ORAL HEALTH ASSESSMENT OF ELDERLY PEOPLE LIVING IN THE
ARKHANGELSK REGION, RUSSIA

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Master’s Thesis

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Master’s Degree Program in Health and Wellbeing in the Circumpolar Area
Institute of Health Sciences
University of Oulu
2016
This thesis analyses the oral health of elderly people living in Arkhangelsk, Russia. Complex oral health assessment includes objective, standardized dental tests and indices recommended by WHO. The aim of the study was to determine the alterations in dental, periodontal, salivary, glossal and immune status of oral health in elderly persons, the influence of possible unhealthy habits on the health of oral cavity and to compare these indicators with literary sources. The research focuses on elderly people older than 60 years old, who reside in a home for the elderly in Arkhangels.

Modern world social and health tendencies dictate the necessity of ongoing research of the aging population problem. Aging is a natural phenomenon and an inevitable process but when the number of old-aged people exceeds the number of working-age population it causes serious modifications in health care, economics, social support and so forth. The socio-demographic situation in the Arkhangelsk region is characterized by a considerable increase in the number of retirement age people who suffer from severe somatic disorders. Organs and tissues of the mouth do not represent an exception, so the elderly experience serious problems with their oral health as well.
The hypothesis of the study has proved to be mostly true: our conclusion is that the young-old and the old demonstrate poor oral health. We have observed 100% prevalence of caries and decayed, missed, filled teeth index (DMFT) = 24,5 with predominance of missing teeth; the level of hygiene equals to 3,4; poor condition of dentures; high prevalence of periodontal diseases and oral mucosa lesions; low salivary flow rate (0,08 ml/min) and pH (6,0), high saliva viscosity and deterioration of the oral immunity indicators such as interleukin-8 (IL-8), immunoglobulin G (IgG), tumor necrosis factor alpha (TNF-α), secretory immunoglobulin A (SIgA) and cortisol.

This study may be used to formulate recommendations for the elderly, social workers and health management bodies to improve the oral wellbeing of this group of people. The data received during this study can be also be of use for other countries of the Barents region in two similar respects: dental features of the aging population and the influence of living conditions in the North on oral health.

Keywords: population aging, oral health care, the elderly, the young-old, the old people, dental, periodontal, salivary, glossal and immune status.
ABBREVIATIONS

CI – Confidence Interval
CI-S – Calculus Index Simplified
CPI – Community Periodontal Index
DAS – Dental Anxiety Scale
DI-S – Debris Index Simplified
DMFT – Decayed, Missed, Filled Teeth
DoH – Declaration of Helsinki
ELISA – Enzyme Linked Immunosorbent Assay
FDI – Federation Dentaire Internationale
FU – Functional Units
GOHAI – Geriatric Oral Health Assessment Index
IADR – International Association for Dental Research
IgG – Immunoglobulin G
IL-8 – Interleukin-8
LCDC – Lifestyle Change plus Dental Care
LNU – Level of Living Survey
MCS – Microcrystallization of Saliva
Md, Q2 – median
MPS – Microcrystallization Potential of Saliva
NSMU – Northern State Medical University
OHIP-14 – Oral Health Impact Profile
OHI-S – Oral Hygiene Index Simplified
OHRQoL – Oral Health Related Quality of Life
OIDP – Oral Impacts on Daily Performance inventory
PMA – Papilla, Marginal, Alveolar gingiva
POPs – Posterior Occluding Pairs
Q1 – First Quartile
Q3 – Third Quartile
r – Correlation Coefficient
SD – Sample Standard Deviation
SIgA – Secretory Immunoglobulin A
SST – Salivary Surface Tension
SWEOLD – SWEdish Panel Study of Living Conditions of the Oldest OLD
TNF- α – Tumor Necrosis Factor alpha
\( \bar{x} \) – Arithmetic Mean or Average
WHO – World Health Organisation
WHOQOL-Old – World Health Organization Quality of Life-Old
WMA – World Medical Association
WST – Water Surface Tension
FIGURES

Figure 1. CPI index teeth ................................................................. 33
Figure 2. Types of saliva’s microcrystallization (Belskaya 2011) ...................... 36
Figure 3. Saliva microcrystallization, type c ........................................... 41
Figure 4. Saliva microcrystallization, type d ........................................... 42
Figure 5. Saliva microcrystallization, type e ........................................... 42

TABLES

Table 1. Distribution of the population of older age groups in Arkhangelsk region (Arkhangelskstat 2016) ................................................................. 10
Table 2. Oral conditions observed in elderly patients (El Osta et al. 2012, Porter et al. 2015) ................. 11
Table 3. Contamination degree of natural teeth and dentures .......................... 12
Table 4. Mean DMFT, DT, MT, FT and remaining teeth in the studies of the different countries ...... 12
Table 5. Association of periodontal diseases with somatic pathology and conditions .......................... 16
Table 6. Programs in dental health .......................................................... 22
Table 7. Violations in the oral cavity due to senescence .................................. 27
Table 8. Parameters of local immunity ....................................................... 43
Table 9. Correlation between oral indices and markers ................................... 44
Table 10. Necessity of orthopedic treatment ............................................... 48
Table 11. Distribution of partial edentia in elderly groups ............................... 48
Table 12. Distribution of oral hygiene levels among the elderly ........................ 49
Table 13. Distribution of CPI codes ......................................................... 50
Table 14. Severity of hyposalivation among the elderly ................................... 52
Table 15. Levels of immunity markers in saliva ........................................... 53
1. INTRODUCTION

Current health tendencies largely define the directions of health research. One of the most evident and urgent issues is the problem of population aging. As stated by World Health Organization (WHO), the world’s population of those aged 60 years and older is expected to increase from 605 million to 2 billion by 2050, i.e. will nearly double from 12% to 22% (WHO 2015). Currently both in the developed and developing countries the reduction of birth and mortalities rates and growth in life expectancy are changing the demographic profile of the countries’ population (Matsuka et al. 2012, Rodrigues et al. 2012b, Yao & MacEntee 2014a, Martins et al. 2014). Due to advances in technology and medicine the proportion of older people will continue to rise worldwide (Srivastava et al. 2012).

The problem of population aging can be approached to from different aspects. It can be a sign of advancement of social and health care and also represent public health challenge (Ayernor 2012). On the one hand, the elderly people often play an active role in the community, labor market and contribute to child upbringing, provide a precious reservoir of wisdom and thus play a major role in shaping of the wellbeing of future generations (Kumar et al. 2015). On the other hand, when the number of old-aged people exceeds that of working-age population it needs major readjustment in social and health services, economic development with the aim to preserve health and wellbeing of the elderly (Andrade et al. 2012, Eustaquio-Raga, Montiel-Company & Almerich-Silla 2013, Liu et al. 2013).

At present oral diseases are among the most widespread diseases all over the world. Though oral pathology does not represent a major mortality threat, it certainly influences the general health of people and makes a significant impact on quality of life (Srivastava et al. 2012, Arcury et al. 2013, Gil-Montoya et al. 2015). Geriatric patients require more complex measures of prevention, intervention and oral health reabilitation. They experience dramatic physiological, psychological and functional changes by the end of life, which may limit the capacity to perform proper oral hygiene techniques, while substantially increasing
the risk of dental caries, gingival infections and periodontal disease (Velasco-Ortega et al. 2013, Chen et al. 2013b, Cornejo et al. 2013, Gulcan et al. 2014). The oral diseases can cause or worsen major systemic conditions, such as heart disease, stroke, pneumonia, diabetes and infective endocarditis. The advanced age combined with a history of smoking and/or drinking can also put this group at increased risk of developing oral cancers. (Levy, Goldblatt & Reisine 2013.)

Back in 1982 WHO established the goal to keep functional and aesthetic dentition with at least 20 natural teeth to 50% of individuals aged between 65 and 74 years by the year 2000 (Ribeiro et al. 2011) and the preference for keeping natural teeth even among older people exists in some areas (Muirhead, Marcenes & Wright 2014). However, billion of dollars have been spent on dental care for diseases which can generally be prevented with adequate oral hygiene. The wide spread myth that oral diseases and edentulousness are typical of the aging and culturally and so the image of toothless old people persists across cultures. (Wiener et al. 2012, Cornejo et al. 2013.)

The socio-demographic situation in the Arkhangelsk region is characterized by a persistent population decline, increase in the number of people of retirement age, increase in the number of citizens registered as disabled and growth in the number of people with mental disorders. Thus, starting from 2006 the total number of people in the age groups 60-64, 65-69, 70 and over has steadily grown (see Table 1). Based on the age structure forecast in 2018 there will be a 10,6% fall of the working population and 8,5% increase in the amount of elderly people in the proportion. The rise in the number of elderly residents determines a significant growth in demand for social services and health care, including dental aid. (Arkhangelskstat 2016.)

Social service provided by 20 state financed hospitals and homes for the elderly with branches all over the Arkhangelsk region have a capacity of 2696 beds, including 9 neuropsychiatric and 6 gerontopsychiatric boarding homes. Inpatient social services also support 12 temporary accommodation outlets for senior citizens and disabled cared after by state social institutions with a total bed capacity of 370 beds. (Ministry of Labor,
employment and social development of the Arkhangelsk region 2014.) Also in Arkhangelsk there is a shelter for homeless with 30 beds. During 2013 the growth of foster families for the elderly and disabled has been actively encouraged in Arkhangelsk region as one of inpatient replacement methods.

Table 1. Distribution of the population of older age groups in Arkhangelsk region (Arkhangelskstat 2016).

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>60-64</td>
<td>37888</td>
<td>37247</td>
<td>42859</td>
<td>50180</td>
<td>61329</td>
<td>69537</td>
<td>73611</td>
<td>77174</td>
<td>81006</td>
<td>82606</td>
<td>85038</td>
<td></td>
</tr>
<tr>
<td>65-69</td>
<td>60962</td>
<td>61802</td>
<td>54463</td>
<td>45420</td>
<td>36991</td>
<td>32306</td>
<td>31929</td>
<td>36785</td>
<td>43121</td>
<td>52868</td>
<td>59935</td>
<td></td>
</tr>
<tr>
<td>70 and over</td>
<td>100557</td>
<td>101189</td>
<td>104733</td>
<td>107307</td>
<td>110450</td>
<td>111665</td>
<td>113421</td>
<td>110431</td>
<td>105442</td>
<td>101799</td>
<td>99282</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>199407</td>
<td>200238</td>
<td>202055</td>
<td>202907</td>
<td>208770</td>
<td>213508</td>
<td>218961</td>
<td>214390</td>
<td>229569</td>
<td>237273</td>
<td>244255</td>
<td></td>
</tr>
</tbody>
</table>

In September 2016 the “Care” home for the elderly was opened with the capacity of 200 beds. Opening of the home for the elderly is a successful example of state-private funded partnership. The building was renewed and equipped by private investors, with some of the maintenance costs paid by the pension funds and some covered by the regional budget. (Government of Arkhangelsk region 2016.)

Concerning dental care there are no special surgeries for the elderly people while there is a shortage of specialized dental programs for them with the notable exception of the program which provides free dentures for the Second World War veterans. Dental aid is generally provided on the same basis as for the rest of the population. It is highly advisable to conduct a comprehensive research with the aim of accessing the dental health of the elderly in the Arkhangelsk region. Furthermore, it is important to promote disease prevention when formulating dental health programs for older adults. It is likely that there will be greater demand for the treatment aimed at preserving the teeth. The effectiveness of preventive strategies will require further research and further economic analysis of tooth replacement programs. (Gerritsen et al. 2010.)
2. LITERATURE REVIEW

2.1. Oral diseases

The elderly demonstrate in general poor oral health which should be the object of concern for doctors, scientists and officials. The most evident mouth disorders of the elderly are presented in Table 2.

Table 2. Oral conditions observed in elderly patients (El Osta et al. 2012, Porter et al. 2015).

