Orthodontic treatment for a patient after menopause

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As our society ages, a gradual increase in the demand for orthodontic services among older patients has occurred. These patients are more likely to have periodontal problems, as well as bone turnover rates and psychological profiles that differ from younger patients. Menopause is a significant factor among older women.

Menopause is a normal physiological event, and it is a marker of potential pathological processes of deficiency and disease.[1] Bone mineral content and bone mineral density increase with age until reaching a peak at 30 to 40 years. After that, they decrease by 1% to 2% a year.[2] Throughout their lives, women tend to have lower bone mass than men, and they lose bone more rapidly with aging.[3] Women lose 30% to 50% of trabecular bone tissue and 25% to 35% of cortical bone mass around the time of menopause (Figure 1).[4,5] Moreover, during menopause, many women experience systemic symptoms of autonomic instability, such as hot flashes, sweats, and chills, that are regarded as directly dependent on estrogen.[1] Psychological symptoms are also regarded as components of the menopausal syndrome.[4] A study of 100 consecutive women attending a menopause clinic in California found that 79% presented with severe physical symptoms (vasomotor and general physical symptoms), 63% had significant depression, mood problems or sexual difficulties, and over half were clinically obese.[6] A study from Melbourne showed similar results and indicated that mood problems exceeded 6 years in duration.[7] Orthodontic treatment during this time, therefore, must include the consideration of problems such as bone loss, retention instability, and temporomandibular dysfunction.

The present case was treated while the patient was in menopause. The patient had systemic problems, localized periodontitis, and she exhibited several medical problems during the course of treatment.

Case report

The female patient was 61 years 1 month at the initial visit. Her chief complaint was protrusion of the maxillary incisors with excessive anterior overjet and crowding of the mandibular incisors

Figure 1
Bone mineral density. Compared with males, bone mineral density in females drops rapidly around menopause.

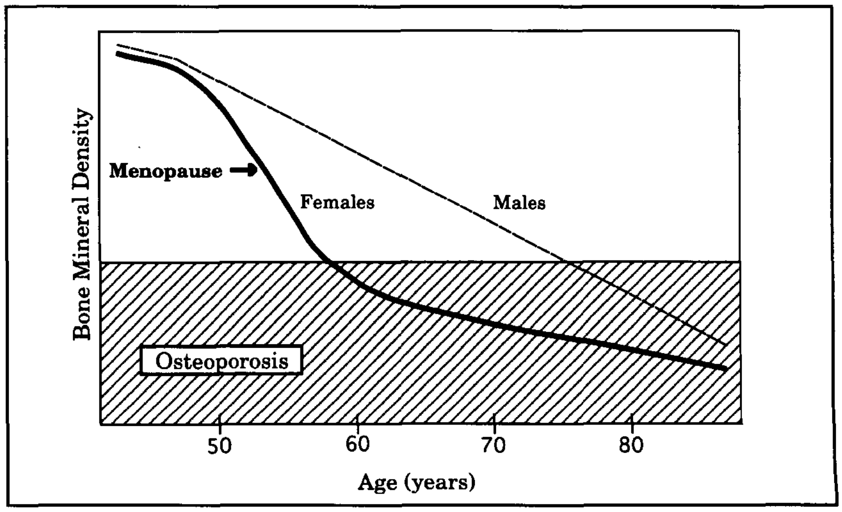


Figure 2A


Figure 2B


Figure 2C

Figure 2A-E
Pretreatment intraoral photographs.

Figure 3
Pretreatment facial photographs at 61 years 2 months. Note the bimaxillary protrusion in profile.

Figure 4
Preteatment panoramic radiograph.

Figure 5A-C
Intraoral photographs during treatment. Tip Edge brackets were used.


Figure 2D

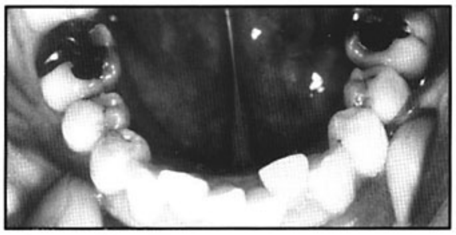
Figure 2E


Figure 3

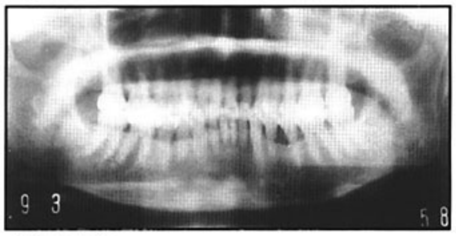
Figure 4


Figure 5A

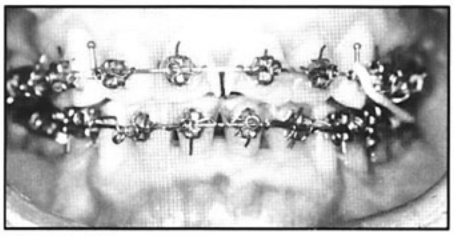
Figure 5B


Figure 5C

(Figure 2A-E). She also complained of irritation of the incisal papilla for the past 40 years

