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The need for orthopedic dental services for the elderly population of Kazakhstan

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Abstract

Objective: To determine the orthopedic dental status of the elderly population of Kazakhstan using clinical and diagnostic determinants.

Methods: The dental status of 708 patients from three institutions in Almaty, Kazakhstan, was recorded using WHO dental questionnaires. The patients were divided into groups according to their age and sex, and modern statistical methods were used to process the data. Through the construction of tables and graphs, calculation of relative values, and assessment of the reliability of the differences in the data, we determined if there were any differences between the groups.

Results: The study revealed that most patients who needed orthopedic dental care were 60 years of age and older. The older the age of patients with registered diagnoses of partial and complete adentia, the greater the need for removable prosthetics. The most common type of orthopedic treatment required for these patients was removable dentures. Analysis of the quantitative relationship between the need for orthopedic dental care and patients' gender revealed the following patterns: the critical value of Chi-square at the significance level $p \leq 0.0001$ was 23.95, the exact Fisher criterion was 0.0000 ($p=0.0000$), and the calculated Cramer's V criterion and the conjugacy coefficient showed the relationship between the variables were at the levels of 0.17 and 0.18, respectively.

Conclusions: Owing to the aging population in Kazakhstan, and indeed the world, the problem of medical adaptation and social rehabilitation of older age groups is pertinent, and our findings argue that the introduction of geriatric dental services in Kazakhstan is warranted.

Keywords: gerontology, orthopedic dentistry, elderly, geriatric.

Introduction

The world's population is steadily aging, resulting in an increase in the proportion of people over 60 years old today compared to 40 years ago [1, 2]. According to UN forecasts, by 2050, the number of elderly people will exceed 2 billion and make up more than 20% of the global population. Presently, this figure does not exceed 11%, and in 1950 it was 8% [3, 4]. Experts forecast that depopulation and population aging will continue; consequently, the ratio of age groups will change and will affect social and economic well-being. Similar demographic phenomena occur in the Republic of Kazakhstan. Unfortunately, the elderly sector of the population in the Republic of Kazakhstan does not receive the necessary attention regarding dental care [5-7]). Oral health is known to affect a person's general health, and most elderly people need extensive, multifunctional dental treatment to preserve their oral health [8-11]. Thus, the requirement for a geriatric dentistry service in the Republic of Kazakhstan is evident. Dental services like orthopedic dentistry should also include fully covered gerontology services [12].

In 1983, the International Association for Gerontology (IAG) began to apply the concept of Gerontostomatology, the science of dentistry in elderly people, which is considered a separate discipline of dentistry and not a special part of gerontology [13]. Many epidemiological surveys conducted in other countries have revealed the unsatisfactory condition of the oral cavity in older age

groups. Physiological aging processes affect the human dental system through changes in the structure of teeth and a decrease in the number of teeth [14]. Poor oral health, including edentulism, changes in the oral mucosa, and inferior removable dentures, in combination with chronic general somatic diseases, significantly reduces the body's adaptive capabilities, seriously affecting the quality of life in the elderly [15]. Furthermore, oral health is an important and integral part of systemic health and can influence systemic conditions [16]. Preserving the health of the elderly can be aided by restoring the chewing apparatus, allowing efficient chewing of food and functioning of the entire digestive system, which, in turn, prevents serious somatic diseases and diseases of the gastrointestinal tract. In this regard, the improvement of orthopedic dental care for elderly people is the most urgent task today in dentistry [17].

In the Republic of Kazakhstan, databases measuring the number of patients with socially significant diseases are being created. Analysis of this data reveals a high level of morbidity within the elderly population. High morbidity rates among the elderly population are associated with a relatively low level of accessibility to highly qualified medical care [18]. Many sociodemographic, behavioral, medical, and financial barriers related to the accessibility and utilization of dental services have been observed in the elderly populations of all countries [19]. Given the momentum and extent of the current population growth, access to dental care is essential to influence quality of life in elderly people. The introduction of gerontodentistry will provide an opportunity to extensively improve elderly health, but it will undoubtedly take a lot of time for a global transformation. This work will help to draw attention to the urgent need for gerontological services, and the need to include dental care in its services. Orthopedic dental care, in addition to the being one of the most needed services among the elderly and one of the most expensive dental services, unfortunately is not included in the services of medical insurance. The first impetus to address this issue, at the first stage, is a revision of the areas covered by medical insurance by the state to include dentistry, which would significantly improve the dental condition of the Kazakhstan population. The introduction of dental services to the list of insured medical care will facilitate the financing of the population and be fundamental in the concept of improving oral health services.

