

6. Gaetani L, Blennow K, Calabresi P, Di Filippo M, Parnetti L, Zetterberg H. Neurofilament light chain as a biomarker in neurological disorders. *J Neurol Neurosurg Psychiatry*. 2019;90(8):870–81. doi: 10.1136/jnnp-2018-320106.
7. Kumari P, Rothan HA, Natekar JP, Stone S, Pathak H, Strate PG, et al. Neuroinvasion and encephalitis following intranasal inoculation of SARS-CoV-2 in K18-hACE2 mice. *Viruses*. 2021;13(1):132. doi: 10.3390/v13010132.
8. Li Y, Li M, Wang M, Zhou Y, Chang J, Xian Y, et al. Acute cerebrovascular disease following COVID-19: a single center, retrospective, observational study. *Stroke Vasc Neurol*. 2020;5(3):279–84. doi: 10.1136/svn-2020-000431.
9. Lopez-Leon S, Wegman-Ostrosky T, Perelman C, Sepulveda R, Rebolledo PA, Cuapio A, et al. More than 50 Long-term effects of COVID-19: a systematic review and meta-analysis. *medRxiv*. 2021. doi: 10.1101/2021.01.27.21250617.
10. Mina FB, Billah M, Karmakar S, Das S, Rahman MS, Hasan MF, et al. An online observational study assessing clinical characteristics and impacts of the COVID-19 pandemic on mental health: a perspective study from Bangladesh. *Z Gesundh Wiss*. 2023;31(2):319–27. <https://doi.org/10.1007/s10389-020-01445-2>.
11. Olsson B, Portelius E, Cullen NC, Sandelius Å, Zetterberg H, Andreasson U, et al. Association of cerebrospinal fluid neurofilament light protein levels with cognition in patients with dementia, motor neuron disease, and movement disorders. *JAMA Neurol*. 2019;76(3):318–25. doi: 10.1001/jamaneurol.2018.3746.
12. Park Y, Kc N, Paneque A, Cole PD. Tau, glial fibrillary acidic protein, and neurofilament light chain as brain protein biomarkers in cerebrospinal fluid and blood for diagnosis of neurobiological diseases. *Int J Mol Sci*. 2024;25(12):6295. doi: 10.3390/ijms25126295.
13. Riffenburgh R, Gillen D. *Statistics in medicine*. Elsevier Inc. Vol. 822. Elsevier Inc. London; 2020. DOI:10.1080/00031305.2022.2054626.
14. Rogers JP, Chesney E, Oliver D, Pollak TA, McGuire P, Fusar-Poli P, et al. Psychiatric and neuropsychiatric presentations associated with severe coronavirus infections: a systematic review and meta-analysis with comparison to the COVID-19 pandemic. *Lancet Psychiatry*. 2020;7(7):611–27. doi: 10.1016/S2215-0366(20)30203-0.
15. Siriken B, Başkan C, Güler A, Demir H, Aka N. *Coronavirus Disease (COVID-19)*. Livre de Lyon. 2020;66–65.

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R.A. Chobanov, Y.H. Hajiyeva, F.G. Bakhishli
Azerbaijan Medical University, Baku, Azerbaijan

ELDERLY PEOPLE WITH DIFFERENT TYPES OF NUTRITIONAL BEHAVIOR HEALTH STATUS AND QUALITY OF LIFE

e-mail: mic_amu@mail.ru

The purpose of the study was to assess the distribution of nutritional behavior types in different age groups of elderly people and their health status and quality of life. The research was conducted on the basis of 4 city polyclinics (patients, guests), 4 schools (parents) and 14 different companies and departments (employees) of Baku city. The types and social and hygienic aspects of the formation of feeding behavior were determined by a blind survey using the international DEBQ questionnaire. Quality of life was determined by the SF-36 international questionnaire. In total, the health of elderly people can be assessed as unsatisfactory according to the survey. Almost all types of nutritional behavior did not exceed 0.52 points, which corresponds to a low assessment of self-health. Health and quality of life indicators were lower for all types of nutritional behavior, only in mixed nutritional behavior type their indicators were more positive.

Key words: elderly people, quality of life, health status, eating behavior.

