

Investigation of the Correlation Between the State of Prosthetic Appliances, Organ System Dysfunctions and the Degree of Independence in Elderly Home Residents

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Summary

The aim of the investigation was to evaluate the quality of prosthetic appliances relative to chronic organ system dysfunctions and the level of independency in a group of elderly individuals. The study group included 175 elderly home residents in the Zagreb region over 60 years of age (average 76.8 years, S.D. 10.72), which consisted of 66 male (37%) and 109 female (63%) individuals. The examination included dental status, oral and general health history. Quality of prosthetic appliances was evaluated according to the CDA index for fixed, and the modified Nevalainen et al. index for removable prosthetic appliances. Assessment of functional independency of an individual was done using the Activity of Daily Living index by Miura, Araki and Umenai. Over 82% of individuals were in need of fixed, removable or combined prosthetic treatment. The most common general health conditions involved cardiovascular (29%) and locomotor (18%) systems. Correlation was determined between the poor state of prosthetic appliances and chronic conditions of CVS ($r=0.54$, $p<0.05$) and locomotor ($r=0.69$, $p<0.05$) systems, psychological ($r=0.88$, $p<0.05$), neurological ($r=0.72$, $p<0.05$) and digestive ($r=0.65$, $p<0.05$) dysfunctions. Spearman's correlation analysis determined significant correlation between the ADL and the CDA indices scores ($r=-0.468$, $p<0.01$), and the ADL and the modified Nevalainen's et al. indices scores ($r=-0.572$, $p<0.05$), where lower ADL scores were correlated to the poorer condition of the prosthetic appliances.

Key words: elderly, prosthetic appliances, ADL index, organ system dysfunctions.

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Introduction

Degenerative changes of sensory organs and psychological scope in the elderly impair normal physiological as well as social functions. The effects of such impairment of an individual become evident on the entire organism, various organ systems, and especially the state of remaining teeth and prosthodontic appliances, which are often less than satisfactory. Adequate and complete prosthodontic therapy influences the gastrointestinal system and nutritional capability in the elderly, directly influencing their quality of life. With the growing population of elderly people the overall number of chronic disabilities and diseases also increases, thus causing an increase in various therapeutic intakes (1). During dental treatment planning for elderly dental patients more time is needed for studying medical histories and treatments, and calls for intense consultations with general medical practitioners (2).

The tendency in modern dental and prosthodontic therapy is to preserve as many intact teeth as possible. Osterberg, Mellstrom and Sundh (3) in their comparative investigation of edentulousness of the elderly, over 70 years of age in Göteborg determined that within a ten year span edentulousness dropped by 18% (from 52% to 34%). Hildebrand et al (4) investigated the chewing quality in an elderly population and established that teeth positioning is the key factor, influencing the quality of chewing. A number of studies suggest higher probability of tooth loss and oral diseases in functionally incapacitated elderly compared to their functionally independent counterparts (5-8). The finding is explained by the inability to maintain proper hygiene and regularly perform dental check-ups (5-8). Hildebrand, Loesche, Lin and Bretz (9) have warned of the relationship between the functional integrity of dental arches and health of different organ systems. Chewing capability and strength deteriorates with age, mainly due to the loss of teeth. Other orofacial changes related to ageing which influence chewing capability deterioration include lip positions, chewing muscles and tongue function, changes involving swallowing, oral stereognostic capability, tongue sensitivity and taste. Chewing function in denture wearers does not match their dentate counterparts. To a certain extent, functional damage depends on

the presence and quality of dentures, quality and state of FPDs, teeth and their supporting structures. Relationship has been determined between the reduced masticatory function and general health deterioration. Poor oral health condition with poor quality of present prosthodontic appliances can be important factors, causing improper food consumption, indigestion and involuntary weight loss in persons with general health impairment.

Aim of investigation

The aim of the investigation was to evaluate quality of prosthodontic appliances relative to organic system dysfunctions and the level of independence within a population of elderly home residents living in Zagreb, Croatia.

