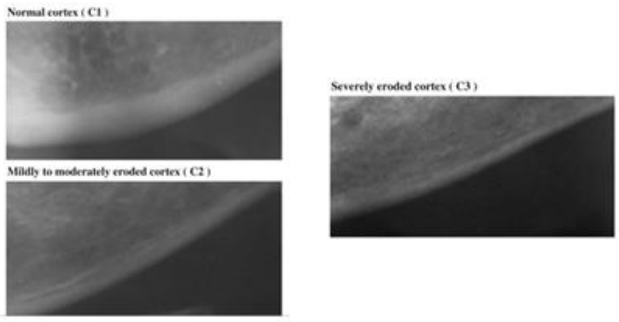

Figure 2. Classification of mandibular bone density according to the MCI method: C1, C2, C3.[15]

Results

Among the 92 subjects who participated in this study, the mean and standard deviation values of the PDA-ID questionnaire was 1,942.5 ± 248.5 points with a minimum to maximum score range of 1,160 to 2,200 points. (Table 1). Nearly 60% of the subjects were 45 to 60 years old, while 62% had an advanced education level. Further, 57.6% of subjects had prior denture experience lasting up to three years, while nearly 85% of the subjects had a duration of edentulism of up to 12 months. More than 50% of the study population was not satisfied with their complete denture treatment. According to the X line, 58.7% were classified as a low ridge, while, according to the Y and Z lines, 53.3% were classified as a low ridge. More than 50% of the subjects were classified as having low bone density of the mandible (Table 2).

PDA-ID (VAS 100 mm)	Mean	SD
Function:		
How much pain do you feel?	93.7	7.28
How easy is it for you to swallow food boluses and water?	91.5	9.54
How well do you enjoy your meal?	87.1	12.95
How worn out does your jaw feel?	92.9	8.66
Lower denture:		
How worried are you about other people watching ?	87.4	1.78
How is your lower denture retained on the ridge?	88.6	9.55
How does your lower denture fit?	86.9	11.21
How uncomfortable is your lower denture?	87.3	9.40
Upper denture:		
How often does food debris get stuck under your upper denture?	91.6	7.20
How does your upper denture fit?	92.3	8.15
How often does your upper denture fall down?	91.7	8.23
Expectation		
How satisfactory will the new dentures be?	85.9	11.39
How problematic will the new dentures be?	88.3	1.10
How well will the new dentures fit?	8.1	19.82
Aesthetics and speech:		
How worried are you about other people watching?	84.2	16.19
How easy is it for you to speak?	88.2	9.62
How worried are you about your mouth?	86.7	13.68
How often do your dentures click when chewing?	88.7	12.92
Importance:		
How much do you consider your dentures as part of your body?	8.3	24.96
How important are your dentures to you?	88.0	12.20
To what degree can you care for your dentures without any difficulty?	93.6	7.39
How at ease do you feel when wearing your dentures?	87.5	7.36
Total:	**1942.5**	**248.57**

Table 1. Mean and standard deviation values of the PDA-ID questionnaire.

		Frequency (n = 92)	Percentage
Age	45–59 years	54	58.7
	> 60 years	38	41.3
Sex	Male	55	59.8
	Female	37	4.2
Education level	Advanced	57	62
	Basic	35	38
Duration of edentulism	≤ 12 months	78	84.8
	>12 months	14	15.2
Previous denture experience	> 3 years	9	9.8
	≤ 3 year	53	57.6
	Never used	30	32.6
Patient satisfaction regarding complete denture treatment	Satisfied	44	47.8
	Not Satisfied	48	52.2
Vertical height of the mandible:			
X line (anterior)	Normal	38	41.3
	Low	54	58.7
Y line (posterior)	Normal	43	46.7
	Low	49	53.3
Z line (posterior)	Normal	43	46.7
	Low	49	53.3
Bone density of mandible	Normal (C1)	36	39.1
	Low (C2 & C3)	56	6.9

Table 2. Frequency distribution of subjects.

Statistically, the intraobserver and interobserver reliability test results for vertical height and bone density of the mandible suggested no significant differences existed between the two observers. The intraobserver reliability test for the vertical heights of the mandible with Bland–Altman test were as follows: the X line had a limit of agreement of between −2.347 and 1.520 and at a 95% confidence interval of −0.413 (−0.613 −0.213); the Y line had a limit of agreement of between −2.347 and 1.520 and a 95% confidence interval of −0.430 (0.635 −0.213); and the Z line had a limit of agreement of between −2.425 and 1.453 and a 95% confidence interval of −0.486 (−0.687 −0.285). The interobsever reliability test for mandibular vertical height with the Bland–Altman test were as follows: the X line had a limit of agreement of between −1.100 and 2.094 and at 95% confidence interval of 0.497 (0.331 −0.662); the Y line had a limit of agreement of between −0.891 and 2.101 and a 95% confidence interval of 0.605 (0.450 −0.760); and the Z line had a limit of agreement of between −0,990 and 2,380 and a 95% confidence interval of 0,695 (0.520 −0.869). The intraobserver and interobserver reliability outcomes for bone density of the mandible with Kappa value were as follows: .89 and 0.78.