Р.А. Чобанов, Я.Г. Гаджисва, Ф.Г. Бахишли

РІЗНІ ТИПИ ХАРЧОВОЇ ПОВЕДІНКИ, СТАН ЗДОРОВ'Я І ЯКІСТЬ ЖИТТЯ У ЛІТНІХ ПАЦІЄНТІВ

Метою дослідження була оцінка розподілу типів харчової поведінки у різних вікових групах людей похилого віку, стану їх здоров'я та якості життя. Дослідження проводилося на базі 4 міських поліклінік (пацієнти, відвідувачі), 4 шкіл (батьки) та 14 різних підприємств та відомств (співробітники) міста Баку. Типи та соціально-гігієнічні аспекти формування харчової поведінки визначалися методом сліпого опитування з використанням міжнародного опитувальника DEBQ. Якість життя визначалася за міжнародним опитувальником SF-36. Загалом за результатами опитування здоров'я людей похилого віку можна оцінити як незадовільне. Практично всі типи харчової поведінки за опитувальником не перевищували 0,52 бали, що відповідає низькій оцінці власного здоров'я. Показники здоров'я та якості життя були нижчими за всіма типами харчової поведінки, тільки при змішаному типі показники були більш позитивними.

Ключові слова: люди похилого віку, якість життя, стан здоров'я, харчова поведінка.

One of the most urgent demographic problems worldwide is the ongoing population aging. According to the United Nations, the share of people over 65 years old has increased by 9 %, and in 2025, the number of people over 65 years old in the world will exceed 800 million, which will make up 10 % of the population. In 2050, this share may reach 16 %. All the mentioned shows once again that the number of the population belonging to the ≥65 age group will increase at a great pace compared to other population

groups [3, 11]. According to the results of the conducted researches, for more than half a century, the number of population aged ≥ 60 years worldwide has more than tripled and will reach about 2 billion in 2050. It is also expected that the number of population aged ≥ 65 years in the 27 member states of the European Union will increase from 17.1 % in 2008 to 23.5% in 2030 [2].

Older people are the most valuable asset of any society, but they are also heterogeneous, many require support at one time or another to remain independent and fully integrate into society. Protecting the health and life expectancy of older people is directly related to the availability, acceptability and quality of medical care provided to them [2, 5].

Nutrition is a necessary component to maintain the body's vital functions. But defects in food behavior, high-calorie foods, "fast foods", sweet drinks, etc. when used too much, exhausts the body and causes various diseases. As for elderly people, these data are very scarce [6, 9].

Several types of food behavior are distinguished: external—when a person's reaction is primarily triggered by external stimuli that cause appetite and a desire to try certain foods; emotiogenic – "eating stress" and related problems, taking food as a result of emotional distress; restrictive – personal food restrictions and bans on many favorite and high-calorie foods, is an independent attempt to lose excess weight using strict diets [8, 10].

Nutritional disorders cause dangerous diseases. These include anorexia, bulimia, obesity, non-communicable and other diseases [1, 10]. In this regard, the need to study the distribution of nutritional behavior types in different age groups of elderly people regard their health status becomes urgent.

The purpose of the study was to assess the distribution of nutritional behavior types in different age groups of elderly people and their health status and quality of life.

Materials and methods. The research was conducted on the basis of 4 city polyclinics (patients, guests), 4 schools (parents) and 14 different companies and departments (employees) of Baku city. The types and social and hygienic aspects of the formation of feeding behavior were determined by a blind survey using the international DEBQ questionnaire, which included questions reflecting the social and hygienic aspects of the formation of nutritional behavior. The survey included questions about the respondents' assessment of their health.

The average value of the $1 \times q_1$ sum of the applied self-assessment health index (SHI) (1—very bad, 2—bad, 3—satisfactory, 4—fairly good, 5—very good) is multiplied by their share in the total respondents. $SHI = (1 \times q_1 + 2 \times q_2 + 3 \times q_3 + 4 \times q_4 + 5 \times q_5) : 5$, where q_i is the share of respondents who chose answer i . Fluctuations in the health index on the received scale are 0.2–1.0. When interpreting the data, the health index should be taken into account, its value up to 0.6 is a low indicator of self-assessment of health, 0.61–0.8 is an average value, and 0.81–1.0 is a high indicator.

When processing the obtained results statistically, we used the Student's coefficient, the average weighted arithmetic quantity and the correlation coefficient. Quality of life (QoL) was determined by the SF-36 international questionnaire. Quality of life with ≥ 70 points is considered "satisfactory", and with ≤ 30 points "unsatisfactory". 4,200 questionnaires were distributed among the elderly, 576 questionnaires were filled out in the initial response, 887 questionnaires were re-answered with the participation of family members, and there were a total of 1,463 questionnaires. Medical staff of the polyclinic, school teachers, senior students of AMU participated in the research work.