The purpose of this study was to identify problems in orthopedic dentistry among the elderly, justifying the creation of a gerontological service.

Methods

Assessment of Orthopedic Dental Status

The orthopedic dental status of 708 patients from the Center for the Provision of Special and Social Services, the WWII Veterans' Polyclinic, and the dental clinic of Asfendiyarov NMU JSC, in Almaty, Kazakhstan, between 2015 and 2021 was determined using special questionnaires recommended by WHO (2013). Patients were divided into the following age groups: 45–59 years old (9.9%), 60–74 years old (46.9%), 75–90 years old (37.4%), and over 90 years old (5.8%). Orthopedic dental status was assessed, revealing the presence of single crowns; bridges; combined, partial, or completely removable dentures; and the complete absence of dentures. The need for orthopedic dental care was determined by considering the presence of defects in the dentition, the complete absence of teeth, the presence of dentures in need of replacement, and the absence of dentures according to the following five criteria:

1. The need for prosthetics is not required i.e., the absence of defects in the dentition, and the condition of the natural teeth and existing prostheses is satisfactory. There are no indications for prosthetics.
2. The need for non-removable prostheses. Defects of the dentition of Kennedy class III (no more than three teeth), Kennedy class IV (no more than four teeth), and satisfactory condition of natural teeth. Indications for the manufacture of non-removable prostheses.
3. The need for a partial removable prosthesis. Defects of the dentition of Kennedy class I and II, extensive defects of class III (absence of more than three teeth), or class IV (absence of more than four teeth).
4. The need for combined prosthetics (partial removable and non-removable prostheses). A combination of defects of Kennedy class I, II, III, and IV. Indications for a bridge prosthesis (Kennedy class I, III, and IV) or a partial removable prosthesis (Kennedy class I and II).
5. The need for a complete removable prosthesis or a combination of a partial removable and a complete removable prosthesis. Complete absence of teeth on one jaw and a partial absence of teeth on the other jaw. Complete absence of teeth on both jaws.

Research Design

The design of the study in this paper is of a mixed type, including a cross-sectional and retrospective analysis.

Statistical Analysis

Modern statistical methods were used to process the data, including grouping by gender and age, construction of tables and graphs, calculation of relative values, and assessment of the reliability of the differences in the data.

For the conjugacy tables, the significance of the differences between the actual (revealed as a result of the study) quantitative or qualitative characteristics of the sample in each category and the theoretical amount expected in the studied groups with the validity of the null hypothesis was evaluated using the criterion Chi-square (χ^2). Then the value of the criterion χ^2 was calculated using the formula:

$$\chi^2 = \sum_{i=1}^{r}\sum_{j=1}^{c}\frac{(O_{ij}-E_{ij})^2}{E_{ij}}$$

where *i* is the row number (from 1 to r), *j* is the column number (from 1 to c), Oij is the actual number of observations in cell ij, *Eij* is the expected number of observations in cell ij.

For multi-field tables, to assess the strength of the relationship between nominal/categorical variables, it is more appropriate to apply Cramer's V criterion (Cramer's V). The values of both criteria vary from 0 to 1. This criterion can be calculated by the formula:

$$V = \sqrt{\frac{\chi^2}{n*(r-1)*(c-1)}}$$

The obtained value of Cramer's V criterion is interpreted according to the recommendations of Rea & Parker.