A significant difference (*P* = .000) was found between different lines of vertical heights of the mandible (X line, Y line, and Z line) and patient satisfaction regarding complete denture treatment. Meanwhile, no significant difference (*P* = .160) was noted between bone density of the mandible and patient satisfaction regarding complete denture treatment (Table 3).

Variable	N	PDA-ID Questionnaire		*P*
		Satisfied	Not Satisfied	
Vertical height of the mandible:				
X line (anterior)				
Normal > 35.64 mm	38	32 (34.8%)	6 (6.5%)	.000*+
Low ≤ 35.64 mm	54	12 (13%)	42 (45.7%)	
Y line (posterior)				
Normal > 33.55 mm	43	31 (33.7%)	12 (13%)	.000*+
Low ≤ 33.55 mm	49	13 (14.1%)	36 (39.1%)	
Z line (posterior)				
Normal > 28.25 mm	43	31 (33.7%)	12 (13%)	.000*+
Low ≤ 28.25 mm	49	13 (14.1%)	36 (39.1%)	
Bone density of the mandible:				
Normal	36	21 (22.8%)	4 (16.3%)	.160+
Low	56	23 (25%)	33 (35.9%)	

Table 3. Correlation between patient satisfaction and vertical height and bone density of the mandible.
* Significant (*P* < .05)
+ included into multivariate analysis (*P* < .250).

Patient satisfaction following complete denture treatment was not affected by age (*P* = .890), sex (*P* = .174), or duration of edentulism (*P* = .202). Conversely, a significant difference was found between the level of patient satisfaction according to education level (*P* = .013). Also, patient satisfaction was affected by

the nature of previous denture experience (*P* = .000). From this, predictive factors that could be included in a multivariate analysis (*P* < .250) were vertical height of the mandible (*P* = .000), bone density of the mandible (*P* = .160), education level (*P* = .013), sex (*P* = .174), duration of edentulism (p = .202), and previous denture experience (*P* = .000) (Table 4). Multivariate analysis revealed the patient's satisfaction with complete denture treatment was mostly affected by vertical height of the anterior mandible (*P* = .000) (Table 5).

Variable	N	PDA-ID Questionnaire		P
		Satisfied	Not Satisfied	
Age (years)				
45–59	54	25 (27.2%)	29 (31.5%)	.890
≥ 60	38	19 (20.7%)	19 (20.7%)	
Sex				
Male	55	30 (32.6%)	25 (27.2%)	.174+
Female	37	14 (15.2%)	23 (25%)	
Education level				
Advanced	57	21 (22.8%)	36 (39.1%)	.013*+
Basic	35	23 (25%)	12 (13%)	
Duration of edentulism				
≤ 12 months	78	40 (43.5%)	38 (41.3%)	.202+
> 12 months	14	4 (4.3%)	10 (10.9%)	
Previous denture experience:				
> 3 years	9	5 (5.4%)	4 (4.3%)	.000*+
≤ 3 years	47	35 (38%)	18 (19.6%)	
Never used	30	4 (4.3%)	26 (28.3%)	

Table 4. Correlation between patient satisfaction and age, sex, education level, duration of edentulism, and previous denture experience.
*Significant (*P* < .05)
+included into multivariate analysis (*P* < .250).

	B	S.E	Wald	df	*P*-Value	OR	CI 95%	
							Min	Max
X line (anterior)	2.568	.584	19.350	1	.000*	13.042	4.153	4.953
Denture experience > 3 years	-.241	.870	.077	1	.781	.786	.143	4.323
Denture experience ≤ 3 years	1.735	.998	3.026	1	.082	5.671	.803	4.075

Table 5. Results of logistic regression analysis.
*Significant (*P* < .05).