Results of the study and their discussion. The analysis of the results of the survey shows that the prevalence rate of external and emotional types of nutritional behavior (NB) among elderly people is approximately the same and is 21.1 ± 1.1 % and 21.5 ± 1.1 %, respectively ($P > 0.05$). The prevalence of the restrictive type of NB is significantly higher— 28.4 ± 1.2 % ($P < 0.001$). However, according to NB, 29.0 ± 1.2 % of elderly people did not belong to the mentioned NB types. The point is that many people, including the elderly, do not, in our opinion, sustain a certain nutritional behavior, which can be explained by the following; the first is associated with material deprivation that limits the abuse of desired food. Second, a person's habits change with age, which can cause adjustments in NB. Third, it is difficult for a certain person in the family to follow a certain nutritional behavior and must obey the food choices of other family members. From this point of view, we consider it appropriate to define a mixed-type NB. In addition, the age of elderly people significantly affects changes in NB types (Table 1).

The prevalence of different types of eating behaviors is closely related to the age of the elderly. In particular, from 60–64 years to 90 years (with increasing age of elderly people), the frequency of the external type of food behavior consistently decreases from 27.1 ± 2.1 % to 5.6 ± 2.6 % ($r = 0.81 \pm 0.16$). In the same sequence, the frequency of emotional nutritional behavior decreases from 24.3 ± 2.5 % to 11.1 ± 3.7 %. These indicators confirm once again that NB types are not always observed and often overlap with each other. In addition, with increasing age, the number of diseases also increases, and therefore older people prefer to follow restrictive food behaviors, that is, different diets. In this regard, the frequency of the restrictive type of NB is naturally associated with the age of older people. Thus, as their age increases, its frequency increases from 24.6 ± 2.6 % to 38.8 ± 5.8 %.

Table 1

Detection of different types of NB depending on age in elderly people

Age groups, age	Number of elderly participants in questionnaires	Frequency of NB types							
		Extreme		Emotional		Restrictive		Mixed	
		n=308		n=314		n=416		n=425	
		abs.	%	abs.	%	abs.	%	abs.	%
60–64	288	78	27.1±2.6	70	24.3±2.5	76	26.4±2.6	64	22.2±2.5
65–69	265	67	25.3±2.7	61	23.0±2.6	76	28.7±2.8	61	23.0±2.6
70–74	240	76	19.2±7.5	50	20.8±2.6	71	29.6±3.0	73	30.4±3.0
75–79	219	7	21.5±2.8	44	20.1±2.7	59	26.9±3.0	69	31.5±3.1
80–84	208	36	17.3±2.6	43	20.7±2.8	59	28.4±3.1	70	33.7±3.3
85–89	171	30	17.5±2.9	38	22.2±3.2	47	27.5±3.4	56	32.7±3.6
≥90	72	4	5.6±2.6	8	11.1±3.7	28	38.9±5.8	32	44.4±5.9
Total	1463	308	21.1±1.1	314	21.5±1.1	416	28.4±1.2	425	29.0±1.2

However, elderly people, even with many diseases, do not always follow a restrictive nutritional behavior, they often expand the range of food products and increase the amount of food consumed. Thus, a mixed-type NB with an age-related association is formed. As elderly people get older, its frequency increases from 22.2±2.5 % to 44.4±5.9 % ($r=0.77±0.19$). As we have seen, defining mixed nutritional behavior becomes legitimate.

In order to assess the health status prospectively, the self-report method is often used when the respondents themselves assess their health status. The method is very convenient and quite objective, so we used this method to assess the health of elderly people with different nutritional habits. The results are shown in Table 2.

