Bone Mineral Density: A Risk Factor for Periodontal Disease Progression?

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What changes are required from the fields of gerontology and geriatrics in response to the changes seen in the country and societies it seeks to serve? In Japan, it is well known that the number of elderly people in the population—people over the age of 65—has been exceptionally rapid. It is estimated that by the year 2010, the elderly population will comprise 22% of the total Japanese population.

To examine the many links between oral health and general health and well-being, and to make the findings useful for policy making, our longitudinal interdisciplinary study on aging (Niigata Study) was begun in 1996. Figure 1 shows the variables that we selected in the Niigata Study, and Figure 2 shows the outcomes of the Niigata Study, which we have confirmed.1-4

Osteoporosis is the most common metabolic bone disease among the elderly, and the incidence of osteoporotic fractures obviously increases with age. In addition, elderly people often experience periodontal destruction. Because bone loss is a common feature of periodontitis and osteoporosis, both diseases may share common etiologic agents that influence their processes. The final expression of periodontitis is mediated by the complex interactions occurring within an intricate mosaic of host, microbial factors and environmental factors.5 We evaluated the relationship between systemic bone mineral density and periodontal disease, controlling the known confounding factors.6

Summary

According to a registry of residents, questionnaires were sent to all 70-year-olds among the 4,542 inhabitants of Niigata city in Japan. Participants were informed of the purpose of the survey and the overall response rate was 81.4%. After dividing the residents into groups of males and females, 600 people—which became the screened population—were selected randomly in order to have approximately the same percentage of males and females. The final expression of periodontitis was examined using a modified classification system.7 We compared the screening results with the bone mineral density derived from the same group of people, and found that those with lower bone mineral density had a higher number of periodontal pockets. This suggests that bone density and periodontal health may be associated.

Drilling Is No Longer Necessary

The frightening sounds of the drill wafting into the dental practice waiting area could soon be a thing of the past. At least during the early stages of caries, annoying drilling could become a thing of the past. Japanese researchers have developed an artificial dental enamel with which small holes can filled without the use of the sometimes painful procedure of drilling.

With the white paste small holes can be repaired quickly, thus write the researchers around Kazue Yamagishi from the Dental Institute in Tokyo in the current issue of the magazine Nature (Vol. 433, S. 819).

The artificial enamel is chemically and structurally similar to natural enamel. Once laid on the tooth, it adheres to the natural enamel by so-called nano-crystalline growth. After being allowed to work for 15 minutes there were no gaps in the surface of the tooth visible under an electron microscope, thus continue the researchers in their article.

The human tooth is comprised of an approximately 2 mm thick layer of enamel, which consists of crystals so-called lime salts. Acid building bacteria attack this layer and develop holes that are at first less than 50 micrometers deep (one micrometer is one thousandth of one millimeter). Up until now, even small areas of tooth failure were first drilled and then filled with, for example, amalgam. The scientists argue that this procedure removes a disproportionately large quantity of health tooth substance. By using their new paste, this can be avoided. Another advantage is the artificial tooth enamel’s great durability. In addition, it protects the tooth against future caries attacks because it strengthens the natural glass.

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number of male and female participants for the study.

Among the screened population, 184 subjects were included in the study, who did not have diabetes mellitus, whose blood sugar was less than 140 mg/dL, or who had more than 20 teeth, who were non-smokers, and who did not take medication for osteoporosis.

Four dentists measured probing attachment level at six sites per tooth (Kupper values: 0.62–0.80). In addition, we utilized the data on bone mineral density (BMD) of the heel, which we measured using an Ultra-Sound Bone Densitometer (Fig. 5). This enables the measurement of bone density (BMD) of the heel. Ultrasound densitometry enables the measurement of the physical properties of bone, specifically BMD. The ultrasound signal is sent to os calcis. Stiffness is a clinical index combining speed of sound and broadband ultrasound attenuation, which provides a measurement of bone mineral density in cancellous bone as the speed of sound travels through bone.1,10

Stiffness is a clinical index combining BUA and SOS, which is calculated by the spread speed of superimposed waves. The formula is:

$$\text{BUA} \times 0.67 + \text{SOS} \times 0.38 \times 0.28$$

This chart the SOS and BUA into biological relevant ranges. Stiffness is defined in the monitor of the bone densitometer as the percentage for the value of a normal younger generation. Osteopenia is defined as a stiffness that is ≤ 85 for females and ≤ 90 for males.11 Follow-up clinical surveys were done by measuring probing attachment level. Finally, 170 subjects who could participate in both the baseline and the follow-up examinations were included in the analysis.

We measured the number of progressive sites that had a 5 mm of additional attachment loss during the 5 years. After dividing the subjects into an osteopenia group (OG) where stiffness was ≤ 85 for females and ≤ 90 for males—and a no-osteopenia group (NOG), we evaluated the number of progressive sites that had a 5 mm of additional attachment loss during the three years by two-way analysis of variance (ANOVA).

The mean number of progressive sites for the OG and NOG, respectively, were 4.65 ± 5.51 and 5.26 ± 5.01 in females, 6.88 ± 9.41 and 5.11 ± 2.70 in males. The difference in the mean number of progressive sites between the OG and NOG was statistically significant by ANOVA after controlling the gender (p = 0.045).

In addition, after controlling serum albumin concentration, serum total cholesterol concentration, triglyceride, and C-reactive protein (CRP) concentration, serum total cholesterol concentration was significantly associated with the number of progressive sites which had 3 mm additional attachment loss during the 3 years (sensitivity: correlation coefficient = 0.199 [p = 0.001]; gender: correlation coefficient = –4.412 [p = 0.020]).

The results showed that the stiffness in the subjects in the OG had a higher number of progressive sites for additional attachment loss than the subjects in the NOG. This three-year longitudinal study clearly demonstrates that BMD is a risk factor for periodontal disease progression in an elderly population.

Future Outlook

According to our findings about the link to BMD, some systemic factors that contribute to both loss of bone mass and periodontal disease progression have been identified.12–14 Maybe systemic factors of bone remodeling also modify local tissue response to periodontal disease. The BMD of the mandible is affected by the mineral status of the skeleton and also by general diseases that cause generalized bone loss.15,16

Recently, several biochemical markers of bone metabolism have been developed, including a uronic cross-linked N-telopeptides of type I collagen (NTx), a bone-specific alkaline phosphatase (BALP), and others. We would like to also evaluate the relationship between BMD using these biomarkers and maxillary/man- dibular general bone loss in our future studies.

The mouth and face are highly accessible parts of the body, sensitive to and able to reflect changes occurring internally. For the clinician, the mouth and face provide ready access to physical signs and symptoms of local and generalized disease. During routine oral examinations, periodontal disease, including maxillary/mandibular general bone loss, may be diagnostic of early osteoporotic changes in the skeleton.

References