Material and methods

The investigation was performed on a group of 175 elderly home residents over 60 years of age (average 76.8, S.D. 10.72), consisting of 66 male (37%) and 109 female (63%) individuals. Dental status and general health history was recorded. Evaluation of crown and bridge quality was done using the California Dental Association (CDA) index (10) by two trained examiners in the standardized CDA index clinical parameters.

The evaluation of removable dentures was done according to the modified Nevalainen et al. index (11) for the quality of dentures. The special needs evaluation was performed in collaboration with psychologists working in the institutions for the elderly involved in the study. Standardized method used was the Activity of Daily Living (ADL) index by Miura, Araki and Umenai (12) ranging from level 1 (functionally completely dependent on professional help) to 5 (functionally independent) according to the following criteria: ability to feed, bathe, independently dress, maintain personal hygiene, presence of incontinence, and mobility (12).

Statistical analysis was performed by the SPSS for Windows 11.0 statistical software package.

Results

More than 82% of the subjects were in need of new fixed, removable or combined prosthodontic appliances. The most common general health problems included the cardiovascular (29%) and locomotor (18%) systems (Figure 1). Seven subjects (4%) scored 1 on the ADL index (completely dependent), while 52.6% scored 5 (functionally independent) (Table 1). Only 19.8% of the subjects had visited a dentist within the last 5 years, while 39% had not visited a dentist in over 10 years.

Over 80% of crowns and bridges needed replacement due to improper seating and marginal adaptation which presented the largest problem. Due to poor shape, color and surface quality 40% of the crowns and bridges needed replacement. Only 10% of the crowns and bridges were rated as adequate (Figure 2).

Evaluation of the quality of dentures according to the modified Nevalainen et al (11) index showed extremely poor and poor retention found in 58%, and extremely poor and poor stabilization in 60% of upper dentures. Extremely poor and poor retention was determined for 84% of lower dentures, and extremely poor and poor stabilization for 66% of lower dentures.

Correlation was determined between poor state of prosthodontic appliances and chronic diseases of the cardiovascular system ($r=0.54$, $p<0.05$), locomotor system ($r=0.069$, $p<0.05$), mental health disturbances ($r=0.88$, $p<0.05$), neurological diseases ($r=0.72$, $p<0.05$) and gastrointestinal diseases ($r=0.65$, $p<0.05$).

Although correlation between poor state of the prosthodontic appliances and respiratory diseases was borderline ($r=0.39$, $p=0.052$), it was determined as not statistically significant, just as such correlation with genitourinary and endocrinologic diseases ($p>0.05$).

Spearman's correlation analysis determined significant correlation between the ADL and the CDA indices scores ($r=-0.468$, $p<0.01$), as well as between the ADL and the modified Nevalainen et al. indices scores ($r=-0.582$, $p<0.01$), where lower ADL value was correlated with poorer condition of prosthodontic appliances.

Discussion

The study results show that 87% of subjects were in need of prosthodontic therapy. These results are in agreement with a study by Knabe and Kram (8) who showed similar findings.

Similar stability of upper and lower dentures was found. However, after correcting the results by the age factor of the dentures it was evident that the stability of upper dentures was significantly poorer compared to that of lower dentures. This finding is in agreement with a study by Nevalainen et al (11), who explain it by the difference in stability of the upper and lower dentures at the time of their first placement. Anatomic and morphologic changes after dentures placement involving the upper jaws are greater compared to the lower jaws. Stability of upper dentures at the time of their first placement is usually very good, but it deteriorates with time. Stability and retention of lower dentures at the time of placement is usually already poorer than the upper dentures, but it deteriorates at a slower rate compared to the upper dentures. Suenaga et al (13) showed that the lower denture base size was not significantly correlated to the amount of alveolar ridge resorption, which could also explain the results of the present study.