Table 2

Level of self-reported health and QoL indicators in the elderly with different types of NB

Level of self-reported health	Frequency of level of self-reported health in different types of NB									
	Extreme		Emotional		Restrictive		Mixed		Total	
	n=308		n=314		n=416		n=425		n=1463	
	abs.	%	abs.	%	abs.	%	abs.	%	abs.	%
Very bad	45	14.6±2.0	58	18.5±2.2	81	19.5±1.9	36	8.5±1.4	220	15.0±0.9
Bad	105	34.1±2.7	98	31.2±2.6	129	31.0±2.3	74	17.4±1.8	406	27.8±1.2
Suffice	91	29.5±2.6	86	27.4±2.5	108	26.0±2.2	149	35.1±2.3	434	29.7±1.2
Fairly good	56	18.2±2.2	55	17.5±2.1	75	18.0±1.9	123	28.9±2.2	309	21.1±1.1
Very good	11	3.6±1.1	17	5.4±1.3	23	3.5±1.1	43	10.1±1.5	94	6.4±0.6
Mean indicator	0.48		0.41		0.52		0.71		0.53	
QoL indicators in the elderly with different types of NB										
Types of NB	Number of elderly people	QoL indicators in different types of NB						Mean point of QoL		
		<30 point		30–70 point		>70 point				
		abs.	%	abs.	%	abs.	%			
Extreme	308	179	58.1±2.8	109	35.4±2.7	20	6.5±1.4	31.9±2.3		
Emotional	314	196	62.4±2.7	87	27.7±2.5	31	9.9±1.7	31.6±2.3		
Restrictive	416	228	54.8±2.4	141	33.9±2.3	47	11.3±1.6	34.8±2.1		
Mixed	425	168	39.5±2.4	171	40.2±2.4	86	20.2±1.9	43.2±2.0		
Total	1463	771	52.7±1.3	508	34.7±1.2	184	12.6±0.9	35.8±1.8		

Among respondents with external, emotogenic, and restrictive NB types, the frequency of self-assessment of health as “very bad” was quite high and varied between 14.6±2.0 % and 19.5±1.9 %. The frequency of “poor” self-rated health for such nutritional behaviors was low, ranging from 31.0±2.5 % to 34.1±2.7 %. At the same time, the frequency of these self-assessments among respondents with mixed types of NB was lower, 8.5±1.4 % ($P<0.05$) and 17.4±1.8 % ($P<0.001$), respectively. Only the frequency of “unsatisfactory” health assessment for all types of NB was approximately the same, i.e. 26.0±2.2 % and 35.1±2.3 %.

In respondents with extreme, emotional and restrictive NB types, the frequency of self-assessment of health as “fairly good” is significantly reduced and varies from 17.5±2.1 % to 18.2±2.2 %. The indicator of self-assessment of health “very good” further decreased from 3.6±1.1 % to 5.5±1.1 % ($P>0.05$). The indicators of these self-assessments were better for mixed-type NB – 28.9±2.2 % ($P<0.001$) and 10.1±1.5 % ($P<0.05$), respectively. In other words, self-assessment of health with mixed type NB is more positive than other types of NB. Therefore, this type of NB should be thoroughly evaluated in terms of the variety of food products consumed and their caloric content.

In general, the health of elderly people can be assessed as unsatisfactory according to the survey. Only with mixed-type NB, the SHI index was higher by 0.71 points compared to other types of NB, and

the other types did not exceed 0.52 points, which corresponds to a low assessment of self-health. The above is confirmed by the results of the survey assessing the quality of life of elderly people.

Quality of life is considered satisfactory with a score of 70 points or higher. Therefore, according to our calculations, the quality of life of elderly people cannot be considered satisfactory. However, if the mean indicators of quality of life for extreme, emotional and restrictive types of eating behavior were almost the same and ranged between 31.6 ± 2.0 points and 34.8 ± 2.1 points, for the mixed type of eating behavior this indicator was significantly higher. was high and averaged 43.2 ± 2.0 points ($P < 0.01$).

As evidenced by many sources, protecting the health and increasing the life expectancy of older people is directly related to the quality of medical care provided to them [2, 5].

The impact of late-life weight changes on incident dementia is unclear. Mendoza J., aimed to investigate the associations of body mass index and weight changes with dementia. With this purpose 1,673 dementia-free participants aged ≥ 60 and older were observed. The author concluded that body mass index and weight changes showed U-shaped associations with dementia risk. Excess weight gain and loss alike are associated with an almost 3-fold higher risk of dementia [8]. So, this factor undoubtedly impacts on quality of life.