<table>
<thead>
<tr>
<th>Organs and tissues of oral cavity</th>
<th>Disease/problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teeth</td>
<td>Caries</td>
</tr>
<tr>
<td></td>
<td>Sensitive teeth</td>
</tr>
<tr>
<td></td>
<td>Low hygiene</td>
</tr>
<tr>
<td></td>
<td>Tooth loss</td>
</tr>
<tr>
<td>Periodontium</td>
<td>Low hygiene</td>
</tr>
<tr>
<td></td>
<td>Gingivitis</td>
</tr>
<tr>
<td></td>
<td>Periodontitis</td>
</tr>
<tr>
<td></td>
<td>Tooth loss</td>
</tr>
<tr>
<td>Salivary glands</td>
<td>Hyposalivation</td>
</tr>
<tr>
<td></td>
<td>Xerostomia</td>
</tr>
<tr>
<td>Oral mucosa</td>
<td>Candidiasis</td>
</tr>
<tr>
<td></td>
<td>Cancer</td>
</tr>
<tr>
<td>Temporo-mandibular joint</td>
<td>Chronical pain</td>
</tr>
<tr>
<td>Alveolar bone</td>
<td>Loose or ill-fitting dentures</td>
</tr>
</tbody>
</table>

Oral hygiene is often perceived as an unimportant procedure and the situation is made worse by the inability of the elderly to perform tooth brushing adequately. In one of the studies only 28,8% of 61–70 years old subjects used both tooth brush and tooth paste/tooth powder while 11,8% of them used sea weeds for cleaning their teeth (Aapaliya et al. 2015). In the research of tooth and dentures hygiene unsatisfactory hygienic conditions of oral cavity and prostheses have been observed (see Table 3) (Ushnitsky et al. 2013b). In turn, the oral care level and destructive oral biofilms are significantly associated with caries, periodontitis and tooth loss (Wiener et al. 2012, Chen et al. 2013b).
Table 3. Contamination degree of natural teeth and dentures.

<table>
<thead>
<tr>
<th></th>
<th>None</th>
<th>Low</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Young-old</td>
<td>4,88±0,48%</td>
<td>22,91±0,39%</td>
<td>42,31±0,29%</td>
<td>29,90±0,35%</td>
</tr>
<tr>
<td>Old</td>
<td>0%</td>
<td>12,42±1,33%</td>
<td>67,97±0,49%</td>
<td>19,61±1,22%</td>
</tr>
</tbody>
</table>

As a rule, dental caries is widely spread among senior citizens. DMFT index (DT-decayed, MT-missing and FT-filled teeth) is a conventional index used by dentists to evaluate caries intensity. According to the literary sources the meaning of DMFT can fluctuate noticeably, with a greater number of teeth in DMFT structure presented by extracted teeth while the amount of remaining teeth is deficient (Table 4).

Table 4. Mean DMFT, DT, MT, FT and remaining teeth in the studies of the different countries.

<table>
<thead>
<tr>
<th>Study</th>
<th>Country</th>
<th>DMFT</th>
<th>DT</th>
<th>MT</th>
<th>FT</th>
<th>Remaining teeth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ribeiro et al. 2011</td>
<td>Brazil</td>
<td>5,49</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rodrigues et al. 2012a</td>
<td>Brazil</td>
<td>20,19±7,97</td>
<td>0,53±1,50</td>
<td>19,65±8,75</td>
<td>0,92±1,95</td>
<td>8,00±8,63</td>
</tr>
<tr>
<td>Cornejo et al. 2013</td>
<td>Spain</td>
<td>22,8</td>
<td>2,1</td>
<td>20,5</td>
<td>0,2</td>
<td>10,2</td>
</tr>
<tr>
<td>Gaszynska et al. 2014</td>
<td>Poland</td>
<td>27,6±5,2</td>
<td></td>
<td></td>
<td></td>
<td>5,6±7,3</td>
</tr>
<tr>
<td>Castrejon-Perez et al. 2012</td>
<td>Mexico</td>
<td>11,8±9,2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liu et al. 2013</td>
<td>China</td>
<td>13,9±9,64</td>
<td>2,396±3,29</td>
<td>11,226±9,63</td>
<td>0,296±0,88</td>
<td></td>
</tr>
<tr>
<td>Aapaliya et al. 2015</td>
<td>India</td>
<td>2,08±1,14</td>
<td>1,19±0,93</td>
<td>3,83±1,26</td>
<td>0,13±0,39</td>
<td></td>
</tr>
<tr>
<td>Henriksen, Axell &amp; Laake 2003</td>
<td>Norway</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>17</td>
</tr>
<tr>
<td>Tegza et al. 2013</td>
<td>Russia; all</td>
<td>22,75</td>
<td>1,72</td>
<td>18,26</td>
<td>2,77</td>
<td></td>
</tr>
<tr>
<td>Mkhitaryan et al. 2015</td>
<td>Russia,</td>
<td>21,3</td>
<td>10,6%</td>
<td>62,4%</td>
<td>27,0%</td>
<td></td>
</tr>
<tr>
<td>Yushmanova et al. 2007</td>
<td>Russia; Arkhangal region</td>
<td>28,83</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

DMFT, DT, MT, FT and remaining teeth readings are expressed by x±SD or %

More than a half of the elderly have periodontal (gum) disease caused by the accumulation of a specific bacterial biofilm around the teeth (Muirhead, Marcenes & Wright 2014, Hu et
Periodontal status is usually assessed using various periodontal indices which mostly take into account the presence of bleeding, dental calculus and loss of periodontal attachment. For instance, 97.4% of women need periodontal treatment in Spain and 90-100% of elderly people of both sexes in Russia (Yushmanova et al. 2007, Cornejo et al. 2013, Mkhitaryan et al. 2015). Although most seniors claim using brush and floss as regularly as younger people, several factors contribute to an increased risk of poor oral health in this age group, such as hypofunction of the salivary glands and difficulty brushing and flossing with a reduced immunity against infection (Kelsall & O'Keefe 2014).


According to a report of Andrade et al. (2012) 97.7% of the elderly need oral prosthesis. In the opinion of El Osta et al. (2012) the sufficient number of dental functional units (FU - the number of tooth pairs participating in mastication) is more than 4 and it is a better indicator of masticatory function than the number of teeth present. People who have fewer than four FUs report difficulties in chewing or swallowing and they tend to avoid hard foods, including meat, vegetables and bread. They can consequently be at risk of malnutrition, which may affect their general health and reduce their life expectancy. (El Osta et al. 2012.) Ribeiro and colleagues (2011) suggest that three to five occlusal units or functional posterior occluding pairs (POPs) provide sufficient occlusal stability for a prolonged period of time. In this connection the preservation of natural teeth is very
important not only for normal mastication and nutrition but also for general health and quality of life. Otherwise, dental prosthetics is a way to keep oral health in the situation when natural teeth have already been lost. In the case of the elderly it is found that they often do without oral prosthesis, since they believe that the teeth are not the first priority, prophylaxis will not work well and losing teeth is regarded as normal (Martins et al. 2014). Consequently, when scientists try to estimate percentage of elderly people who wear complete or partial denture they often obtain greatly very low percentage (Ushnitskyi et al. 2013b, Kumar et al. 2015, Hiltunen, Vehkalahti & Mantyla 2015).

Non-caries cervical lesions are serious dental problem as well and nowadays more and more attention is paid to it. Erosion is associated with chemical or electrochemical effect of “extrinsic” (acidic food, drink, occupational-related erosion) and “intrinsic” (eating disorders and gastroesophageal reflux disease, vomiting and regurgitation) factors. In turn, abrasion, attrition, abfraction and wedge-shaped cervical lesions are often connected with mechanical processes: bruxism, chewing on one side, biting hard objects, overzealous tooth brushing and excessive occlusal loading. (Oginni & Adeleke 2014.) In the literature review Johansson et al. (2012) demonstrated that dental erosion is spread throughout the world with different frequency: United Kingdom 2-77%, Sweden 12-22%, Iceland 1-6%, Saudi Arabia 26-34% and so on. According to Lai and colleagues (2015), who examined a particular territory – Guangzhou, Southern China, the prevalence of non-caries lesions (V-shaped, wedge-shaped, or disk-shaped lesions and occlusal attrition) was 81.3%, with a mean of 4.4 teeth affected amongst 65- to 74-year-olds. About a half of the elderly subjects have at least one tooth with lesion that needed restoration. (Lai et al. 2015.) At present it should be taking into account these types of hard tissue lesions not only because of its increasing prevalence but also because there is some data about unsatisfactory longevity of resin-based composite restorations (Oginni & Adeleke 2014). Considering the fact that elderly prefer tooth extraction as the easier way of treatment than restoration they tend not to seek restorative dental aid in case of therapeutic treatment failure.

According to a recent report, the prevalence of subjective dry mouth and reduced stimulated salivary flow rate is significantly higher in older individuals than in younger
Dry mouth is the most prominent oral health problem among seriously ill patients and affects more than 90% of hospice cancer patients. This condition arises in the advanced age not only due to somatic pathology but also because of a large number of medications taken (non-selective β-adrenoceptor blockers, selective β(1)-adrenoceptor blockers, antipsychotics, antidepressants, anxiolytics, anticholinergic medications, drug for the treatment of osteoporosis, diuretics, sedatives/hypnotics, anti-inflammatory drugs/analgesics) (Ohara et al. 2013, Johanson et al. 2015). Reduction in salivary flow may be a fundamental factor of oral diseases such as dental caries and mucosal lesions. Moreover, hyposalivation is associated with dysphagia, halitosis and affects social activities. (Takeuchi et al. 2015, Chen & Kistler 2015.) However, in study of Cunha-Cruz et al. (2013) the statistically significant association between dental caries and salivary flow has not been found.

Another problem is deterioration of taste perception and ability to identify and discriminate basic taste qualities which may deprive people of the pleasures of eating is the cause of poor appetite, weight loss and malnutrition. Taste loss associated with poor oral health could be due to toxins and inflammatory products produced by the oral bacteria (caries, gum diseases, poor oral hygiene, tongue coating and atrophic tongue). (Solemdal et al. 2012.)

The most three common clinical pathologies of the oral mucosa lesions are leukoplakia and leukokeratosis that were found in 10,5% of examined people, candidiasis 5,82% and lichen planus 2,2% (Konopka et al. 2015).

2.2. Comorbidity

Elderly people suffer from different diseases connected with oral health. Dental infections or loss of teeth can exacerbate chronic diseases such as diabetes, asthma, arthritis, kidney, cardiovascular (angina pectoris, stroke, hypertension), pulmonary, Alzheimer’s disease and obesity (Metcalf, Northridge & Lamster 2011, Ribeiro et al. 2012, Saengtipbovorn & Taneepanichskul 2014, Kelsall & O'Keefe 2014).
Poor oral health may also cause inadequate consumption of fruit and vegetables, functional
disability, lower scores on cognitive testing, poorer self-rated level of general health, social
cohesion, self-esteem and quality of life that can significantly undermine a person’s ability
Mansfield 2015).

Periodontal diseases are among the most prevalent dental diseases. They include dental
calculus, gum inflammation and bleeding, loss of periodontal attachment (shallow and deep
periodontal pockets), tooth mobility and tooth loss. In Table 5 somatic pathology and
adverse conditions connected with periodontal diseases are presented.

<table>
<thead>
<tr>
<th>Study</th>
<th>Factors associated with periodontal diseases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zhang et al. 2014</td>
<td>Periodontitis and diabetes, hypertension, rheumatoid arthritis, cardiovascular diseases, depression, anxiety,</td>
</tr>
<tr>
<td></td>
<td>obesity, malnutrition, smoking, alcohol consumption, socioeconomic status, stress, adverse pregnancy outcomes</td>
</tr>
<tr>
<td>Northridge et al. 2015</td>
<td>Diabetes, cardiovascular diseases</td>
</tr>
<tr>
<td>Ansai et al. 2013</td>
<td>Tooth loss and increased risk of all-cause and cancer mortality, but not of cardiovascular disease</td>
</tr>
<tr>
<td></td>
<td>Tooth loss and orodigestive cancer</td>
</tr>
<tr>
<td>Eustaquio-Raga, Montiel-</td>
<td>Deficient masticatory function and malnutrition</td>
</tr>
<tr>
<td>Company &amp; Almerich-Silla 2013</td>
<td>Psychosocial and emotional problems</td>
</tr>
<tr>
<td>Siukosaari et al. 2012</td>
<td>Periodontitis and cardiovascular mortality risk</td>
</tr>
<tr>
<td></td>
<td>Periodontitis and cerebral ischaemia</td>
</tr>
<tr>
<td>Hu et al. 2015</td>
<td>Tooth loss and all cause mortality include causes such as cardiovascular disease, stroke and dementia</td>
</tr>
</tbody>
</table>

Again, poor oral health can be caused by various diseases or conditions. Hereby
hypofunction of the salivary glands and its consequence – xerostomia – may be an outcome
of diabetes and the adverse effects of medications or cancer radio-therapy (Chen et al.
2013a, Yao & MacEntee 2013). Mental illness, including schizophrenia, depression,
bipolar disorder and dementia are characterized by inadequate plaque control,
magnification of hyposalivation and dry mouth, impaired ability to provide hygiene
resulting in high caries experience and tooth loss (Velasco-Ortega et al. 2013, Luo et al.
2015, Hu et al. 2015).
The following socio-economic factors such as place of residence (urban or rural areas), institutionalization, education level, availability of dental insurance, occupation, economic status and others affect dental health. Poor oral health and poor oral health habits are likely to be observed among people working in sales/service, skilled/labor, agriculture/forestry/fishery or others or those with no occupation than those whose longest jobs were professional/technical. There are a number of reasons which can explain this tendency. Firstly, professional workers have more possibility to manage their schedule and get dental aid. Secondly, occupation type is also related to living place where density of dentists can vary. Agriculture/forestry/fishery workers are more likely to live in rural areas and professional/technical workers live in urban areas. The third reason is that the type of work is linked to dental health awareness. Agriculture/forestry/fishery workers and people without an occupation pay less attention to their appearance and speech which is usually associated with the state of their teeth. The fourth point is that large companies which employ professional/technical workers have their own oral health program while small companies mostly have not. Therefore, agriculture/forestry/fishery workers have little possibility to gain dental aid and information about dental health. (Yamamoto et al. 2014.)