The conjugacy coefficient is a measure of the strength of the relationship based on the criterion χ^2. The conjugacy coefficient was calculated using the formula:

$$C = \sqrt{\frac{\chi^2}{\chi^2+n}}$$

where n is the sample size, and χ^2 is the value of the Chi-square criterion. Conjugacy coefficients range between 0 (no relationship) to values approaching 1 (strong relationship) but do not reach 1.

Statistical and mathematical data processing was carried out using the software packages SPSS version 22.0 and Statistica version 6.0 on a personal computer Aspire E 15 Intel Core i5 2.8 GHz.

Results

Older Patients Have a Greater Probability of Adentia

Comparative analysis between the patients' diagnoses and ages revealed a statistically significant relationship between the 45–59 years and the 60–74 years age groups ($p \leq 0.01$) with a calculated odds ratio (OR) of 2.60; the 45–59 years and over 90 years age groups (OR=3.61; $p \leq 0.01$); adentia and 75–90 years age group (OR = 2.15; $p \leq 0.05$); adentia and the over 90 years age group (OR=3.02; $p \leq 0.01$); crown defect and 45–59 years age group (OR=2.04; $p \leq 0.05$); breakdown of the prosthesis and the 75–90 years age group (OR=2.54; $p \leq 0.01$), and the breakdown of the prosthesis and the over 90 years age group (OR=7.44; $p \leq 0.001$). In other cases, there was a uniform percentage distribution both in terms of ages and diagnoses with ORs in the range of 0.25–1.66 ($p \geq 0.05$). Kruskal-Wallis analysis of variance in the context of age (66.77; $p \leq 0.0001$) and in the context of diagnosis (40.76; $p \leq 0.0001$) helped conclude that the older the patient (75–90 years and older than 90 years), the more pathologies were observed: combined class 30.6%–34.1%, adentia 37.0%–51.2%, crown defect 4.5%, and prosthesis breakage 2.3%–7.3%. Conversely, in younger patients (45–59 years and 60–74 years), pathology varied between the age groups (45–59 years: 17.1%–21.1%; 60–74 years: 10.0%–6.6%; 75–90 years: 12.9%–7.2%, and over 90 years: 11.4%–3.9%).

Thus, assessment of the quantitative relationship between diagnoses and patients' ages revealed that the critical value of χ^2 at the significance level $p \leq 0.0001$ was 97.60, the Spearman correlation coefficient was 0.22 (p=0.0001), and the calculated Cramer's V criterion and the conjugacy coefficient showed an average relationship between the studied variables at the levels of 0.21 and 0.35, respectively. Based on the data, the older the age, the greater the probability of adentia.

Older Patients Have a Greater Need for Orthopedic Dental Care

Comparative analysis of the need for orthopedic dental care and patients' age found a statistically significant relationship between no need and age 60–74 years ($p \leq 0.05$) with a calculated OR of 3.02 and between a need and age over 90 years ($p \leq 0.05$; OR = 3.16) (Table 1 and Figures 1 and 2). In other cases, there was a uniform percentage distribution both in terms of age and the need for orthopedic dental care with calculated ORs in the range 0.30–1.78 ($p \geq 0.05$). Kruskal-Wallis analysis of variance in the context of age (29.57; $p \leq 0.0001$) and in the context of the need for orthopedic dental care (8.47; $p \leq 0.03$) helped conclude that older patients (75–90 years and older than 90 years), had a greater need for orthopedic dental care (35.8%–53.7%), whereas, for younger patients (45–59 years and 60–74 years), the need was not registered, meaning dental care, but not orthopedic dental care, was required (72.9%–68.1%).

Thus, when assessing the quantitative relationship between the need for orthopedic dental care with patients' age, the following patterns were revealed: the critical value of $\chi 2$ at the significance level $p \leq 0.0001$ was 39.92, the Spearman correlation coefficient was -0.09 ($p \leq 0.003$), and the calculated Cramer's V criterion and the conjugacy coefficient showed a weak and average relationship between the studied variables at the levels of 0.16 and 0.23, respectively.

