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Original article

Ten-year longitudinal study on the state of dentition and subjective masticatory ability in community-dwelling elderly people

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ABSTRACT

Purpose: The aim of this study was to reveal whether the differences in further loss of teeth and occlusal supports, and change in masticatory ability depend on the status of dentition at the age of 70 in community-dwelling elderly people.

Methods: A 10-year longitudinal survey was carried out on 349 (176 females and 173 males) elderly subjects. The subjects to be analyzed were classified into four groups in accordance with the classifications of Miyachi's Triangular Classification. Zone A: subjects with ten or more occlusal supports. Zone B: those with nine to five occlusal supports. Zone D: those with four or fewer occlusal supports and 11 or more remaining teeth. Zone C: those with ten or fewer remaining teeth. The numbers of remaining teeth and occlusal supports were recorded in both examinations. Questionnaires regarding their food intake status were given to subjects.

Results: Subjects in Zone B had greater numbers of teeth loss than those in Zones A and C. Subjects in Zone B and D lost greater numbers of occlusal supports than subjects in Zones A and C. The number of food items that could be chewed had significantly decreased in subjects who remained in Zone A and those who changed from Zone B to Zones D and C.

Conclusions: It was shown that various states of dentition classified by Miyachi's Triangular Classification at the age of 70 resulted in different numbers of remaining teeth and occlusal supports and changes in masticatory ability 10 years later in community-dwelling elderly people.

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1. Introduction

Masticatory ability plays a vital role in nutrition intake [1] and the enjoyment of daily activities [2,3]. It is important to correctly evaluate masticatory ability in order to establish health and improve QOL in elderly patients. To date, research based on a variety of both subjective and objective evaluation methods showed that the masticatory ability of elderly people is affected by factors such as the number of remaining teeth [4,5], the number of occlusal supports [6], occlusal force [7], salivary flow rate [8], and periodontal status [9]. Moreover, the crucial factors for masticatory performance vary, depending on the phase of occlusal collapse [10]. Tooth loss and a decrease in occlusal supports associated with aging are estimated to be the foremost factors reducing masticatory ability in elderly people.

In clinical practice, it is assumed that the prognosis of residual teeth is affected by tooth-related factors such as tooth type, periodontal condition, root canal treatment, and abutments for dentures, and is also affected by status of dentition expressed by occlusal supports and residual teeth [11,12]. Recent research is aimed at classifying clinical characteristics of the patient, evaluating the degree of difficulty of prosthodontic care, and then applying this information in diagnosis and treatment planning [13]. Evaluation of the status of dentition is included as one aspect. Miyachi's Triangular Classification [14], which is widely used in clinical practice today [15–17], was adopted as part of the multi-axis assessment protocol to measure treatment difficulty in prosthodontic care recommended by the Japan Prosthodontic Society. This classifies patients seeking prosthodontic care into four types using coordinate systems based on the number of remaining teeth and the number of occlusal supports in order to evaluate the degree of difficulty of prosthodontic treatment. The rationale behind the classification system is based on the clinical observation that the risk of the changing status of dentition varies depending on the area. In order to establish the clinical effectiveness of assessment of states of dentition, changes taking place over time in the state of dentition and resultant changes in function need to be verified based on long-term acquisition of longitudinal data.

In the present study, a ten-year follow-up study was carried out targeting community-dwelling elderly people living in Niigata City from the time when they were 70 years old until they turned 80. Changes in the state of dentition were analyzed based on the concept of Miyachi's Triangular Classification, and changes in masticatory ability were examined by means of questionnaires. The aim of this study was to reveal whether the differences in further loss of teeth and occlusal supports, and changes in masticatory ability depended on the status of dentition at the age of 70 in community-dwelling elderly people.

2. Materials and methods

2.1. Subjects

Study questionnaires were mailed to all residents of Niigata City who were 70 years old as of April 1998 (4542 people),

asking if they would like to participate in the study. Replies were received from 3695 people. Of those, people who were willing to undergo health checkups were given preference and 600 people were randomly selected with approximately the same number of males and females, in order to investigate the influence of gender. A baseline study was conducted in 1998, when the participants were 70 years old, and follow-up studies were subsequently conducted once a year. In the research described here, analysis was conducted of 349 people (176 females and 173 males) who participated in both the baseline study and the study conducted ten years later, when they were 80 years old. All of the analyzed subjects were healthy and were living independently, without receiving any special nursing care. The study protocol was approved by the Ethics Committee of the Faculty of Dentistry, Niigata University.

2.2. Oral examination

Oral examination was conducted to record the state of remaining teeth and the present condition of removable dentures. Residual root stumps and the pontics of fixed bridges were excluded. Abutments of telescopic dentures were included as remaining teeth. Four dentists conducted the examination, and calibration of the examiners was done prior to examination in the baseline and later studies.

2.3. Classification of the status of dentition

The subjects to be analyzed were classified into four groups based on the number of occlusal supports and the number of remaining teeth, in accordance with the classifications of Miyachi's Triangular Classification [14] (Fig. 1). If a patient had the same type of teeth in both the maxillary and mandibular jaws on the ipsilateral side, it was considered to be one occlusal support, and the total number of such pairs was calculated as the number of occlusal supports. The number of remaining teeth was defined as the total number of remaining teeth in the maxillary and mandibular jaws, excluding third molars. In the original triangular classification, residual tooth roots were considered as remaining teeth. In this study, however, because we were not able to obtain information as to whether the residual tooth roots were targeted for extraction, or whether they were useful teeth that were actively being used, they were treated as lost teeth.

The classified groups were labeled using the notation used by Kuboki et al. [13], who adopted Miyachi's Triangular Classification to classify the location and extent of edentulous areas. Subjects with ten or more occlusal supports were classified into Zone A, while those with nine to five occlusal supports were classified into Zone B, those with four or fewer occlusal supports and 11 or more remaining teeth were classified into Zone D, and those with ten or fewer remaining teeth were classified into Zone C.

2.4. Questionnaire on food acceptance

Subjects were given a questionnaire regarding their food intake status, which was created with reference to questionnaires evaluating the masticatory ability of complete dentures devised by Sato et al. [18] and Hirai et al. [19]. In the

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