2.3. Quality of life

The impacts of poor oral health on the quality of life of the elderly is not always recognized by dental professionals although good oral health is an integral part of general wellbeing and a contributory factor to oral health related quality of life (OHRQoL) (Yao & MacEntee 2013, Huang, Chan & Young 2013, Gaszynska et al. 2014, Yao & MacEntee 2014a). Attention of the entire health care team should be addressed to the maintenance of elderly individuals’ oral health that will allow them to speak, chew, recognize flavors, live without pain or discomfort and communicate with others with no lost to their self-esteem (Rodrigues et al. 2012b).

The concurrence of various oral health problems can have a negative effect on one’s OHRQoL and cause poor self assessed oral appearance (Vilela et al. 2013, Chen et al. 2013). Key factors of that are the advancing age, living in rural areas, lower levels of education and health awareness (Kotzer et al. 2012), trust and confidence in their dentist
There is significant evidence that those with low self-rated oral health have the smallest primary social networks and the largest need of activities intended to improve the quality of life of the elderly (Arcury et al. 2013, Leon et al. 2014). There are two plausible relationship mechanisms between social participation and dental health with social network functioning as a main effect and stress buffering (Takeuchi et al. 2013). Poor oral health can result in social stigma, with poor dental appearance resulting in low self-esteem, less social interaction, lower employability, lower life satisfaction and greater mobility limitations (Andrade et al. 2012).

To evaluate OHRQoL some instruments have been developed. Among available OHRQoL instruments the Geriatric Oral Health Assessment Index (GOHAI) and the Oral Health Impact Profile (OHIP-14), self-reported instruments designed to assess oral health problems in older adults are regarded as the most comprehensive assessments. (El Osta et al. 2012, Rodakowska et al. 2014, Leon et al. 2014.) Dental anxiety could be measured using the four-item Dental Anxiety Scale (DAS) (Bell et al. 2012). The Oral Impacts on Daily Performance inventory (OIDP) is one of the many self-reported inventories to assess OHRQoL in terms of adverse impacts that oral conditions can have on everyday life experiences (Gulcan et al. 2014). In 1999 the WHO drafted the World Health Organization Quality of Life-Old (WHOQOL-Old) project specifically to measure quality of life in the elderly population. The aim of the project of Rodrigues et al. (2012b) was to draft and test a generic quality of life measure for international/cross-cultural use. This tool allows to assess the impact of social and healthcare services on the quality of life of elderly individuals as well as to better identify the areas of investment for achieving better gains in the quality of life. (Rodrigues et al. 2012b.)

2.4. Accessibility of dental aid

A series of studies claim there are some fundamental barriers to deliver dental aid for the elderly especially for those living in rural areas and those belonging to ethnic groups (Wu et al. 2011, Yao & MacEntee 2014a).
The first and the most solid is a financial barrier. Due to the prevalent attitudes towards dental procedures as unimportant and unnecessary dentistry has been largely excluded from health care because of budgetary constraints. For example, in Spain public health service confines itself exclusively to diagnosis and pain-relief medicines or tooth extraction. Any other treatment is to be arranged with a private practice and paid for by the patient. (Eustaquio-Raga, Montiel-Company & Almerich-Silla 2013.) Some employees sponsor dental services but after an individual is retired he or she must pay out of their own pockets and the elderly have lower income (Yao & MacEntee 2013, Kelsall & O'Keefe 2014, Herr et al. 2014). At the same time individuals who use public and/or philanthropic services give generally a negative assessment of dental services (Martins et al. 2014).

In Russia there is a mandatory health insurance system which includes dental aid as well. It contains therapeutic and surgical treatment of oral diseases and hygienic procedures but does not cover prosthetics and orthodontic treatment. It means that each individual who has insurance policy can receive dental aid in state funded dental clinics. The funds for mandatory health insurance system are formed by employers’ insurance contributions, federal and regional budget funds. Dental consultations and/or treatment in private clinics are also available for those who can afford it. Furthermore, private companies enter into a contract with private clinics that provide private health insurance service. (ConsultantPlus 2016.) Although there is still low availability of dental aid for some group of people both within the framework of mandatory health insurance (inadequate time to treat a patient, dated equipment and materials, shortage of personnel and so forth) and private sector (price and income disparity) (Official website of the Russian Dental Association 2016).

Behavioral barrier explains the fact that people generally seek dental care only in case of pain or discomfort (52% of visits) and there are also widespread believe that tooth loss is an inevitable consequence of aging and those who postpone treatment until they have to replace all of their remaining natural teeth with complete dentures (43,2% of visits). On the contrary, only 4,2% of respondents visit the dentist for regular check-ups. (Gaszynska et al. 2014.) Another reason is mental health disorders and theirs manifestations that affect the
elderly: memory and independence loss, anxiety, depression and behavioral changes (Soloviev et al. 2015).

There are also some institutional factors which may have significant implications for public health. For the institutionalized elderly dental health plays a great role, so the caregivers’ skills in providing dental care is of great importance. Some studies reveal that not all caregivers are adequately trained to care for elderly individuals, especially in providing oral hygiene care, not sufficiently aware of the existence of institutional protocols on oral health among residents and not always recognize the value of dental knowledge. It is considered important that changing attitudes of caregivers towards the importance of their own oral health may contribute towards improving the level of oral care for the elderly (Cornejo-Ovalle et al. 2013, Pihlajamaki et al. 2016.)

Another institutional factor is education of dentists and hygienists. It is well-known fact that geriatric patients often have several chronic health conditions and/or take some medications. So this group of patients requires special approach and many dentists feel not sufficiently prepared to deal with this population due to lack of adequate clinical training while they were studying in dental school. The reason is that dental schools either do not have or just declare geriatric component in their curriculum but not all of them fully teach it. (Levy, Goldblatt & Reisine 2013.) Matsuka et al. (2012) also argue for a need to increase the numbers of dental schools offering geriatric training courses at nursing care facilities in order to enable early student contacts with this population and to expand students’ future choices. For example, in Finland there is a licentiate degree in “suugeritria”. This special qualification in geriatric dentistry is offered by Finland Dental Association to better deal with oral health problems for this growing group of population. (Suomen Hammasläilikäriliitto 2013.)

Organizational barriers include lack of specialists and limited health care due to living conditions and difficulties of access to healthcare services, particularly in rural areas (Ribeiro et al. 2011, Arcury et al. 2013). For instance, in Canada only 10% of dentists, hygienists, denturists and dental therapists practice in remote areas where one-third of
senior Canadians live (Yao & MacEntee 2014a). According to Widström and colleagues (2010), inhabitants of the Barents region of Norway, Sweden, Finland and to a greater extent in Russia have more difficulties of access to dental aid than their compatriots living in the south of these countries. The main reasons are, as listed above, the lack of dental providers and economic constraints. For example, in Arkhangelsk region there is only one dentist per 2292 of population, and this is so nationwide – 4 dentists per 10000 of people, while the figure is almost twice higher than in Norway, Sweden and Finland. (Widstrom et al. 2010.)

2.5. Programs

Despite increases in medical spending there is still health disparity in special group of people making it necessary to maintain equity in health care policy. First of all some legislative measures should be introduced:

- encouraging a government-administered universal dental plan supported financially by redirecting the premiums currently paid for private dental insurance in each province and territory,
- establishing official guidelines for standards of oral care within all dental health facilities to reduce complications from oral diseases,
- reviewing the admission criteria for dental and dental hygiene programs to include the applicants with mature social and human values sufficiently prepared to deal with chronic disease and disability problems in aging population. (Yao & MacEntee 2014b.)

Long-term routine dental care is considered as a way to reduce major tooth loss and improve quality of life at age 65 years and older (Crocombe 2015). With the aim of maintaining dental health among the elderly some programs were introduced by governments, scientists and health providers in different countries. Examples of those programs are presented in Table 6.
<table>
<thead>
<tr>
<th>Program</th>
<th>Country</th>
<th>Aims</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>SWEdish Panel Study of Living Conditions of the Oldest OLD (SWEOLD), since 1992</td>
<td>Sweden, <a href="http://www.sweold.se">www.sweold.se</a></td>
<td>To describe and analyze the living conditions of elderly people in Sweden</td>
<td>- SWEOLD provides nationally representative data which can be used to identify age and cohort effects.</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>- SWEOLD, together with Swedish Level of Living Survey (LNU), provide longitudinal interview data over a 40-year period. Individuals can be followed through several stages from midlife to later life and mortality, thus allowing for a life course perspective.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Analyses of SWEOLD data have provided valuable insights into health trends among the elderly Swedish population and into health inequalities between women and men and different socio-economic groups. (Lennartsson et al. 2014.)</td>
</tr>
<tr>
<td>ElderSmile clinical program, since 2004</td>
<td>USA, <a href="http://aging.columbia.edu">http://aging.columbia.edu</a></td>
<td>To improve access to and delivery of oral health care for seniors</td>
<td>- ElderSmile successfully incorporated education, screening, and referral for diabetes and hypertension into its service delivery offerings.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- ElderSmile provides important care to an often overlooked population more vulnerable to serious dental conditions and related diseases such as diabetes, heart and lung diseases, and stroke.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Linking primary care and oral health screening in senior centers help assess disease impact and identify minority seniors in need of medical and dental services. (Marshall et al. 2013.)</td>
</tr>
<tr>
<td>Lifestyle Change plus Dental Care (LCDC) program</td>
<td>Thailand</td>
<td>To improve glycemic and periodontal status in the elderly with type 2 diabetes</td>
<td>Increasing awareness, changing attitudes and improving practice in providing oral health and dealing with diabetes mellitus of the elderly with type two diabetes (Saengtipbovorn, Taneepanichskul 2014).</td>
</tr>
<tr>
<td>The WHO Oral Health Program</td>
<td>Globally</td>
<td>To strengthen the implementation of systematic oral health programs oriented towards better oral health and quality of life for older people</td>
<td>WHO supports countries in establishing appropriate oral health surveillance systems. It collects essential oral health data and information on lifestyles to determine the impact of risk factors for the oral diseases among older people in each country and to design intervention programs targeting these risk factors. WHO encourages public health care administrators and decision-makers to design effective and affordable strategies and programs for better oral health and quality of life of the elderly, which are integrated into general health programs. (Petersen &amp; Yamamoto 2005.)</td>
</tr>
<tr>
<td>Subsidized prosthetics</td>
<td>Russia</td>
<td>To increase the availability of dental care</td>
<td>Manufacturing and repairing of dentures (except for the cost of precious metals and ceramet) in municipal health care facilities (Garant 2016)</td>
</tr>
</tbody>
</table>

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*Lennartsson et al. 2014.*


*Saengtipbovorn, Taneepanichskul 2014.*

*Petersen & Yamamoto 2005.*

*Garant 2016.*
The Columbia University College of Dental Medicine and its partners institute the ElderSmile clinical program to cover the unmet need for oral health care in older adult population which currently includes 51 prevention centers. These centers provide general presentations in English and Spanish of oral health care in later life (e.g. potential oral health hazards, choosing oral health care products and accessing to oral health care, including transportation), demonstrations of brushing and flossing techniques and care of prosthetic devices and oral examinations (including assessment of oral cancers) for older adults electing to participate. Services are provided by two faculty dentists, program staffers and dental students, who are trained by the project director. Taking into account that oral diseases in the elderly are often related to undiagnosed and untreated chronic health conditions, in 2010 screening for diabetes and hypertension was integrated as a measure to attract seniors within the ElderSmile program. Thus, 7.8 % and 24.6 % of diabetes and hypertension respectively were found among ElderSmile participants with no previous diagnosis by a physician. (Marshall et al. 2013, Marshall et al. 2015, Northridge et al. 2015.)

In the framework of LCDC program based on the health belief model, social cognitive theory and cognitive-behavioral theory participants suffering from diabetes mellitus received a lifestyle and oral health education program, individual lifestyle counseling, oral hygiene instruction followed by an educational booster by viewing an educational video covering all of the above mentioned issues (Saengtipbovorn & Taneepanichskul 2014).