Table 1 Quantitative relationship between the need for orthopedic dental care and patients' age

Indicators			Age				Total
			45–59 years old	60–74 years old	75–90 years old	Over 90 years old	
Need for orthopedic dental care	Not registered	Absolute number	4	37	10	1	52
		Total %	0.6%	5.2%	1.4%	0.1%	7.3%
	No	Absolute number	15	69	95	22	201
		Total %	2.1%	9.7%	13.4%	3.1%	28.4%
	Yes	Absolute number	51	226	160	18	455
		Total %	7.2%	31.9%	22.6%	2.5%	64.3%
Total		Absolute number	70	332	265	41	708
		Total %	9.9%	46.9%	37.4%	5.8%	100.0%

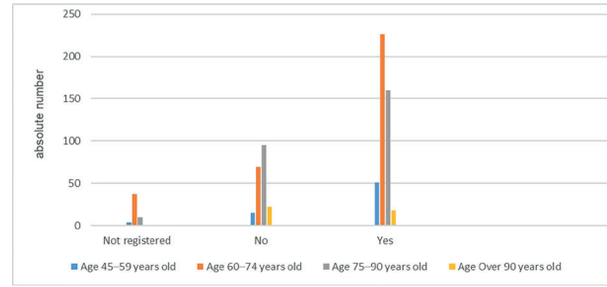

Figure 1 - Quantitative relationship between the need for orthopedic dental care and patients' age

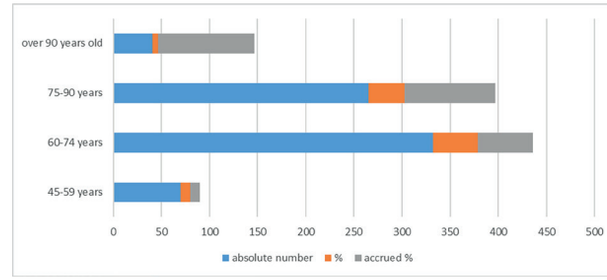

Figure 2 - Graph showing the total number of patients in each age group requiring orthopedic dental care

The Need for Orthopedic Dental Care Does Not Depend on Gender

Comparison of the need for orthopedic dental care with patients' gender showed a statistically significant difference ($p \leq 0.0001$) between "no need" and "need" (19.2% vs. 49.8% in men and 80.8% vs. 50.2% in women) with a calculated relative risk of 4.15 (Table 2 and Figure 3).

Thus, when assessing the quantitative relationship between the need for orthopedic dental care with patients' gender, the following patterns were revealed: the critical value of $\chi 2$ at the significance level $p \leq 0.0001$ was 23.95, the exact Fisher criterion was 0.0000 (p=0.0000), and the calculated Cramer's V criterion and the conjugacy coefficient showed a weak relationship with variables of 0.17 and 0.18, respectively.

Table 2 Quantitative relationship between the need for orthopedic dental care and patients' gender

Indicators			Gender		Total
			Male	Female	
Need for orthopedic dental care	Not registered	Absolute number	10	42	52
		% by line	19.2%*	80.8%*	100.0%
		% by column	2.8%	12.1%	7.3%
		Total %	1.4%	5.9%	7.3%
	No	Absolute number	100	101	201
		% by line	49.8%*	50.2%*	100.0%
		% by column	27.8%	29.0%	28.4%
		Total %	14.1%	14.3%	28.4%
	Yes	Absolute number	250	205	455
		% by line	54.9%	45.1%	100.0%
		% by column	69.4%	58.9%	64.3%
		Total %	35.3%	29.0%	64.3%
Total		Absolute number	360	348	708
		% by line	50.8%	49.2%	100.0%
		% by column	100.0%	100.0%	100.0%
		Total %	50.8%	49.2%	100.0%

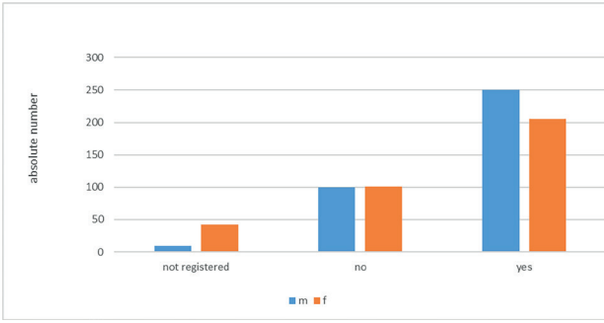

Figure 3 - Quantitative relationship between the need for orthopedic dental care and patients' gender