Medical history

A myoma of the uterus and a mammary tumor and hemangioma had been surgically removed when the patient was 52. She had a history of hemorrhagic diathesis for which she received vitamin C therapy. She had suffered from kidney disease with diphtheria bacillus infection, and pulling therapy had been performed for shifted cervical vertebrae. The patient had been using a digestant for gastroptosis for the preceding decade and antilipemic agents to control high cholesterol. Moreover, she had been taking estrogen supplements for 3 years.

Intraorally, the patient presented with periodontitis and incisal papillitis. The maxillary incisors showed unique wear, the result of an occupational habit of biting on sewing needles. The maxillary incisors were protruded with excessive overjet, whereas the mandibular incisors were crowded and overerupted, touching against the palate. The curve of Spee in the mandibular arch was severe. Temporomandibular joint function was healthy, and she had never experienced clicking, pain, or any other TMD symptoms.

The frontal facial photograph showed relatively well balanced facial thirds (Figure 3). Laterally, however, she showed an acute nasolabial angle and mentalis strain on lip closure .

Cephalometric analysis revealed that the patient had a Class I bimaxillary protrusion (Table 1). The upper and lower lips were extremely protruded (E-line to lower lip: +7.5 mm; L-1 to APo: +11.0 mm), with proclined maxillary and mandibular incisors (U-1 to SN: 112.9°; IMPA: 114.6°). Both points A and B were located far anteriorly from nasion perpendicular line. The mandibular plane angle was relatively flat (FMA: 17.0°).

Periodontal examination revealed that she had periodontitis. Pocket depths of the mandibular left premolar area were up to 7 mm, although

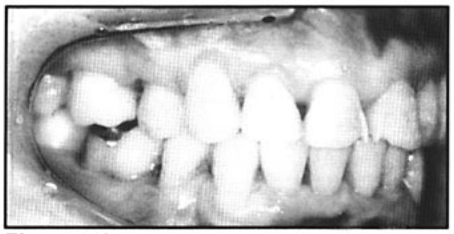
Figure 6A

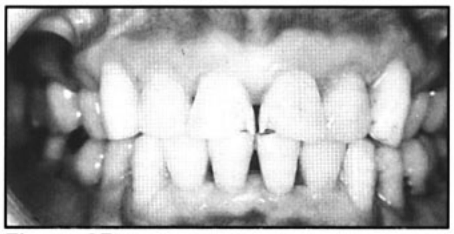
Figure 6B


Figure 6C

Figure 6D

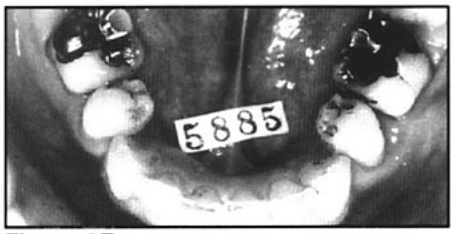

Figure 6E

Figure 6A-E
Posttreatment intraoral photographs.

Figure 7

Figure 7
Posttreatment facial photographs. Treatment term was 1 year 10 months.

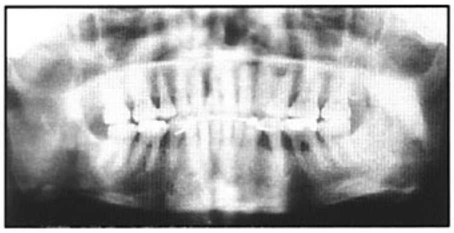
Figure 8

Figure 8
Postteatment panoramic radiograph.

there was no bleeding. Collagenase activity in the crevicular fluid was lower than in healthy controls.[8] Thus, the periodontitis was judged to be in a chronic, stable phase. Upon comprehensive discussion with periodontists, it was decided that the patient could start orthodontic treatment with extraction of four first premolars. She would be under periodontal care during orthodontic treatment.

The patient was excited about starting treatment.

Table 1
Pretreatment and posttreatment cephalometric values

Measurement	Pretx 61 y 2 m	Posttx 63 y 0 m
SNA	82.8	83.7
SNB	77.8	78.8
ANB	4.0	4.0
WITS	+5.0 mm	+3.0 mm
Nasion Perpendicular to:		
Point A	+12.0 mm	+12.0 mm
Point B	+10.0 mm	+10.0 mm
Mand. Plane	17.0	15.0
U1 to SN	112.9	103.0
L1 to MP	114.6	105.0
L1 to APo	+11.0 mm	+5.0 mm

Diagnosis

Angle Class I bimaxillary protrusion with periodontitis

Treatment objectives

1. Reduce the excessive anterior overjet;
2. Reduce the excessive anterior overbite;
3. Correct the crowding of the mandibular dentition; and
4. Improve the facial profile and lip competency.