Dealing with oral health of the elderly, WHO, Federation Dentaire Internationale (FDI) and the International Association for Dental Research (IADR) set the following goals to reach by 2020:

- dental caries: reduce the number of teeth extracted because of dental caries at age 65–74 years by X%;
- periodontal diseases: reduce the number of teeth lost because of periodontal diseases by X% at age 65–74 years with special reference to tobacco use, poor oral hygiene, stress and current systemic diseases;
tooth loss: reduce the number of edentulous persons by X% at age 65–74 years, increase the number of natural teeth preserved by X%, and increase the number of individuals with functional dentitions (20 or more natural teeth) by X% at age 65–74 years. (Petersen & Yamamoto 2005.)

In Russia veterans of the Second World War and other wars and as well as old-age pensioners and disabled are eligible for free dental prostheses, and in some regions free services in the field of prosthetics (in addition to the above categories) can be obtained by other groups of people, for instance, heroes of the Soviet Union, heroes of the Russian Federation and the individuals awarded the Order of Glory, disabled workers and people with disabilities from childhood (Benefit portal, Russia, 2014).

Elderly receive regular care not only from dentists but also from other medical and nursing care providers, making it necessary to improve physician-nurse-dentist cooperation to better address the oral health needs of these individuals. This partnership has a number of advantages:

- assessment of oral health need in controlling various medical conditions and/or geriatric syndromes including chronic pain, depression, social anxiety and withdrawal, malnutrition, dysphagia, irregular medication schedule;
- assistance to promotion of oral health care;
- physicians, nurses and other palliative care providers able to identify oral health needs in patients with life threatening conditions and to arrange regular medical referrals;
- oral health techniques could also be implemented at bedside that reduce the need to transfer patients to dental offices, thus minimizing the stress for patients and their caregivers and the potential disruption of homeostasis due to transfer. (Metcalf, Northridge & Lamster 2011, Chen et al. 2013a, Chen & Kistler 2015.)

It also should be mentioned that cooperation between health care providers may become more effective with the improvement and development of dental technology (Ornstein et al. 2015). Nevertheless, with growing availability of free dental check-ups through mobile dental units, many people discontinued seeing there dentists and claimed they would not
keep dental appointments (Niesten, van Mourik & van der Sanden 2013).

Due to the global threat of dental diseases and population aging there is a need to develop integrated dental and mental health care with emphasis on prevention of dental problems among the elderly (Velasco-Ortega et al. 2013). The main directions of dental measures in the future are education of dentists to work with the elderly and physicians to diagnose dental problem, organization of help in dental care and check-up facilities, improving awareness of dental health, enlargement of governmental financial assistance in dental aid coverage.
3. AIMS OF THE STUDY

Object of this research is the worsening of oral health condition due to aging. The research subject is the oral health status in the elderly residents of the North of Russia.

The aim of the study is the assessment of main oral health indices of a group of elderly residents of the home for the elderly in Arkhangelsk, Russia.

Research questions are:
1. How does the age affect the oral health of the elderly home residents?
2. What kind of changes in the basic parameters of the oral health of the subjects can be attributed to old age?
3. Can there be possible links found between the various parameters of oral health?
4. What is the influence of bad lifestyle habits (smoking and alcohol use) on the dental wellbeing of the elderly home residents?

The practical tasks are:
1. Collecting oral health data of the individuals living in the home for the elderly in Arkhangelsk.
2. Assessing the oral health changes and comparing the dental, periodontal, salivary, glossal and immune status of the elderly patients with WHO standards or the data obtained from other studies.
3. Defining the effects of bad habits (smoking and alcohol use) on the oral health of the elderly.
4. Making recommendations for the patients and social workers that can improve oral wellbeing of this group of people and increase awareness of the importance of dental care.
5. Assessment of the dental help needs of this group of patients and making proposals for further dental care improvements.
The research hypothesis is the growing risk of poor oral health increasing with the advanced age, with the assumption that the older the patient is the further his or her dental health deteriorates given that senescence affects conditions of dental, periodontal, salivary, glossal and immune status (Table 7). Contrary to that, the null hypothesis states that oral health does not deteriorate due to aging.

**Table 7. Violations in the oral cavity due to senescence.**

<table>
<thead>
<tr>
<th>Status</th>
<th>Manifestations in the oral cavity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dental</td>
<td>Increased level of caries and its complications, non-caries lesions, edentulousness</td>
</tr>
<tr>
<td>Periodontal</td>
<td>Gum and periodontium inflammation</td>
</tr>
<tr>
<td>Salivary</td>
<td>Alteration in physical saliva parameters</td>
</tr>
<tr>
<td>Glossal</td>
<td>Enlargement of tongue coating</td>
</tr>
<tr>
<td>Immune</td>
<td>Changes related to the deterioration of immune system</td>
</tr>
</tbody>
</table>
4. MATERIALS AND METHODS

4.1. Formal permission and adherence to ethical norms

The study protocol has been approved by the Ethics Committee of Northern State Medical University (NSMU), Arkhangelsk, Russia and the pertaining ethical permission has been granted. The written permission has been obtained from the manager of the home for the elderly, Arkhangel'sk, Russia.

4.2. Informed consent

Making sure that the purpose and details of the study are understood by the subjects, the written informed consent has been obtained from all the individuals who were willing to participate in the study. The consent forms were obtained from the subjects before the examination and the protocol of the present study was followed in accordance with the Declaration of Helsinki (DoH) of the World Medical Association (WMA). The written consent and examination sheets were printed in Russian (Appendix 1) and distributed to each participant.

4.3. Study design, population and duration

A descriptive cross-sectional survey was conducted to assess the data concerning to dental, periodontal, salivary, glossal and immune status of the elderly individuals above the age of 60 residing in home for the elderly, Arkhangelsk, Russia during August 2012.

4.3.1. Inclusion criteria

The inclusion criteria were:
1. Subjects who were willing to participate and given the informed consent.
2. Patients aged 60 and above.
3. The individuals residing in the home for the elderly in Arkhangelsk.
4.3.2. Exclusion criteria

The exclusion criteria were:
1. Subjects who were not willing to participate.
2. Subjects aged less than 60.
3. Subjects with whom it was not possible to follow the protocol of the study, patients with reduced cognitive function and those with terminal diseases.

About 80 people lives in the home for the elderly with 26 were included in the study. The reasons given for relatively low response were such as feeling too sick, too tired, just had my teeth checked and having dentures only, the same as given in the study of Solemdal et al. (2012).

4.4. Examination of patients

Dental examination was given in accordance with WHO’s Oral Health Surveys, Basic Methods, 4th and 5th Edition, and the comprehensive assessment was carried out for 26 subjects. A specially prepared questionnaire was used to acquire information on age, education, individual habits, comorbidity as well as to record relevant information about dental, periodontal, salivary, glossal and immune status and observations concerning the general look of patients participating in the research were also recorded (Appendix 2).

The oral examination was conducted by means of Community Periodontal Index (CPI) probe and dental mirror (WHO 2013). The probe is graduated by every 1 mm at one end and by sections on the other end up to 3,5 mm, from 3,5 to 5,5 mm, 8,5 and 11,5 mm, and ends with a ball in diameter of 0,5 mm (Konopka et al. 2015).

4.4.1. Dental status

The evaluation of dental status includes the prevalence of caries, identification of decayed, missing and filled teeth, type of edentulous arches and the presence of prostheses.
The DMFT index is fundamental both in clinical practice and research as oral health-related quality of life assessment tool. The D component includes all teeth with carious crown, carious root and filled crown or root with caries. The M component comprises missing teeth not only due to caries but to any other reason. The F component includes teeth only with filled crown and without caries, when one or more permanent restorations are present and there is no caries anywhere on the crown. The basis for DMFT calculations is 32 teeth, i.e. all permanent teeth including wisdom teeth. Teeth with fissure sealant or fixed dental prosthesis/ bridge abutment, special crown or veneer/implant are not included in calculations of the DMFT index.

During visual examination and probing non-carious lesions were noticed (e.g. attrition, abrasion, erosion etc.).

The number of decayed teeth with crown or root caries (DT), missing (MT) and filled teeth (FT) were recorded. DT and MT were summed up to obtain the decayed and missing teeth (DMT) index and subtracted from FT. This index – FT-DMT reflects the attitude towards dental health. If its reading is more than 0, the attitude is considered as favorable. If the reading is less than 0 or equal 0, it implies that person does not care much about preserving oral health (poor hygiene level, rare dental examinations and treatment). (Opravin et al. 2011.)

To access the type of edentulous jaws the classification of E. Kennedy of partially edentulous arches was used:
- Class I – bilateral free ended partially edentulous.
- Class II – unilateral free ended partially edentulous.
- Class III – unilateral bounded partially edentulous.
- Class IV – bilateral bounded anterior partially edentulous. (Wikipedia 2016.)

In case of complete edentia the Oxman’s classification for upper and lower jaws was applied. According to this classification there are four types of edentulous jaws:
Type I – high residual alveolar ridge, high maxillary tuberosities, prominent palatal vault and adequate attached mucosal base.

Type II – moderately expressed atrophy of alveolar bone and maxillary tuberosities, less deep palate and lower attachment of the movable mucosa.

Type III – highly expressed but even atrophy of alveolar ridge, flattening of the palatal vault. Movable mucosa attaches at the top of the alveolar bone.

Type IV – uneven atrophy of alveolar ridge, a combination of features of the previous types. (Mironova 2012.)

In addition, the presence of removable dentures was recorded for each jaw. The codes were as follows:
0 – No denture.
1 – Partial denture.
2 – Complete denture.
9 – Not recorded. (WHO 2013.)

4.4.2. Periodontal status

Oral Hygiene Index Simplified (OHI-S), papilla, marginal and alveolar gingiva index (PMA), CPI were used to establish periodontal status. The level of oral hygiene was estimated with OHI-S developed in 1960 by John C. Greene and Jack R. Vermillion. OHI-S’ index teeth are 11, 16, 26, 31, 36 and 46. The index is composed of two components, one describing the soft (debris index simplified (DI-S)) and one the calcified (calculus index simplified (CI-S)) deposits present. DI-S and CI-S are measured on the labial surfaces of teeth numbers 11, 16, 26, 31, and the lingual surfaces of 36 and 46. The criteria for the DI-S assigning scores of 0-3 are as follows:
0 – No debris or stain present.
1 – Soft debris covering no more than one-third of the tooth surface being examined or the presence of extrinsic stains without debris regardless of surface area covered.
2 – Soft debris covering more than one-third but not more than two-thirds of the exposed tooth surface.
3 – Soft debris covering more than two-thirds of the exposed tooth surface.
The criteria for the CI-S assigning scores of 0-3 were as follows:

0 – No calculus present.

1 – Supragingival calculus covering no more than one-third of the exposed tooth surface being examined.

2 – Supragingival calculus covering more than one-third but not more than two-thirds of the exposed tooth surface, or the presence of individual flecks of subgingival calculus around the cervical portion of the tooth.

3 – Supragingival calculus covering more than two-thirds of the exposed tooth surface or a continuous heavy bank of subgingival calculus around the cervical portion of the tooth.

The DI-S and CI-S scores are obtained by the sum of the debris score for all teeth, divided by the number of surfaces scored. Then sums of debris and calculus indices were summed up to derive OHI-S score. At least two of the possible six surfaces have been included in order to calculate the score, and the adjacent teeth were substituted for the selected teeth if they were missing. The clinical relevance to the DI-S and CI-S is as follows: 0,3- 0,6 – good oral cleanliness; 0,7-1,8 – fair; 1,9-3,0 – poor. The interpretation for OHI-S is 0,0-1,2 – good; 1,3-3,0 – fair; 3,1-6,0 – poor. (Wei, Lang 1982.)

To evaluate the gingival inflammation PMA index developed by Schour and Massler in 1944-1947 (Wei, Lang 1981) in modification by C.Parma (1960) was used. The inflammation presents in the interdental papilla (P) has been assessed as the equavalent of one point. Then, the spread to the marginal gingiva (M) – two points and ultimately the attached gingiva (A) – three points. (Rebelo and Corrêa de Queiroz 2011.) The number of affected papillary, marginal and attached units for individuals aged over 15 years are 28 to 30 calculated by the following formula (Danylevskiy 2000):

\[ \text{PMA} = \frac{\text{Sum of points}}{3 \times \text{Number of teeth}} \times 100\% \]

CPI was used for assessment of periodontal bleeding, calculus and periodontal pockets. Dentitions have been divided into 6 sextants: 18–14, 13–23, 24–28, 38–34, 33–43 and 44–
48. Index teeth for adults aged 20 years and older are 17/16, 11, 26/27, 36/37, 31, 46/47. A sextant is to be examined only if there are two or more teeth present which are not indicated for extraction. The two molars in each posterior sextant are paired for recording and, in case of one missing, there is a replacement. If no index tooth is present in a sextant qualifying for examination, all the teeth that are present in that sextant are examined and the highest score is recorded as the score for the sextant. (WHO 1997.)