Discussion

There are several methods by which to measure vertical height and bone density of the mandible with panoramic radiographs.[8–11] In this study, the Xie et al. method was used because it does not depend on the location of the foramen mental. Most panoramic radiographs do not show the anatomic structure of the foramen mental. Additionally, the MCI method was used because of its simplicity and avoidance of the need to perform linear measurements. A significant correlation was found between mandibular vertical height and patient satisfaction. Some previous studies have reported that the stabilization of the lower denture is the most important factor affecting patient satisfaction.[7,17,18] Alveolar bone height in the mandible determines the area of the denture-bearing surface. The more denture-bearing area available to support the denture, the greater the retention and stabilization of the denture will be.[19] Meanwhile, Carlsson et al. reported that there is no correlation between the denture-bearing area and patient satisfaction.[18] The retention and stabilization of the lower denture constitute 1 of 6 major aspects evaluated by the PDA-ID questionnaire.[12,13] Statistically, there was no relation between bone density of the mandible and patient satisfaction observed. In this study, patient satisfaction was not directly affected by mandibular bone density. Kusdhany et al. determined that low bone density among osteoporotic patients influenced alveolar ridge resorption. Finally, alveolar ridge resorption affects the retention and stabilization of dentures.[3] It is also important to consider that patient satisfaction can be influenced by many factors such as psychologic factors, the dentist–patient relationship, the adaptation process, and patient personality.[20–22]

The complete denture apparatus used by subjects in this study was of a good quality as it was implanted via a standard operation at the Dental Teaching Hospital, Faculty of Dentistry, Universitas Indonesia. All dentures were constructed by a prosthodontic resident and undergraduate student supervised by prosthodontists. Berg et al. stated that the construction of a good complete denture depends on technical, biological, and physiological interactions between the patient and dentist. In their study, the majority of patients were satisfied with their complete dentures; however, even if the denture is well-constructed, some patients remained dissatisfied with their new dentures. In several studies over the past 30 years, the proportion of complete denture wearers who were dissatisfied with new and well-made protheses ranged between 10% and 15%.[18]

Age, sex, and the duration of edentulism did not show a statistical correlation with patient satisfaction regarding their complete denture treatment. This is supported by several previous studies reported that age and sex were not

correlated with patient satisfaction.[13,16,18] Opposite from this study, the longer the duration of edentulism, the more the resorption will be.[5,6]

Meanwhile, in this study, patient satisfaction showed a significant correlation with education level and previous denture experience. A previous study reported that there was a significant negative correlation between education level and patient satisfaction in that those with a lower education level had less expectations for their complete dentures. Moreover, patients with low education levels assumed more often that edentulism was not a major problem.[18] Miranda et al. reported that subjects with lengthier denture experience had a better score for patient satisfaction.[20] Elsewhere, Turker et al. suggested that subjects wearing dentures for more than three years had a greater ability to masticate, better tasting and speech abilities, and experienced more convenience in mastication. Finally, such a condition will improve patients' satisfaction with their complete dentures.[16]

In this study, logistic regression testing revealed the most influential factor affecting patient satisfaction regarding complete denture treatment was the vertical height of the anterior mandible. The height of the alveolar mandible influences the retention and stabilization of the mandibular denture. Many factors contribute to the movement of the mandibular denture at the anterior point. When the mouth is opened wide, the muscle of the lower lip can act as a tight band that pushes up the lower denture.[19] Moreover, the attachment of the frenulum lingualis could be located very high on the alveolar crest, which will compromise the lingual seal of a lower denture, increasing lower denture movement at the anterior point. Meanwhile, in the posterior region of the mandible, the anatomic structure of the fossa retro mylohyoid will conduct compensatory closure for the lower denture and improve the retention of the lower denture at the posterior point.[19]

The primary limitation of this study is the size of the sample. Further, data of systemic disorders such as diabetes were not collected based on laboratory testing. Also, distortions of conventional panoramic radiographs should be considered, mostly as a result of the patient's head position. Along these lines, variation in vertical measurements from conventional radiographs could be minimized by using a standard head position. Otherwise, the use of a digital panoramic approach might yield an optimum result for linear measurement, allowing for the adjustment of contrast and brightness.

According to this study, it is suggested that a self-assessment questionnaire evaluating complete dentures be developed that is more appropriately aligned with the sociocultural condition in Indonesia. Furthermore, the arrangement of the objective evaluation of complete dentures is also required due to the importance of this evaluation in determining the success of complete denture treatment.

Conclusions

Vertical heights of the mandible, education level, and previous denture experience have strong correlations with patient satisfaction regarding their complete dentures. Meanwhile, bone density of the mandible, age, sex, and duration of edentulism statistically did not show significant correlations with patient satisfaction regarding their complete dentures. Ultimately, the most influential factor impacting patients' satisfaction regarding their complete dentures was vertical height of the anterior mandible.

Acknowledgements

This research received a grant from Hibah PITTA Universitas Indonesia.

Declaration of Interest

The authors declare that there are no conflicts of interest.