Treatment progress

Prior to orthodontic treatment, the patient was referred to a periodontal office where she received tooth cleaning and scaling, along with brushing instructions. In lieu of immediate extractions, the mesial surfaces of the first premolars were sliced to create spaces for anterior tooth alignment. The canines, however, did not move during the first 3 months. Four first premolars were extracted and the mandibular canines finally seemed to show slight movement. At this time, the periodontist cautioned that the pocket depths on the maxillary canines had reached +4 mm. The maxillary canines started to move 1 month later. The anterior crowding and deep bite were corrected, and excessive overjet and deep overbite were corrected in 5 months with 0.016" Australian wires. The patient wore

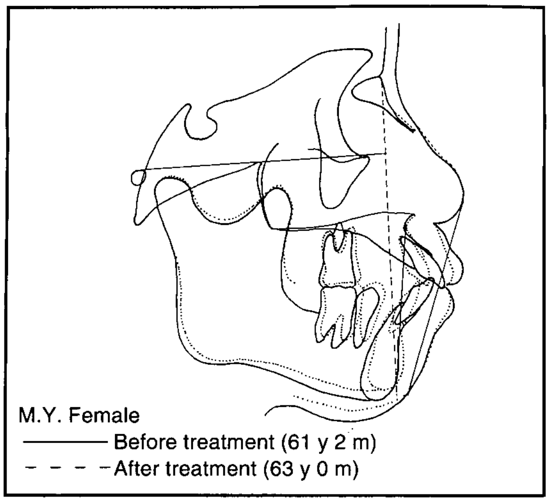

Figure 9

Pre- and posttreatment superimposition. The maxillary and mandibular incisors were retracted with some improvement of tha facial profile.

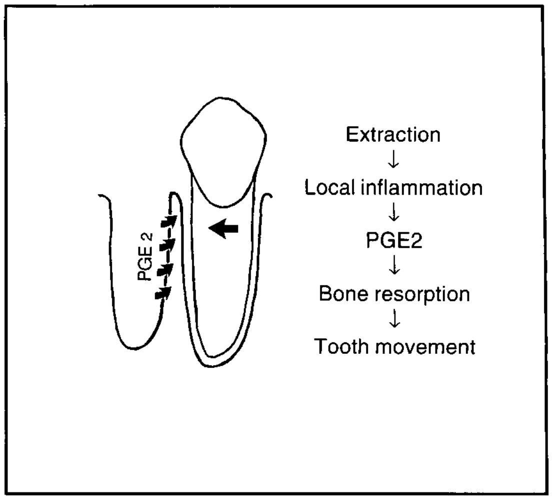

Figure 10

Extraction causes a local inflammation, which stimulates migration of bone resorbing factors such as PGE2, which causes tooth movement.

Class II intermaxillary elastics during treatment. Closure of the extraction spaces was completed in 6 months with 0.022" Australian wires. Then, 0.022 x 0.0275 stainless steel wires and sidewinder springs[9] were used to upright all the teeth (Figure 5A-C), although the teeth did not begin to move for about 6 months. At this time, the patient was hospitalized 3 months for removal of a mammary tumor. While in the hospital, she received chemotherapy. By the time she was released, the teeth had started to upright, a process that took another 13 months; even then, the canines were not fully uprighted (Figure 8). Periodontal status of the mandibular left premolar and first molar area was slightly worse after orthodontic treatment than before, although no acute clinical inflammation occurred during the treatment.

Results

The patient was satisfied with the results of orthodontic treatment. Treatment term was 24 months. The patient did not show any obvious psychological changes and demonstrated good cooperation throughout treatment. The overjet, overbite, and crowding of the mandibular arch were corrected. Both the maxillary and mandibular incisors were tipped lingually about 10° (Table 1). L-1 to APo line improved from +11.0 mm to +5.0 mm. The mandibular plane angle closed by 2° and SNB increased by 1°. The nasion perpendicular to both points A and B did not change. The facial profile was improved, although she still looked protrusive (Figures 7 and 9). Lip competency was achieved. Tooth movement was very slow and ideal root alignment could not be achieved, although we waited more than a year for root uprighting. There was no evidence of root resorption on the posttreatment radiograph. The teeth were retained with a wraparound retainer on the maxillary dental arch and a lingual bonded retainer on the mandibular arch. The patient did not experience any TMJ symptoms during or after treatment.