To conduct the examination CPI probe was used with the gingiva of all teeth present in the mouth was examined by inserting the tip of the WHO CPI probe between the gingiva and the tooth to assess the absence or presence of bleeding. When the probe was inserted, the ball tip followed the anatomical configuration of the surface of the tooth root and the full extent of the sulcus or pocket explored. The index teeth, or all remaining teeth in sextant, are to be examined and the high test score is to be entered in the appropriate box (Figure 1).

The codes are as following:
0 – Healthy.
1 – The bleeding observed, directly or by using a mouth mirror, after probing.
2 – Calculus detected during probing, but all of the black band on the probe visible.
3 – The pocket of 4-5 mm (gingival margin within the black band on the probe).
4 – The pocket of 6 mm or more (black band on the probe nt visible).
X – Excluded sextant (less than two teeth present).
9 – Not recorded. (WHO 1997.)

![Figure 1. CPI index teeth.](image)
4.4.3. Salivary status

Salivary status involves saliva quality description (color, foamy, presence of impurities) and evaluation of salivary flow rate, type of saliva microcrystallization, viscosity, surface tension and pH.

Resting saliva was collected to diagnose a reduction in salivary flow. The collection was performed between 9 and 11 am and the subjects had been instructed not to eat or drink any beverages except water, not to smoke and chew gum one hour before the examination. The patients were advised to rinse the mouth for 5 seconds with 5 mL distilled water and then to rest for five minutes. The subjects were asked to minimize the movements especially mouth movements during the collection and to keep eyes open before an initial swallow, to keep mouth slightly open and allow saliva to drain into the 10 ml sterile tube. At the end of the collection, participants expectorated the accumulated saliva into a tube. After 5 or 10 minutes, in case of low flow rate, the volume of collected saliva was measured, and the salivary flow rate was expressed in mL/min. (Yurdukoru, Terzioglu & Yilmaz 2001, Navazesh & Kumar 2008, Ueno et al. 2014.)

Measurement of salivary viscosity was done using the Hess viscometer graduated in centipoise (cP). The viscometer consists of two similar graded pipettes fixed in parallel on the holder. The pipettes have identical capillaries and are jointed with rubber tubes and one of the pipettes ends with a valve. There is glass tip which is used for suction to create vacuum in the pipettes. The procedure is as follows: firstly, portion of distilled water fills the pipette up to 0 level and the access to the pipette is blocked by the valve. Then saliva fills the other pipette up to 0 level, after which the valve is opened and both liquids go up: the saliva up to level 1 cP and the water up to the level which registers as saliva’s viscosity level. Afterwards, the capillary is cleaned with alcohol, ammonia and ether after each measurement.

For determination of salivary surface tension (SST) three to four drops of saliva are filled into the pipette and then one drop of saliva is placed on the filter paper from the height of 1
cm and in a minute the contour of spot is circled with the pen. The area of the circle is calculated by the formula:

$$SST = \frac{WST \times S_s}{S_w},$$

where WST – water surface tension (72, 72 nanometer/meter), $S_s$ – area of salivary drop, $S_w$ – area of distilled water drop. $S_w$ for the filter paper is 5,97 cm$^2$. (Goryachev 2011.)

Saliva’s crystal structure is essential for organism homeostasis. The shape of crystals is determined by the wave gradient between the crystal-forming elements and environmental factors. When pathology occurs, changes at the molecular and submolecular levels are taking place, producing an impact on the rate of crystal-forming elements which finds an expression in a modified form, size and number of facies’ branches. (Dobrenkov 2014.) To determine microcrystallization of saliva (MCS) samples of oral fluid were collected in chemically clean test tubes. The same amount of saliva was collected with the pipette and placed on a glass plate three consecutive times and dried at room temperature. Subsequent analysis of obtained samples was performed in accordance with the listed below scale and criteria for evaluating the type of MCS using an electron microscope «Leica DM750» (Germany) with an 4x-100x magnification. The normal results of MCS are characterized by a clear pattern of large elongated prismatic crystal structures spreading from the center of the drop, fusing with each other and forming a tree like or pteridophytes shape (the picture corresponds to the reading of 5 (Figure 2, a)). The destruction of crystal structure caused by various adverse factors is assessed to get the results of MCS. The following types of crystal destruction are identified: large prismatic elongated crystal structures fused together in a random order are measured as 4 points (Figure 2, b); if the center of the drop shows some star-shaped crystals form while on the periphery there are enlarged dendrite crystals, the reading is 3 points (Figure 2, c); if the individual crystals are in the form of rods or twigs arranged across the field then the reading is 2 points (Figure 2, d); if the entire area of the drop is taken by a large number of crystal structures of isometrically arranged, stellate, round or irregular shape, then the reading is 1 point (Figure 2, e); the complete absence of crystals in the field of view equals 0 points (Figure 2, f). (Belskaya 2011.)
The microcrystallization potential of saliva (MPS) was expressed by the mean point of crystallization of three drops: 0,0-1,0 – very low; 1,1-2,0 – low; 2,1-3,0 – fair; 3,1-4,0 – high, 4,1-5,0 – very high (Vasilieva 2013).

Resting salivary pH values were measured by dipping pH strips McolopHast™ pH 4,0 – 7,0 (Merck, Germany) into unstimulated saliva for 10 seconds and comparing them with a pH reference chart placed on the pack.

4.4.4. Glossal status

Evaluation of glossal status was conducted by using the tongue dorsal surface test which registrates the presence of coating and hyperkeratosis. By means of tongue dorsum visual inspection a list of changes are registered according to the following criteria:
0 – No changes.
1 – Coating on the tongue dorsum.
2 – Coating on the tongue dorsum and minor hyperkeratosis.
3 – Coating on the tongue dorsum and significant hyperkeratosis of filiform papillae.
(Ivanova 2009.)

4.4.5. Immune status

Assessment of local immunity in the mouth was conducted by studying the amounts of interleukin-8 (IL-8), immunoglobulin G (IgG), tumor necrosis factor alpha (TNF-α), secretory immunoglobulin A (SIgA) and cortisol in saliva samples. Samples were stored at –30°C until enzyme-linked immunosorbent assay (ELISA) was done in the biochemical laboratory of NSMU. For this method manufacturer supplied reagents “Vector-Best” (Novosibirsk) A-8762, A-8756, A-8662, A-8668 were used.

The procedure begins with the adding of 100 μl of activating solution into strips wells incubated for 30 minutes at 37 °C after which washed. Then, in the first two wells of the strips 100 μl the calibration samples were placed while in the remaining wells 100 μl of test samples were added and then incubated for 45 minutes at 37 °C after which washed again. Next, into each well 100 μl of conjugate solution was added and incubated for 30 minutes at 37 °C, and washed at the end of the incubation. Then in all wells strips100 μl of orthophenylenediamine solution were put and incubated for 25-30 minutes at room temperature. The end of the reaction was performed by addition of 50 μl of stop solution to each well. The analysis results were recorded spectrophotometrically at the wave length of 492 nm. According to the measurement the results the calibration curve was graphed and immunoglobulin concentrations were assessed. (Vector-best 2016.)

After the comprehensive examination the intervention urgency was determined according to what is recommended by WHO:
0 – No treatment needed.
1 – Preventive or routine treatment needed.
2 – Prompt treatment including scaling needed.
3 – Immediate (urgent) treatment needed due to pain or infection of dental and/or oral origin.
4 – Referred for comprehensive evaluation or medical/dental treatment (systemic condition). (WHO 2013.)

4.4.6. Statistical analysis

The data is entered and analyzed with STATA version 13.1.220 (StataCorp LP, Texas, USA). In the first place the Shapiro-Wilk normality test is applied to test normality. For normally distributed quantitative variables the sample arithmetic mean or average ($\bar{x}$), sample standard deviation (SD) and confidence interval (CI) are determined. For statistical analysis of quantitative data which is non-normally distributed, median (Md, Q₂), first and third quartile (Q₁ and Q₃) and CI are used. Statistical significance is considered if p-value is 0.05. To assess relationships between variables the correlation coefficient (r) is computed. For parametric data the Pearson’s product-moment correlation coefficient is applied and for nonparametric equivalents the Spearman's rank correlation coefficient is used. For qualitative data proportions (ω) and CI are performed. In addition, the linear regression test is applied to examine the relationship between quantitative outcomes and quantitative variables.
5. RESULTS

As stated above, the response rate was relatively low (32,5%) and during the study 26 patients were examined. After applying inclusion-exclusion criteria we have got 23 patients aged 60 to 89 years. Three patients were excluded because they were younger than 60. Thus, the mean age (\(\bar{x}(SD)\)) of the participants of the study (\(n = 23\)) equals to 76,9 (8,1) years.

According to age-related changes, a wide variety of somatic pathology was observed, including almost all organs and systems of human body (cardio-vascular, gastro-intestinal, respiratory, urinary tract, musculoskeletal system, neoplasms, undergone operations, allergies, ear and eye diseases). Moreover, changes in neural system and mental health such as nervous tics, hand and head tremors, mood swings, lack of trust, unreasonable fears have been registered.

When individual lifestyle habits were assessed, one patient revealed nicotine addiction dating back to a few decades, and we observed that this patient developed the following changes in her appearance and anamnesis: the parchment skin, which was dry and wrinkled with yellow tint and in the rough quality of voice. She has undergone neoplasm. Another patient reported a long-term alcohol addiction: her face was hyperemic, edematous and there were nose telangiectasia.

The appearance of patients who participated in the research is characterized by loss of turgor and skin elasticity, deep nasolabial and mentolabial folds, reduced height of the lower third of the face, mesioclusion, cyanosis of the lips and nasolabial triangle, which may be attributed to heart diseases.

5.1. Dental status

After the visual examination and probing was performed the prevalence of dental caries was found as 100%. The meaning of DMFT was 24,5 that corresponds to very high caries intensity which begins when the DMFT equals to 6,6 or higher (\(\bar{x} = 24,5, SD = 6,3; 95\%\))
Besides, missing teeth (86,9%) prevailed over filled (5,5%) or decayed (7,6%) teeth. In addition, there have been found non-carries lesions, in particular, attrition (48% of cases) and wedge-shaped defects (22%) have taken place.

The complete edentia of both jaws have been observed in 6 patients, edentulous upper or lower jaw found in 5 patients, while in the rest of the patients partial edentia registered. In the completely edentulous jaws type II of the Oxman’s classification has been observed in 7 jaws, type III – in 5 and type IV – in 5. To access the type of edentulous jaws the classification of E. Kennedy of partially edentulous arches was used: class I was observed in 14 jaws, class II – in 9 and class III – in 6. There were 18 jaws with no denture (code 0), 9 with partial denture (code 1), 14 with complete denture (code 2) and 5 were not recorded (code 9). Thus, 15 subjects were found to be in need of prosthetic care. In seven patients we have registered defective dentures while eight patients had adequate dentures.

In our study 21 participants had negative reading of FT-DMT index (91%) and only two of them had FT-DMT above zero (9%). The median of that index was -16 (Q₁ = -28; Q₃ = -4; 95%; CI: -20 – -11 ) that testified to negligence among study participants towards their dental health.

5.2. Periodontal status

The level of oral hygiene with OHIS was found equal 3,4 (SD = 1,0; 95% CI: 3,1 – 4,0) that indicates the poor oral hygiene. The mean value of PMA index was 25,2% (SD = 19,3; 95% CI: 15,3 – 35,1) that corresponds to mild inflammation rate. The CPI code 0 (healthy periodontal tissues) was not observed, code 1 (bleeding) in 12,3% (95% CI: 0,08 – 0,19), code 2 (calculus) – 8,0% (95% CI: 0,04 – 0,14), code 3 (shallow pockets) – 10,1% (95% CI: 0,06 – 0,16), code 4 (deep pockets) – 8,0% (95% CI: 0,04 – 0,14) and code X (excluded sextants) in 61,6% of cases (95% CI: 0,53 – 0,69).
5.3. Salivary status

The examination of saliva samples showed the following saliva quality characteristics. In majority of cases saliva was foamy, had yellow or brown colour and a lot of impurities. The salivary flow rate was calculated as 0,08 mL/min (Q₁ = 0,04; Q₃ = 0,15; 95% CI: 0,07 – 0,13), viscosity – 3,0 cP (Q₁ = 2,5; Q₃ = 4,0; 95% CI: 2,7 – 4,0), pH – 6 (Q₁ = 6,0; Q₃ = 7,0; 95% CI: 6,1 – 6,7) and surface tension – 95,8 nanometer/meter (Q₁ = 86,5; Q₃ = 108,8; 95% CI: 78,5 – 103,9).