Discussion

Aging is, unfortunately, an irreversible, continuous and universal process that concerns all living beings, and which leads to a gradual decline in all functions. Comfortable aging depends on various factors including physiological, psychological and economic factors. According to activity theory, socially active individuals have high life satisfaction and positive attitudes towards old age. Attitudes toward old age in one study suggests that perceptions of social exhaustion play an important role in reinforcing negative attitudes toward old age [20].

Our study of 708 patients from Almaty, Kazakhstan, showed that older patients (75–90 years and older than 90 years) had more pathologies upon diagnosis, whereas younger patients (45–59 years and 60–74 years), had pathologies varying within the age groups. In summary, older patients had more missing teeth or even a complete absence of teeth.

We found no significant relationship between diagnosis and gender in line with the literature. Oral disease arises from problems related to oral hygiene, malnutrition, vitamin deficiencies, malocclusion, and other causes that do not depend on gender.

Assessment of the quantitative relationships between the age and gender of patients and their leading clinical diagnostic and therapeutic indicators revealed weak- and medium-level relationships that were statistically reliable. Patients' diagnoses and treatment can be managed through the development of scientific and practical recommendations that will improve medical knowledge.

At the same time, it is necessary to take into account the attitude of elderly people toward the condition of their teeth and oral cavity, their care, their possible reduced interest in life, their attitude to dental care, and their fear of paying for the treatment provided [21].

According to the results of the study in Iran, 32% of the participants corresponded to retirees with low income and socioeconomic status, which could limit the maintenance and fulfillment of their basic needs such as food, health, and shelter. A valuable point in this study is the fact that this population lived in their own homes, which leads not only to less economic expenditure but also to emotional stability at this stage. Galvezet al. [22] among the elderly in Chiclayo [23] found that most of them did not work because they were retired and also belonged to one of the social groups with the lowest socioeconomic income. In this sense, according to some authors, the difference between a healthy old age and a sick elderly person is the amount of money available, so the acquisition of economic resources that can provide decent care in old age should be considered at the young adult stage. that lead to a good quality of life [24, 25].

If we consider the average monthly pension of those living in the "Center for the Provision of Special and Social Services" in Almaty is approximately 70,000–80,000 tenge, and this dental treatment is not included in the scope of guaranteed free provision, it is clear that there is an acute need for orthopedic care. This issue needs government support since the ability to chew is fundamental to a person's quality of life, allowing a full diet, aesthetic appearance, and the capability to communicate normally and lead an active lifestyle [10, 11]. UN experts classify Kazakhstan as a country with accelerated aging rates, and according to their forecasts, 25% of the country will be elderly by 2050.

Therefore, orthopedic dental care should be an essential service. In view of the above, balancing the population requires the adoption of appropriate population policies and decades of planning and implementation in structural, substantive and functional areas in an integrated manner and in different dimensions. For example, forecasting sufficient budgets while a significant portion of the population is shifting from productive to consumptive. Part of this budget is needed for adaptive spaces and services in various areas for older people and caregivers (who devote some of their time and attention to these people).

Conclusions

The novelty of this work lies not only in the identification of an urgent problem that has not been studied in Kazakhstan before, but also in the fact that rational solutions are proposed. Due to the fact that this topic has not previously been raised in our country, to begin with, we had to identify this problem among the elderly, taking as a basis only one city of Almaty and its several sites. A key strategy to solve this issue is the creation of gerontological care programs involving dental care, and peculiarity orthopedic care. We understand that this may require a lot of financial and time resources. The most important starting point is to change the concept of medical insurance, namely the involvement of the dental services. In the Republic of Kazakhstan, there are no official data on the accessibility of medical organizations, including dental services, for elderly people with high levels of morbidity and disability. This study revealed an urgent need to improve gerontostomatology services in the Republic of Kazakhstan.

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