Actually, the evidence regarding body weight fluctuation and dementia are limited. Lan YT, et al tested the hypothesis that weight loss and substantial weight fluctuation predict cognitive decline independent of body weight and traditional risk factors of dementia. They revealed that compared to participants with stable weight, those with weight loss had increased odds of diagnostic progression (adjusted OR=1.35, 95%CI [1.21, 1.51]). Thus, results suggested the linkage between late-life body weight instability and cognitive decline especially among those with greater age or higher cardiometabolic risk [7]. In our study we did not assess only dementia or cognitive disorders but quality of life in complex, so results need further researches.

Various diseases, especially chronic, impact not only function of organs and systems, but also on satisfaction of life [2]. Gorodnytska IM, et al examined 36 patients gastroesophageal reflux disease. It is shown that against the background of the erosive form of gastroesophageal reflux disease, daily manifestations of the symptoms of the disease lead to violations of mainly physical components of quality of life. At the same time, the esophageal symptoms of the non-erosive form of gastroesophageal reflux disease change the quality of life of patients in categories that characterize mental health. In contrast with our study the patient involved in that observation were young individuals (the median age was 30.8 ± 1.6 years) [4]. But regardless of this fact assessment by SF-36 international questionnaire (as in our work) is useful in any age group and should be considered as relevant.

Conclusion

Our results suggest that elderly people, even with many diseases, do not always follow a restrictive nutritional behavior, they often expand the range of food products and increase the amount of food consumed, that leads to overweight.

In total, the health of elderly people can be assessed as unsatisfactory according to the survey. Almost all types of ND did not exceed 0.52 points, which corresponds to a low assessment of self-health.

Thus, there is no consistent commitment to a particular food behavior among older people. As age increases and new diseases are acquired, different types of eating behavior become mixed, which led us to define the mixed eating behavior type. Health and quality of life indicators were lower for all types of NB, only in mixed NB type their indicators were more positive.

However, such nutritional behavior requires its deeper study, especially the food products studied with it and their caloric content, as well as the compatibility of the principles of "healthy nutrition" for older people.

References

1. Chamorro R, Jouffe C, Oster H, Uhlentaut NH, Meyhöfer SM. When should I eat: A circadian view on food intake and metabolic regulation. *Acta Physiol (Oxf)*. 2023 Mar;237(3):e13936. doi: 10.1111/apha.13936.
2. Croke L. Beers Criteria for Inappropriate Medication Use in Older Patients: An Update from the AGS. *Amer. Fam. Physic*. 2020; 101(1): 56-57.
3. Dellefield ME, Harrington C, Kelly A. Observing how RNs use clinical time in a nursing home: A pilot study. *GeriatrNurs* 2019; 33: 256-263.
4. Gorodnytska IM, Skrypyk IM, Maslova GS. Characteristics of disorders of the quality of life of young patients depending on the variant of the course of gastroesophageal reflux disease. *World of medicine and biology*. 2023; 1 (83): 37-42. DOI: 10.26724/2079-8334-2023-1-83-37-42.
5. Guo J, Marseglia A, Shang Y, Dove A, Grande G, Fratiglioni L, et al. Association Between Late-Life Weight Change and Dementia: A Population-based Cohort Study. *J Gerontol A Biol Sci Med Sci*. 2023 Jan 26;78(1):143-150. doi: 10.1093/gerona/glac157.
6. Guo J, Shang Y, Fratiglioni L, Johnell K, Welmer AK, Marseglia A, et al. Individual changes in anthropometric measures after age 60 years: a 15-year longitudinal population-based study. *Age Ageing*. 2021 Sep 11;50(5):1666-1674. doi: 10.1093/ageing/afab045.

7. Lan YT, Blacker D, Yuan C, Chibnik LB, Hofman A, Ma Y. Longitudinal Body Weight Change, Visit-To-Visit Body Weight Fluctuation, and Cognitive Decline Among Older Adults. *J Alzheimers Dis.* 2021;84(2):777-786. doi: 10.3233/JAD-210625.
8. Mendoza J. Food intake and addictive-like eating behaviors: Time to think about the circadian clock(s). *Neurosci Biobehav Rev.* 2019 Nov;106:122-132. doi: 10.1016/j.neubiorev.2018.07.003.
9. Talaei M, Feng L, Barrenetxea J, Yuan JM, Pan A, Koh WP. Adiposity, Weight Change, and Risk of Cognitive Impairment: The Singapore Chinese Health Study. *J Alzheimers Dis.* 2020;74(1):319-329. doi: 10.3233/JAD-191052.
10. Winkens LHH, Strion T, Barrada JR, Brouwer IA, Penninx BWJH, Visser M. The Mindful Eating Behavior Scale: Development and psychometric properties in a sample of Dutch adults aged 55 years and older. *J Acad Nutr Diet.* 2018. vol. 118(7), op. 1277-1290.
11. Yannakoulia M, Mamalaki E, Anastasiou CA, Mourtzi N, Lambrinouaki I, Scarmeas N. Eating habits and behaviors of older people: Where are we now and where should we go? *Maturitas.* 2018; 114: 14-21.