In the evaluation of MCS type c was determined (Figure 3) in 17,3% of all the cases, type d (Figure 4) and e (Figure 5) in 37,3% and 45,3% respectively. The mean value for MPS was found 1,72 (SD = 0,63; 95% CI: 1,46 – 1,98) that corresponds to low microcrystallization potential of saliva.

Figure 3. Saliva microcrystallization, type c
Figure 4. Saliva microcrystallization, type $d$

Figure 5. Saliva microcrystallization, type $e$
5.4. Glossal status

According to the tongue dorsal surface test the code 0 was found in 38% of cases (95% CI: 0,16 – 0,65), code 1 in 56% (95% CI: 0,3 – 0,8), code 2 in 6% (95% CI: 0,01 – 0,39) and code 3 was not found at all.

5.5. Immune status

The results of evaluation of immune status are represented in Table 8.

Table 8. Parameters of local immunity.

<table>
<thead>
<tr>
<th>Index, number of samples</th>
<th>Meaning</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>IL-8(pg/ml) n=16</td>
<td>( \bar{x} = 420,85 ) (SD = 50,52)</td>
<td>313,16 – 528,53</td>
</tr>
<tr>
<td>TNF-α(pg/ml) n=18</td>
<td>Md = 0,93 (Q₁= 0,01; Q₃= 3,53)</td>
<td>0,94 – 4,15</td>
</tr>
<tr>
<td>IgG (mg/ml) n = 21</td>
<td>Md = 26,57 (Q₁= 13,12; Q₃= 34,64)</td>
<td>19,61 – 29,55</td>
</tr>
<tr>
<td>sIgA (mg/l) n=21</td>
<td>( \bar{x} = 390,16 ) (SD = 40,54)</td>
<td>305,6 – 474,72</td>
</tr>
<tr>
<td>Cortisol (nmol/l) n=22</td>
<td>Md = 22,81 (Q₁= 21,04; Q₃= 24,93)</td>
<td>20,72 – 27,94</td>
</tr>
</tbody>
</table>

After examination the urgency of intervention was determined: code 1 was observed in 2 patients, code 2 in 16 cases, code 3 in 4 subjects and 1 patient was referred for specialist treatment.

Statistically significant correlation was found after the Pearson’s and Spearman’s correlation criteria had been applied: strong positive correlation between age and DMFT, strong negative correlation between age and FT-DMT, strong negative correlation between age and TNF, very strong negative correlation between DMFT and FT-DMT, very strong negative correlation between DMFT and surface tension, moderate positive correlation between OHIS and PMA, strong positive correlation between OHIS and IL-8, strong positive correlation between surface tension and FT-DMT, strong negative correlation between surface tension and PMA, strong positive correlation between sIgA and IgG (Table 9).
Table 9. Correlation between oral indices and markers.

<table>
<thead>
<tr>
<th></th>
<th>Age</th>
<th>FT-DMT</th>
<th>Surface tension</th>
<th>PMA</th>
<th>IgG</th>
<th>IL-8</th>
</tr>
</thead>
<tbody>
<tr>
<td>DMFT</td>
<td>( r_s = 0.62; \ p = 0.002 )</td>
<td>( r_s = -0.89; \ p = 0.001 )</td>
<td>( r_s = -0.85; \ p = 0.004 )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FT-DMT</td>
<td>( r_s = -0.71; \ p = 0.03 )</td>
<td>( r_s = 0.9; \ p = 0.0009 )</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TNF</td>
<td>( r_s = -0.78; \ p = 0.01 )</td>
<td></td>
<td>( r_s = 0.49; \ p = 0.004 )</td>
<td>( r_s = 0.79; \ p = 0.002 )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OHIS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PMA</td>
<td></td>
<td></td>
<td></td>
<td>( r_s = -0.69; \ p = 0.04 )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IgA</td>
<td></td>
<td></td>
<td></td>
<td>( r_s = 0.73; \ p = 0.02 )</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Regression analysis showed the two year aging and growth TNF-\( \alpha \) on 1 pg/ml increase DMFT on 1 point, one year aging is connected to decrease of FT-DMT almost on 1 point (regression coefficient \( b \) – -0.89) and one point enlargement OHIS results in 10% PMA index rise.
6. DISCUSSION

Facing the challenge of steady growth of the proportion of the elderly worldwide the International Association of Gerontology singled out gerodontology as a separate scientific branch back in 1983. Currently the proportion of the elderly is continuing to increase demanding broader access to dental care. (Samsonov et al. 2011.)

The data we have obtained is compared with the results achieved by multiple research groups in Russia and abroad taking into account comorbidity, external examination, indices of dental, periodontal, glossal, salivary and immune status of the elderly.

6.1. Questionnaires, external examination

In our study all patients are characterised by suffering from at least one chronical condition (cardio-vascular, neural, gastro-intestinal, respiratory, urinary, musculoskeletal, ear and eye diseases, allergies, neoplasms and mental health problems) or having undergone operations, which corroborates very well with the study of Ovsyannikov (2010) taken place in Moscow where it was found that 100% of respondents had a few long term somatic illnesses (Ovsyannikov 2010).

Visual oral examination allowed to reveal petechiae (8,7%) on hard palate surface 2-3 mm in diameter in two cases that can be a sign of hypertension. Varicous veins in the sublingual area and cyanosis of nasolabial triangle and lips evidence cardio-vascular diseases. papilloma under the tongue was detected in one patient while we have not observed various disorders of skin or oral mucosa such as leukoplakia, hyperkeratoses, cheilitis, scalded mouth syndrome, oral lichen planus, chronical aphthous stomatitis, lingua geographica which were noted among the elderly in other studies (Kopyl 2011).

6.2. Dental status

Dental caries has high prevalence among the elderly. In foreign literary sources the
prevalence of caries fluctuates from 66,03% to 90% (Liu et al. 2013, Yao & MacEntee 2013). In our study we have found that 100% of participants have dental caries that is much higher than that in foreign studies, but it complies with studies carried out in this country. For instance, in a Moscow study 100% caries prevalence was found in all three age groups (60-69, 70-79 and 80 and over). (Apresyan 2005.)

The most common index to determine dental health is DMFT index and meaning of DMFT in elderly group varies from 15,7 to 29,59 (Apresyan 2005, Andrade et al. 2012, Rodrigues et al. 2012a, Rodrigues et al. 2012b, Cornejo et al. 2013, Yao & MacEntee 2013). We found a very high caries intensity (DMFT = 24,5) in Arkhangelsk that corresponds to other locations in Russia: 24,61 in Moscow (Apresyan 2005), 25,4 in Izhevsk (Zinchenko 2008), 29,4 in Kemerovo (Kiseleva 2009). Also Apresyan (2005) reveals that DMFT steadily grows with aging that results in extremely high level of caries among young-old and old persons (Seccombe & Ishii-Kuntz 1991).

On closer examination of the DMFT index we have found that the mean reading of missing teeth almost always prevailed over decayed teeth, which indicates that decayed teeth are usually extracted because of the pain or abscess they caused, so restorative procedures are rarely performed in the elderly (Srivastava et al. 2012). The mean weight of extracted teeth is the highest in DMFT structure and grows with the aging up to 97%. Other elements of DMFT index, such as decayed and filled teeth, amount to 2,7% and 4,1% respectively and tend to decrease with aging. Mean proportion of caries complications is also very low – less than 1%, and at the age at 80 and over it was not discovered at all. Mean proportion of teeth with caries complications which are to be extracted is relatively low (0,6% and 4,8%). It means that urgency of dental surgical aid is not very high because the majority of teeth had already been extracted. (Apresyan 2005, Ovsyannikov 2010.) Our results generally coincide with findings from other studies: proportion of missing teeth is the predominant factor in DMFT structure (86,9%), followed by decayed teeth proportion (7,6%), and filled teeth are the lowest factor (5,5%). In our study there was a patient who had 14 teeth with caries complications and thus the proportion of periodontitis among the whole group amounted to be 4,9% and also there were found 3,7% of teeth roots to be removed.
There are found some peculiarities of dental caries and its complications among the elderly. Caries lesions are generally found on the tooth neck with wide access and they are characterized by rough ridges and pigmented dentin, with the diameter of lesion more than the depth and this lesions and are found painless during the probing. Among the elderly pain is a very rare reason to seek dental aid because of involution of pulp tissue due to systemic diseases such as cardio-vascular, musculoskeletal, connective tissue, endocrine diseases. Furthermore, multiple cases of root caries were found and caries is one of the major causes of periodontitis. Though acute pulpitis was observed in 2% of cases and acute periodontitis in 3,2% in a Stavropol study in our study we did not discover such forms of caries complications at all. (Bragin & Timoshenko 2013.)

Thus, analysis of the DMFT structure in our study showed that the number of missing teeth in the examined patients prevailed over the number of decayed and filled teeth which testifies to extremely high necessity of prosthetic care due to chewing deterioration and relatively low expectations of therapeutic dental aid. According to the results of other studies there is about 95% of 60 to 69 year olds who were in need of prosthetic care at the moment of examination and about 5% who had good quality dentures, and 99% and 89% of patients who need dentures in the other age groups such as 70 to 79 and 80 and over, correspondingly. (Apresyan 2005, Ovsyannikov 2010.) The need of prosthetic aid was found in about 75% of all cases in other studies (Kuzmina 2009, Soldatov 2011). In our study group we found that there was significantly lower need for prosthetic treatment (65%) than in the studies of any age group (Table 10). We have observed complete edentia in 6 patients (26%) that corresponds to study results of Ushnitskyi and colleagues (2013b) (29,03 ± 0,74%). However, Kuzmina (2009) provides data about 5% of participants with complete edentia of both jaws and Unell et al. (2015) found complete edentia in 3% of cases among 70 year olds and 7% among 80 year old subjects in Sweden.

<table>
<thead>
<tr>
<th>Study</th>
<th>Age (years)</th>
<th>Number of persons</th>
<th>Not in need of prosthetic aid numbers</th>
<th>Not in need of prosthetic aid %</th>
<th>In need of prosthetic aid numbers</th>
<th>In need of prosthetic aid %</th>
<th>Have defective dentures numbers</th>
<th>Have defective dentures %</th>
<th>Do not have dentures numbers</th>
<th>Do not have dentures %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present study</td>
<td>60-90</td>
<td>23</td>
<td>8</td>
<td>35</td>
<td>15</td>
<td>65</td>
<td>7</td>
<td>30</td>
<td>8</td>
<td>35</td>
</tr>
<tr>
<td>Ushnitskyi et al. 2013</td>
<td>60-69</td>
<td>138</td>
<td>7</td>
<td>5,1</td>
<td>131</td>
<td>95</td>
<td>92</td>
<td>94,8</td>
<td>31</td>
<td>22,5</td>
</tr>
<tr>
<td>Apresyan 2005</td>
<td>70-79</td>
<td>155</td>
<td>2</td>
<td>1,3</td>
<td>153</td>
<td>99</td>
<td>147</td>
<td>86,1</td>
<td>6</td>
<td>3,9</td>
</tr>
<tr>
<td></td>
<td>80 and over</td>
<td>79</td>
<td>9</td>
<td>11</td>
<td>70</td>
<td>89</td>
<td>68</td>
<td>2</td>
<td>2,5</td>
<td></td>
</tr>
</tbody>
</table>

Type II of Oxman classification of completely edentulous jaws has been discovered in 41,2% of cases of our study participants, type III and IV – in 29,4% of cases, while type I has not been found at all. Our findings vary slightly from those reported by Ushnitskyi and colleagues (2013b): type I – 0%, type 2 – 2,5%, type III – 33,7% and type IV – 7,5%. It is worth observing that classes I and II of the Kennedy classification of partially edentulous arches predominate not only in ours but in other studies as well and these classes are the most difficult to treat (Table 11).

Table 11. Distribution of partial edentia in elderly groups.

<table>
<thead>
<tr>
<th>Study</th>
<th>I class</th>
<th>II class</th>
<th>III class</th>
<th>IV class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present study</td>
<td>48,3%</td>
<td>31%</td>
<td>20,7%</td>
<td>0%</td>
</tr>
<tr>
<td>Timoshenko &amp; Bragin 2013</td>
<td>42,3%</td>
<td>44,8%</td>
<td>9,2%</td>
<td>3,7%</td>
</tr>
<tr>
<td>Ushnitskyi 2013b</td>
<td>55,56 ± 0,46%</td>
<td>21,15 ± 0,92%</td>
<td>6,09 ± 0,98%</td>
<td>3,58 ± 1,01%</td>
</tr>
</tbody>
</table>

During our study we observed non-caries lesions which arise after teeth eruption. Teeth attrition was found in 48% of cases and it was mainly in the spread form. Other studies also show high prevalence of abnormal attrition from 29,74% to 35,3% in this age group. According to Iordanishvili et al. (2014) men suffer more often from abnormal attrition than
women and this phenomenon intensifies with age. Furthermore, wedge-shaped lesions which affect mostly canines and premolars are observed in 22% of cases.