References

1. Cano-gutiérrez C, Borda MG, Arciniegas AJ, Borda CX. Edentulism And Dental Prosthesis In The Elderly : Impact On Quality Of Life Measured With Eurqol – Visual Analog Scale (EQ-VAS). Acta Odontol Latinoam 2015;28(2):149-55.
2. Kaira L, Dabral E. Prevalence of Complete Edentulism among Udaipur Population of India. Saudi J Dent Res 2014;5(2):139-45.
3. Indrasari M, Kusdhany LS, Koesmaningati H. Resorption Level of Edentulous Alveolar Bone in Normal , Osteopenia and Osteoporosis Postmenopausal Women. Int J Clin Prev Dent 2012;8(3):141-6.
4. Marcello-Machado RM, Bielemann AM, Nascimento GG, de Rezende Pinto L, Cury AA, et al. Masticatory Function Parameters in Patients with Varying Degree of Mandibular Bone Resorption. J Prosthodont Res 2017;61(3):315-23.
5. Kingsmill VJ. Post-extraction of the Adult Mandible. Crit Rev Oral Biol Med 1999;10(3):384-404.
6. Abirami G, Samyukta. Residual Ridge Resorption in Complete Denture Wearers. J Pharm Sci Res 2016;8(6):565-9.

7. Alfadda AS. The Relationship Between Various Parameters of Complete Denture Quality and Patients Satisfaction. J Am Dent Assoc 2014;145(9):941-8.
8. Hardanti S, Oscandar F, Azhari. Description of Mandibular Bone Quality Based on Measurements of Cortical Thickness Using Mental Index of Male and Female Patients between 40-60 years old. Imaging Sci Dent 2011;41(4):151-3.
9. Devi Y, Rakesh N, Ravleen N. Diagnostic Efficacy of Panoramic Mandibular Index to Identify Postmenopausal Women with Low Bone Mineral Densities. J Clin Exp Dent 2011;3(5):456-61.
10. Çakur B, Dağistan S, Harorli A, Ezmeci EB. The Mandibular Angle in Osteoporotic Men. Med Oral Patol Oral Cir Bucal 2011;16(2):181-4.
11. Kiswanjaya B, Yoshihara A, Deguchi T, Hanada N, Miyazaki H. Relationship Between the Mandibular Inferior Cortex and Bone Stiffness in Elderly Japanese People. Osteoporos Int 2010;21(3):433-8.
12. Komagamine Y, Kanazawa M, Kaiba Y, Sato Y, Minakuchi S. Reliability and Validity of a Questionnaire for Self- Assessment of Complete Dentures. BMC Oral Health 2014;14(1):45.
13. Rezeki A, Koesmaningati H, Kusdhany L. Relationship between Masticatory Performances and Patient's Satisfaction toward Complete Denture Treatment (Measured Using Color Changeable Chewing Gum and Validated Indonesian Version of Patient's Denture Assessment (PDA)). J Int Dent Med Res 2017;10:454-9.
14. Panchbhai AS. Residual Ridge Height In Jawbones Quantitative Estimation of Vertical Heights of Maxillary and Mandibular Jawbones in Elderly Dentate and Edentulous Subjects. Spec Care Dentist 2013;33(2):62-9.
15. Ernawati M, Kusdhany L, Iskandar H, Rahardjo T. Mandibular Bone Density Index for Prediction of Jaw Bone Osteoporosis in Men. J Int Dent Med Res 2017;10:612-8.
16. Turker SB, Sener ID, Ozkan YK. Satisfaction of the Complete Denture Wearers Related to Various Factors. Arch Gerontol Geriatr 2009;49(2):126-9.
17. Bhat VS, Prasad K, Malli P. A Survey to Assess Patient Satisfaction After Receiving Complete Denture Prosthesis In A. B.Shetty Memorial Institute Of Dental Sciences. NUHS 2014;4(2):81-5.
18. Celebić A1, Knezović-Zlatarić D, Papić M, Carek V, Baucić I. Factors Related to Patient Satisfaction With Complete Denture Therapy. J Gerontol A Biol Sci Med Sci 2003;58(10):948-53.
19. Abe J. Mandibular Suction-Effective Denture and BPS: A Complete Guide. Tokyo: Quintessence Publishing; 2012.
20. Miranda BB, Dos Santos MB, Marchini L. Patients' Perceptions of Benefits and Risks of Complete. J Prosthodont 2014;23(7):515-2
21. Santos BF, dos Santos MB, Santos JF, Marchini L. Patients ' Evaluations of Complete Denture Therapy and Their Association with Related Variables : A Pilot Study. J Prosthodont 2015;24(5):351-7.
22. Gosavi SS, Ghanchi M, Malik SA, Sanyal P. A Survey of Complete Denture Patients Experiencing Difficulties with their Prostheses. J Contemp Dent Pract 2013;14(3):524-7.