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D.P. Shaienko, Ye.V. Stetsuk, L.V. Smahliuk, V.I. Shepitko, V.I. Smahliuk
Poltava State Medical University, Poltava

**THE STRUCTURE AND POSITION OF THE ORTHODONTIC MINI-IMPLANT
 AND THEIR INFLUENCING FACTORS ON THE TRAUMA TO THE CORTICAL BONE
 PLATE DURING ORTHODONTIC LOADING**

e-mail: didental2811@gmail.com

Orthodontic implants, as the skeletal anchorage systems, are widely used by orthodontists due to their property to minimize the impact on the patient's teeth. To identify the factors influencing the contact area between the orthodontic implant and bone, as well as bone resorption around the orthodontic implant. The experimental study compared two methods of orthodontic implant placement: leaving the implant's threaded part in the cortical bone plate and inserting the implant's neck into the bone. Using the same pressure on adjacent implants, the condition of the bone surrounding them was assessed. Leaving the implant's threaded portion within the cortical bone plate increases its damage and the implant's mobility under applied load. A smooth surface with an expanded neck of orthodontic implants provides a larger and denser contact with the cortical bone plate, which distributes the orthodontic load more effectively, thereby reducing the traumatic impact on bone tissue under force application.

Key words: implants, primary stability, anchorage, mandible, orthodontic treatment, damage, tooth, bone.

Д.П. Шашенко, Є.В. Стецук, Л.В. Смаглюк, В.І. Шепітько, В.І. Смаглюк
**ФАКТОРИ ВПЛИВУ СТРУКТУРИ ТА ПОЗИЦІЇ ОРТОДОНТИЧНОГО МІНІМПЛАНТУ
 НА ТРАВМАТИЗАЦІЮ КОРТИКАЛЬНОЇ ПЛАСТИНКИ КІСТКОВОЇ ТКАНИНИ
 ПРИ ОРТОДОНТИЧНОМУ НАВАНТАЖЕННІ**

Ортодонтичні імпланти як скелетні системи анкеражу широко застосовуються ортодонтами, оскільки мінімізують вплив на зуби пацієнта. Метою дослідження було виявити фактори впливу на площу контакту ортодонтичного імплантата з кісткою та резорбцію кісткової тканини довкола ортодонтичного імплантата. В експериментальному дослідженні порівнювались два способи встановлення ортодонтичних імплантів. Залишаючи імплант різьбовою частиною в кортикальній пластинці кістки та із зануренням шийки імплантата в кістку. Використовуючи однаковий тиск на поряд встановлені імпланти порівнювався стан кістки довкола них. Залишаючи імплантат різьбовою частиною в кортикальній пластинці збільшується її пошкодження та рухомість імплантата при застосуванні навантаження. Гладка поверхня з розширеною шийкою ортодонтичних імплантів має більший та щільніший контакт з кортикальною пластинкою, що при навантаженні краще розподіляє ортодонтичне навантаження, зменшуючи травмуючий фактор на кісткову тканину під дією сил.

Ключові слова: імпланти, первинна стабільність, анкераж, нижня щелепа, ортодонтичне лікування, пошкодження, зуб, кістка.

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In 1969, Branemark and his colleagues demonstrated the successful osseointegration of titanium implants, sparking interest among orthodontists. This breakthrough laid the foundation for the development of orthodontic mini-implants, as a stable anchorage is a key factor in orthodontic practice for tooth movement [6, 8]. Currently, skeletal fixation systems have gained widespread use because they significantly reduce the undesirable effects of orthodontic appliances caused by the application of forces to the patient's teeth [4]. The effectiveness of mini-implants is estimated to range from 70 % to 87 %, depending on their characteristics [5]. A key criterion for success is their ability to remain stationary and withstand applied forces during treatment [10]. It is known that the primary stability of mini-implants is associated with their length embedded in the bone and the density of the cortical plate [7]. Unlike dental