Since the FT-DMT index is not yet widely used for all population we resorted to the existing data of adolescents with and without history of the psychoactive substances use. Adolescents who have not used psychoactive substances had the FT-DMT index above zero in 39% of all cases and for the adolescents who had used the substances the index was 61% (Opravin 2012). In our study the FT-DMT index was 91%. These findings suggest that dental wellbeing is an issue of acute interest for all age groups but in the elderly it becomes the most urgent.

6.3. Periodontal status

According to the studies periodontal diseases in the young-old and old persons vary from 37,1% to 91,2% (Vahromeeva 2008, Kuzmina 2009, Soldatov 2011, Bragin & Timoshenko 2013). Healthy periodontal tissue was not observed in our study at all, while 17% of gingivitis and 83% of parodontitis were found.

Estimating hygiene level by using OHIS-index we have received the mean value of 3,4±1,0 which indicates poor oral hygiene level. During the examination the abundance of soft and calcified deposits was found. Other studies also indicate that the elderly have inadequate level of oral hygiene (Zinchenko 2008, Kuzmina 2009, Soldatov 2011, Bragin & Timoshenko 2013). Table 12 compares studies of oral hygiene level. It should be noted that good hygienic level was not found in our study. Poor oral hygiene can be attributed to somatic and psychological disorders, deterioration of fine motor skills and low motivation toward maintenance of dental health.

<table>
<thead>
<tr>
<th>Study</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kiseleva et al. 2009</td>
<td>20,4%</td>
<td>25,8%</td>
<td>53,3%</td>
</tr>
<tr>
<td>Present work</td>
<td>0%</td>
<td>41%</td>
<td>59%</td>
</tr>
</tbody>
</table>
The evaluation of inflammatory process was done by using the PMA index. Our results showed milder inflammation rate (25.2%) than was found in another study where more moderate level of inflammation was observed (41.1%) (Vahromeeva 2008).

Data of CPI index vary from study to study (see Table 13). It should be noted that in some studies the sum of all codes did not equal to 100% and the reason has not been explained in the studies (Kiseleva et al. 2009; Bragin & Timoshenko 2013; Aapaliya et al. 2015). Generally these results show a sign of wide spread of severe form of parodontitis.

<table>
<thead>
<tr>
<th>Study</th>
<th>Code 0</th>
<th>Code 1</th>
<th>Code 2</th>
<th>Code 3</th>
<th>Code 4</th>
<th>Code X</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present study</td>
<td>0%</td>
<td>12.3%</td>
<td>8%</td>
<td>10.1%</td>
<td>8%</td>
<td>61.6%</td>
</tr>
<tr>
<td>Aapaliya et al. 2015</td>
<td>4.8%</td>
<td>0%</td>
<td>12.3%</td>
<td>0%</td>
<td>52.6%</td>
<td>66.7%</td>
</tr>
<tr>
<td>Cornejo et al. 2013</td>
<td>1.9%</td>
<td>3.1%</td>
<td>27.1%</td>
<td>18.5%</td>
<td>5.2%</td>
<td>44.2%</td>
</tr>
<tr>
<td>Bragin &amp; Timoshenko 2013</td>
<td></td>
<td></td>
<td></td>
<td>67%</td>
<td>25.1%</td>
<td></td>
</tr>
<tr>
<td>Kiseleva et al. 2009</td>
<td>0%</td>
<td>22.1%</td>
<td>19.7%</td>
<td>11.3%</td>
<td>14.6%</td>
<td>2.6%</td>
</tr>
</tbody>
</table>

Inflammatory processes in periodontal tissues are primarily the consequence of debris and supragingival and subgingival calculus presence. Traumatizing factors, such as overhanging fillings, low-quality contact point due to poor therapeutic treatments and damaging constructional elements of removable dentures can be other reasons of periodontal pathology. Moreover, hyposalivation, alterations of physical saliva parameters, immune imbalance and comorbidity result in development of gum and parodontium diseases.

6.4. Glossal status

In the study of the people aged 18 to 56 from the Izhevsk research group the readings of the tongue dorsal surface test spread from 1.19 to 1.66 depending to the degree of oral cavity dysbiosis (Ivanova 2009). The value of the tongue dorsal surface test in our study was 0.73 which is substantially lower than that of the younger group in the previously quoted study.
Without bacteriological tests it is hard to explain unambiguously why such low value has been obtained. Microbial landscape in our case might have been balanced or in some way connected with the immune status changing (increasing of local immunity markers).

6.5. Salivary status

In our study there were two purposes for collecting the saliva samples. First, they were collected in order to evaluate physical saliva parameters as well as markers of oral cavity immunity. Examination of the samples was conducted right after the collection and included determination of salivary flow rate, viscosity, pH and surface tension for it is important that saliva does not lose its characteristics with time and temperature changes which could distort pH or viscosity data.

It is general knowledge that aging causes overall degeneration which in turn affects anatomical integrity of salivary glands leading to cell atrophy, hyperplasia of lypocites and connective tissues and functional violations such as hypersalivation, or slalorrhea, hyposalivation, or oligosialia. Among the young-old and old age groups salivary flow deterioration occurs in 55,5 % and 26,7% respectively. (Iordanishvili et al. 2012.) Other studies show percentage of patients with the high degree of hyposalivation – xerostomia – in 35% and 14%, respectively. (Ohara 2013, Novitskaya 2014.)

Ohara and colleagues (2013) claim that xerostomia and hyposalivation are two different conditions: xerostomia is the subjective feeling of oral dryness while hyposalivation is connected with the decreased salivary flow rate. They analyzed the data obtained from previous studies and found that not those who have hyposalivation report xerostomia and, contrary, those who report xerostomia may have normal or high salivary flow. On the whole, there are several reasons of hyposalivation, the most frequent being medication: 80% of the commonly prescribed medications are found to cause xerostomia and more than 400 medications are associated with hyposalivation as an adverse effect. Female patients have hyposalivation more often but the cause-and-effect relationship is yet to be found. The studies of menopausal change may help eliminate the gender differences. (Ohara 2013.)
The present study did not find patients with normal level of salivation while there were found cases with no salivation at all and the data were matched with the results of an Ukrainian study (Table 14). We concluded that salivation disturbance found in our study was more pronounced because xerostomia prevailed among the participants (52,1%) while in the above quoted study the second stage of hyposalivation was the most common (Novitskaya 2014). It is worth noting that in an Yakutian study the participants of two age groups, those 65 to 74 and 75 and over had normal salivation rate (0,57±0,04 and 0,61±0,08 respectively) (Ushnitskyi et al. 2013a).

Table 14. Severity of hyposalivation among the elderly.

<table>
<thead>
<tr>
<th>Salivation flow rate (ml/min)</th>
<th>Novitskaya 2014</th>
<th>Present study</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of participants (%)</td>
<td>Mean value</td>
</tr>
<tr>
<td>Normal (&gt; 0,5)</td>
<td>2 (2,6%)</td>
<td>0,61</td>
</tr>
<tr>
<td>Hyposalivation, 1 stage (0,49-0,35)</td>
<td>4 (5,2%)</td>
<td>0,38</td>
</tr>
<tr>
<td>Hyposalivation, 2 stage (0,34-0,25)</td>
<td>34 (43,6%)</td>
<td>0,32</td>
</tr>
<tr>
<td>Hyposalivation, 3 stage (0,24-0, 1)</td>
<td>27(34,6%)</td>
<td>0,15</td>
</tr>
<tr>
<td>Xerostomia (&lt; 0,1)</td>
<td>11 (14 %)</td>
<td>0,08</td>
</tr>
</tbody>
</table>

Zinchenko (2008) demonstrates that saliva viscosity in the elderly (mean age 61,7±0,4 years) is 1,8 times higher than in adults (mean age 36,2±0,3 years) and this correlates with the data obtained in our study. Moreover, Ushnitskyi and colleagues (2013a) demonstrates viscosity level even higher than that obtained in the present study: 3,84±0,13 in 65 to 74 age group and 3,73±0,18 in 75 and over age group.

We identified pH mean value (6,0) that is lower than pH mean found among population of central and southern Russia aged 18 to 65: 7,0 and 6,5 respectively (Dobrenkov 2014).

6.6. Immune status

The study of Malezhik and colleagues (2011) suggests the following explanations of local immunity changes: the elderly suffer frequently from various gum and oral mucosa inflammatory diseases which are exacerbated by degenerative processes and atherosclerosis. Concomitant atherosclerosis and myocardial dysfunctions aggravate the course of local inflammatory processes in parodontiun and limit its adaptational and
compensatory capacity making the preservation of normal functions the most immediate problem for the dentist. Some studies point out the necessity of further investigation of adaptational resources of the body, including the oral immunity, even in advanced age in order to help restore and maintain normal functioning. (Malezhik 2011.) It should be noted that so far there does not exist age norm of oral immunity markers which can be influenced by many factors such as places of residence, climate conditions, geomagnetic field and nutrition.

Following our study protocol we have examined a set of oral immune status markers such as SIgA, IgG, TNF-α, IL-8 and stress-hormone cortisol level in saliva samples of the participants. Table 15 compares results obtained in our study with the data from other studies.

Table 15. Levels of immunity markers in saliva.

<table>
<thead>
<tr>
<th>Marker</th>
<th>Malezhik et al. 2011 Young-Old 60–74 n=96</th>
<th>Soldatov 2011 Young-Old 60–74 n=47</th>
<th>Lobeyko et al. 2015 Young-Old 61–74 n=20</th>
<th>Present study Young-Old 60–74 n=47</th>
<th>Present study Old 75–90 n=23</th>
</tr>
</thead>
<tbody>
<tr>
<td>IL-8 (pg/ml)</td>
<td>234,5 (113,4; 284)</td>
<td>11,2±2,2</td>
<td>411±44</td>
<td>537,1±262,3</td>
<td>368,0±154,7</td>
</tr>
<tr>
<td></td>
<td>10,7±2,2</td>
<td>Old</td>
<td>342±31</td>
<td>Old</td>
<td>154,7</td>
</tr>
<tr>
<td>TNF-α (pg/ml)</td>
<td>11,0±1,7</td>
<td>18,3±2,9</td>
<td>0,83 (0,686; 0,88)</td>
<td>Old</td>
<td>2,5 (0,095; 4,2)</td>
</tr>
<tr>
<td></td>
<td>9,5±1,9</td>
<td>Old</td>
<td>29,6±3,2</td>
<td>Old</td>
<td></td>
</tr>
<tr>
<td>IgG (mg/ml)</td>
<td>36 (0,15; 0,45)</td>
<td>Young-Old 9±0,02</td>
<td>Young-Old 25,0±11,4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Old 8±0,03</td>
<td>Old 24,4±11,1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>sIgA (mg/l)</td>
<td>308,5 (293,9; 323,1)</td>
<td>Young-Old 920±0,07</td>
<td>Young-Old 416,1±176,3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Old 720±0,07</td>
<td>Old 377,2±195,4</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

IL-8, TNF-α, IgG, sIgA readings are expressed by x±SD or Md (Q1; Q3)

The saliva examination may indicate the presence of broad range of substances reflecting to
the state a person’s health so the present study used the modern laboratory method, such as ELISA, to determine the levels of various immune parameters and their biological activity in the saliva found even in low concentrations.

SIgA constitutes the predominant immunoglobulin isotype in secretions including saliva and maintains integrity of oral mucosa through several mechanisms. It limits microorganisms and viruses adhesion on the surface of mouth epithelium and dental hard tissues such as Streptococcus mutans (Dobrenkov 2014), it neutralizes pathogens’ enzymes and toxins and functions concomitantly with other antibacterial factors such as lysozyme, lactoferrin and saliva peroxidases. Moreover, SIgA plays a crucial role in pathogens penetration prevention in oral mucosa. This fact is of extremely importance because there is a lack of complement system subcomponents and effector cells (monocytes, lymphocytes, and polymorphonuclear leukocytes) in saliva. (Agaeva 2010.) SIgA, as well as other immunoglobulines, belongs to immune humoral factors. Though the humoral immunity map is very individual the normal thresholds of physiological concentrations have been found for adult and children. Thereby, normal levels of SIgA in saliva fluctuate from 115,3 to 299,7 mg/l according to manufacturer of test-systems for ELISA. Simultaneously, it has been advised to use this range only as an approximate and determine the range of SIgA concentration for each laboratory. (Vector-best 2016.) It is pointed out that SIgA concentration depends on salivary flow rate, dietary factors and the state of psychological and physical health (Miletic et al. 1996, Malathi, Mythili & Vasanthi 2014). In our study we have found the level of SIgA to be 390,16 mg/l which exceeds approximate norm of the manufacturer. Lobeyko et al. (2015) found concentrations of SIgA to be 2,2 and 1,9 times higher than those found in our study in the group of young-old (60 to 74) and old (75 to 90) patients, respectively. However, the decreasing trend of SIgA has been observed as in our study.