The results of the modified Nevalainen et al (11) index showed that retention of the upper dentures was considerably better compared to the lower denture retention, which is most likely due to the negative pressure valve present in the upper jaws as opposed to the lower jaws. In the lower jaws such negative pressure effect is impossible due to the shape and size of the denture retention surface, tongue function and masticatory muscle insertions.

Lester, Ashley and Gibbons (14) investigated the relationship between dental status, socioeconomic indices and the need for dental therapy in a group of 263 impaired and functionally dependent elderly. Overall, they found 67% edentulous subjects, with age-dependent growing trend from 45% in 60-70 year-olds to 83% in a group of over 90 year-olds. This result of Lester, Ashley and Gibbons on an overall scale was worse than that of the present study where 37.9% of subjects were edentulous (14). However, the results of the marginal adaptation of crowns and bridges were similar to the results of the pres-

ent study, which are significantly different than the results of Glanz et al. (15) who determined that the crowns were better marginally adapted than the bridges. This dissimilarity could be due to the differences in socioeconomic statuses of the investigated parts of Croatian and Swedish elderly population, relative to the determined statistically significant correlation between the age of the appliance and quality of its marginal adaptation ($p < 0.05$). This is supported by the results of the present study which show 78.6% of crowns and 75% of bridges older than 5 years, and even 64.3% of crowns and 60% of bridges older than 10 years.

In their studies McEntee, Stolar and Glick (16), Kiyak (17), and Slade et al (18) determined statistically significant correlation between the socioeconomic status and the number of teeth present. Number and severity of general health problems and systemic conditions were also greater and more intense in the elderly home residents, supporting the theory of the mentioned studies that the health of the oral cavity positively correlated to the general health (16-18). Results of the present investigation are in agreement with their studies. Similar results were found by Steele et al (19) investigating dental status and the need for dental treatment in 2280 subjects over 60 years of age living in three different communities in England. Between 33% and 57% of subjects were edentulous, compared to 37.9% of edentulous subjects in the present study. Steele et al (19) also confirmed the importance of regular dental check-ups with a statistically significant difference in the number of crowns, where 41.8% of the individuals attending dental check-ups on a regular basis had at least one crown, as opposed to only 10% of those individuals who did not regularly visit dentists. Loesche et al (20) investigated dental and oral health relative to lifestyle and general health status in two groups of elderly individuals, one group being elderly health residents, and another group presented non-institutionalized independent elderly individuals. Their study showed statistically significant correlation between the level of functional dependency of individuals and oral health, where the group

of functionally dependent elderly home residents demonstrated significantly more edentulous individuals, poorer oral hygiene and greater need for prosthodontic treatment. Loesche et al (20) also determined correlation between general health problems, functional dependency and oral health. The results of the present study determined statistically significant correlation between the ADL index and the CDA index values ($r = -0.468$, $p < 0.01$), and the ADL and the modified Nevalainen et al. indices scores ($r = -0.572$, $p < 0.01$), where the lower ADL score was correlated to poorer prosthodontic appliance condition. This finding is completely in agreement with the results of the Loesche et al study (20).

Ettinger (21), and Kail and Silver (22) argue that there are various reasons responsible for the high level of prosthodontic treatment requirement amongst elderly individuals, especially those who are ill and functionally dependent. This argument is supported by the results of the present study in which significant normative prosthodontic treatment requirement was determined within the targeted elderly population.

Conclusions

Based on the results of the study and current literature it can be concluded that adequate and complete prosthodontic treatment has important influence on nutritional state, as well as the state of other organ systems in elderly individuals, directly influencing their quality of life.

Relationship between the state of the masticatory system and oral health and the state of other organ systems is obvious in elderly individuals suffering from chronic diseases and dysfunctions, specifically those functionally dependent elderly home residents. This was confirmed by the determined correlation between the poor condition of prosthodontic appliances and chronic conditions of locomotor, cardiovascular and digestive systems, and psychological and neurological dysfunctions.