IgG is a glycoprotein which is secreted by plasma cells (B-cells). It is a predominant immunoglobulin in normal serum (70-75%, approximately 10 mg/ml). (Divya & Sathasivasubramanian 2014). IgG is a nonsecretory immunoglobulin which enters the oral cavity by passive diffusion through the bloodstream but it can be produced in the oral
cavity by plasmocytes after specific stimulation. Then it proceeds to the place of an immune conflict in the submucosal and mucosal layer. The factors which may increase delivery of serum immunoglobulins into secrets are inflammation of the oral mucosa and its trauma and local allergic reactions. In such cases, the arrival of a large number of serum antibodies to the place of antigen conflict is a biologically appropriate mechanism for strengthening local immunity. Accordingly, it can be assumed that in the young people the barrier function of the mucous membranes of the mouth is optimal, that is why the penetration of nonsecretory immunoglobulin in the saliva in this group of persons is less pronounced. IgG-class antibodies have pro-inflammatory properties and can acquire immunopathologic role when the elimination of antigen is impossible. (Lobeyko 2015.) We have received the IgG values which were lower than in the study of Malezhik (2011), but much higher than in the study of Lobeyko et al. (2015) although the tendency of lowering of the marker with aging is common. The increase in salivary IgG may be due to increased permeability leading to passive diffusion of IgG from the vascular and extravascular compartment into the saliva. This may be suggestive of the active inflammatory process. (Balakrishnan & Aswath 2015.)

IL-8 is a protein and chemoattractant cytokine produced by a variety of tissue and blood cells such as monocytes, T-cells, neutrophils, fibroblasts, endothelial cells, keratinocytes, hepatocytes, chondrocytes and astrocytes as a response to various stimuli including proinflammatory cytokines (IL-1, TNF-α), bacteria, viruses and the results of their metabolism. Unlike many other cytokines, it attracts and activates neutrophils in inflammations. Neutrophils represent the major population of immigrant cells in periodontitis and its response to IL-8 is characterized by migration of the cells, the release of granule enzymes and other intra- and extracellular changes. (Bickel 1993.) Besides, IL-8 takes part in stimulation and degranulation of leukocytes, angiogenesis, promotes the migration of phagocytes in the inflammation focus and causes the synthesis of adhesion molecules. Increased levels of IL-8 were found in patients with tumours (the markers for oral squamous cell carcinoma, head and neck squamous cell cancer), bowel, muscle and joint, kidney, lungs diseases and sepsis. (Rathnayake et al. 2013, Vector-best 2016.) Comparison of our results with the data provided by Lobeyko (2015) shows relatively high
values of IL-8 and the tendency of concentration reduction from the young-old to old age group. Apparently, the decreased concentration of IL-8 with aging leads to a decrease in neutrophils chemotaxis into inflammation centers in the oral cavity and the increased level of bacterial complications.

TNF-α is a proinflammatory cytokine and has several biological effects which are beneficial for host organisms in inflammation and in protective immune responses against a variety of infectious pathogens. TNF-α promotes gene transcription and cell activation perform thereby its anti-tumor activity towards some neoplastic cells, inducing tumor cell apoptosis and cachexia. It activates granulocytes, macrophages, endothelial cells, hepatocytes (acute phase proteins production), osteoclasts and chondrocytes (cartilage and bone tissue resorption), the transcription of other proinflammatory cytokines. This cytokine along with other cytokines from TNF superfamily stimulates differentiation and proliferation of neutrophiles, fibroblasts, endothelial cells (angiogenesis), hematopoetic cells, T- and B-cells and reinforces entrance of neutrophils from bone marrow to bloodstream. TNF-α plays a crucial role in infections, sepsis and autoimmunity processes as well as the pivotal involvement of these molecules in the development of secondary lymphoid organs. (Pfeffer 2003.) Data presented by Soldatov (2011) and Lobeyko (2015) was considerably higher than obtained in our study while a study conducted in Sweden referred to TNF-α concentration below the detection level in more than 50% of the samples. And again, there is the same tendency of increasing concentration from the young-old to the old group (Soldatov 2011, Rathnayake et al. 2013, Lobeyko 2015).

Cortisol is a steroid hormone (glucocorticoid) secreted by the adrenal cortex from cholesterol. Cortisol releases as a response to physical activity and acute stress. It also regulates energy by selecting the right type and amount of substrate (carbohydrate, fat or protein) the body needs to meet the physiological demands placed on it. Chronic elevation of cortisol can have detrimental effect on weight, immune function and lead to increased chronic disease risk. (Aronson 2009.) A research has shown that high morbidity among athletes during high work load could be related to increased levels of cortisol which has an immunosupression effect in the body (Afanaseva 2009).
Hormone level has distinct circadian rhythm and normal concentration in the blood samples is between 190-690 nmol/l in the morning and between 55-250 nmol/l in the evening. Secretion in saliva where cortisol exists in unbond form is also rhythmical: 4,11-20,39 nmol/l in morning hours and 0,6-7 nmol/l in evening hours for females of 51 – 70 years. (Salimetrics 2016.) The results of cortisol concentrations in saliva in our study are slightly higher (22,8 nmol/l for a.m. hours) than the data from assay-kit manufacturer which can be used as a guide only, and there is a trend to cortisol concentration growth from the young-old group to the old. Potentially, it could be a sign of chronic stress influence associated with increased levels of salivary cortisol, salivary IgA and lysozyme (Malathi, Mythili & Vasanthi 2014). This elevated cortisol level can be a marker of a number of conditions. There is factor which influences on cortisol concentration in saliva - gum micro bleeding can cause elevated results due to presence of blood in the saliva. (Kiev and Ukraine Laboratories, 2009.)

In our study we have found some imbalances in the local immune responses to the pathogens. The changes in immunological parameters are to be further examined to determine the relationships between markers and diseases. Likewise, there can be an assumption made about the existence of inflammoaging – chronic, low-grade, “sterile” inflammation, due to several causes, including age-related changes of the immune system. Apparently, the increased levels of local immunity markers could be a symptom of inflammoaging in the oral cavity. (Franceschi & Campisi 2014.)

**6.7. Study limitations**

In our study we used a list of various methods and parameters to estimate the oral health of the elderly. This type of approach is the advantage of our study, but due to the large amount of tests not a sufficient number of patients have been examined and so the obtained data can be transferred to the whole elderly population of Arkhangelsk with reservations because our study focused on the persons living in the home for the elderly. Modern methods, such as electron microscopy of saliva droplets or ELISA, were applied while some are out-of-date (Hess viscometer). Furthermore, the medical status data was construed on the participants’
self-assessment and so no verification to the answers from the anamnestic data was possible. Therefore, there is no proven relationship found between systemic diseases and oral cavity conditions. The immune markers analyzed in this study are general while more specific markers are required to achieve the necessary specificity.
7. CONCLUSION

The primary aim of the study was to determine the level of the main oral health indices in the elderly residing in the home for the elderly in Arkhangelsk, Russia. The oral health markers were divided into dental, periodontal, salivary, glossal and immune status. An attempt to evaluate each status by modern methods has been made and the research hypothesis that the older people have worse dental health has been found true.

After comprehensive examination of the group of the elderly we have concluded that aging affects all the basic parameters of oral health. Dental status of the patients is characterized by 100% prevalence and very high intensity of caries with predominance of extracted teeth, the presence of untreated non-caries lesions and neglect towards dental health according to FT-DMT index results. All the participants of the study were partially or completely edentulous and 65% of them needed prosthetic care. We have observed poor oral hygiene level and prevalence of parodontitis with mild levels of inflammation. Deterioration in salivary status manifests by a decrease in salivary flow rate and pH and increase of saliva viscosity and surface tension. The study of MCS shows low MPS. The tongue dorsal surface test reveals the presence of coating on the tongue dorsum. The changes in immune status consist of elevated of SIgA, IgG, IL-8 and cortisol levels and a decrease in TNF-α level in saliva samples.

Furthermore, significant links between various parameters of oral health have been found such as DMFT and FT-DMT, OHIS and PMA and others (see RESULTS). However, the influence of bad lifestyle habits on the dental wellbeing of the elderly has not been detected in our study because smoking and alcohol use/drinking predominantly were not reported in our study group.

Further investigation of the elderly living in the North of Russia is necessary because of the present study limitations. We believe that we have found important oral health tendencies which prevail globally and at the same time reflect the specificity of Russia’s population.
and climate. The algorithm of oral examination developed in this study can be used as a comprehensive method of oral health assessment in different groups of patients.

The data obtained in this as well as other relevant studies can form a sound foundation for the formulation of comprehensive social and health care policy for the elderly. As Rodrigues and colleagues (2012) claim promotion, prevention, treatment and rehabilitation are key parts of the health care. The analyses of oral health condition of the elderly, education of dentists in different countries and special programs to preserve oral health in this group of patient lead to the conclusion that there is an urgent need of policy modifications in relation to the elderly. At present it is clear that dental aid is to be made fully available for the elderly both economically and logistically; as well as comprehensive training programs on geriatric dentistry are to be developed.

At the same time it is very important to underline that health care improvements can not be restricted to this age group. Continuous efforts by health and state authorities to educate younger generation and improve the lifestyle with the aim to maintain oral health are to be made. (Rodrigues et al. 2012.)

Until the comprehensive data on the topic is obtained to make generalized proposals, it is difficult to formulate recommendations for patients and social workers which can improve oral wellbeing of this group of people by increasing motivation for seeking dental help. Still, the following can be stated:

- maintenance of oral hygiene is a leading factor in prevention of dental diseases which can be related to systemic disorders or quality of life deterioration;
- dental check-ups should be done regularly, at least twice a year;
- tooth extraction should not be longer accepted as a preferable method of dental treatment;
- replacement of missing teeth with dentures should be regarded as a normal procedure with a view to prevent further deterioration of dental health.
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ИНФОРМИРОВАННОЕ СОГЛАСИЕ ПАЦИЕНТА
на участие в клиническом исследовании

Вас приглашают принять участие в научном исследовании, посвященном изучению стоматологического здоровья населения Северо-Западного региона России.

Конфиденциальность:
Информация, полученная лично от Вас в ходе этого исследования, останется конфиденциальной. Доступ к Вашим документам будет ограничиваться уполномоченным персоналом в соответствии с законодательством, рекомендациями и стандартами профессиональной деонтологии. Результаты данного исследования могут быть опубликованы на научных собраниях и в публикациях, информация также может быть предоставлена государственным официальным инстанциям – в любом случае без указания на Вашу личность.

Я, __________________________________________
(ФИО участника)

информирован(а) о целях и задачах проводимого исследования стоматологического здоровья населения и согласен(на) на участие.

Я информирован(а) о том, что могу в любое время по моему желанию отказаться от дальнейшего участия в исследовании, и это не повлечет отрицательных для меня последствий.

Я добровольно соглашаюсь, чтобы данные, полученные в ходе исследования, использовались в научных целях и были опубликованы с условием соблюдения правил конфиденциальности.

Дата «____» ___________ 201 г.
Подпись участника __________________________

В моем присутствии участник __________________________ подписал(а) информированное согласие на участие в исследовании
Подпись исследователя __________________________
### Examination card of dental patient

**Surname** ___________________________________________ **Name** ___________________________________________

**Age** ___________________________________________ **Place of residence** ___________________________________________

**Date**

**Dental diagnosis**

**Comorbidities**
Respiratory system ___________________________________________ Gastrointestinal tract
Urinary system ___________________________________________ Cardiovascular system
Nervous system ___________________________________________ Undergone surgery
**Allergy** ___________________________________________ **Pernicious habits** ___________________________________________

**Dental part**

**Last visit of a dentist**

**Complaints**

**External examination data**

**Oral cavity examination**

**Dental formula**

<table>
<thead>
<tr>
<th>1</th>
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<td>4</td>
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**Occlusion** ___________________________________________ **DMFT** ___________________________________________ **Hygiene index** ___________________________________________

**PMA** ___________________________________________ **CPI** ___________________________________________

**Saliva characteristic, microcrystallisation type**

<table>
<thead>
<tr>
<th>Salivation rate</th>
<th>Saliva viscosity</th>
<th>Saliva surface tension</th>
<th>pH</th>
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<tbody>
<tr>
<td>IgA</td>
<td>IgG</td>
<td>TNF-α</td>
<td>IL-8</td>
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