Discussion

The result of this orthodontic treatment was considered satisfactory, although the patient's lips remained protrusive. She experienced no TMD symptoms or psychological problems. The mandibular fixed retainer would be in place indefinitely because the mandibular incisors were still slightly protruded. The patient's estrogen supplement therapy may have inhibited alveolar bone loss and root resorption.

Tooth movement was very slow in this patient. In fact, significant tooth movement occurred only after the first premolars had been extracted. In an animal experiment in which ovaries were removed, maxillary molar extraction decreased stiffness of the mandible.[10] Perhaps in this patient, extraction of the adjacent teeth decreased stiffness of the adjacent alveolar bone. Extraction is known to cause a local inflammation, which stimulates migration of bone-resorbing factors such as PGE2 (Figure 10). Perhaps the slow turnover of alveolar bone in this case was due to the patient's menopausal status and the estrogen supplement she was taking. Experimental osteoporosis has been reported to change the rate of tooth movement.[11] There is no evidence that chemotherapy or other drug therapy the patient was given would affect the rate of tooth movement.

Involutional osteoporosis can be classified into postmenopausal and senile osteoporosis. However, to make the most appropriate diagnosis, it is more practical to classify patients into two types: high metabolic turnover and low metabolic turnover. Unfortunately, differential diagnoses have not yet been perfected.[12] It has been recognized that bone resorption and formation are closely linked. In healthy individuals, the rates of bone resorption and formation are essentially the same. In osteoporotic patients, however, the rate of resorption is usually higher than that of formation. In other words, uncoupling of bone resorption and bone formation has taken place. In patients with postmenopausal osteoporosis, both bone resorption and bone formation are accelerated, and the rate of resorption usually exceeds that of formation. Conversely, in patients with senile osteoporosis, both bone resorption and formation rates are depressed,[12] although an imbalance still exists between the two.

Experimental ovariectomy has been reported to allow an increased rate of tooth movement.[11] The present clinical experience was not consistent with the experimental tooth movement found in the rat model. Osteoporosis in ovariectomized rats may be of a postmenopausal type (rapid turnover).[13] On the other hand, the present patient might have had senile osteoporosis (low turnover type), because tooth movement was very slow. Moreover, she had been taking estrogen supplements for the last 3 years. Estrogen is an inhibitor of bone turnover and is used to treat osteoporosis. Estrogen also directly promotes collagen synthesis in osteoblast-like cells,[14] and transforming growth factor-b, insulin-like growth factor and procollagen in osteoblasts.[12] Thus, it may be reasonable to find that estrogen decreases the rate of tooth movement.

Some drugs used in the treatment of osteoporosis are shown in Table 2. Both types of drugs may inhibit tooth movement. However, if these drugs are not used during orthodontic treatment in patients with osteoporosis, resorption of alveolar bone and possibly tooth roots could occur with tooth movement. The type of osteoporosis should be included as a part of medical history prior to initiating tooth movement in menopausal females.

Table 2
Drugs used in the treatment of osteoporosis

Inhibits bone turnover	Stimulates bone formation
Estrogen	Calcium
Calcitonins	PTH
Biphosphonates	Fluorides
Vitamin D3	Vitamin K2
Thiazide diuretics	Anabolic steroids
Ipriflavone	
Progestogenes	

Radiogrammetry is useful in assessing bone mineral density.[15] In general, however, osteoporosis is usually diagnosed only when a patient fractures a bone; thus there are probably many undiagnosed osteoporotic older women. Therefore, all postmenopausal patients, and not just those known to have osteoporosis, should be informed that orthodontic treatment may take longer than expected and could cause excessive resorption of alveolar bone and roots of the teeth.

Oral contraceptives that contain estrogen and progesterone may also inhibit tooth movement. Younger women who are taking oral contraceptives might also show a reduction in tooth movement.[16] The effects of these drugs on tooth movement should be clarified in the future.

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Commentary: Orthodontic treatment for a patient after menopause

Anne-Marie Bollen, DDS, MS, PhD

The speed of orthodontic tooth movement depends on the capacity of the periodontal ligament and the alveolar bone to respond and adapt. It is not known how various aspects of the periodontal ligament can affect tooth movement. With respect to bone tissue, it has been shown that orthodontic tooth movement is altered by changes in bone mineral density[1] and bone metabolism.[2] Pharmaceuticals known to affect various aspects of bone turnover (biphosphonates,[3] prostaglandin and prostaglandin inhibitors,[2,4]) also influence the speed of orthodontic tooth movement.

The authors raise an important issue, namely, that the alveolar bone tissue of an older patient is not the same as that of an adolescent. Elders may have less alveolar bone as a result of prior periodontal disease; the alveolar bone present may be structurally and metabolically different from that in younger subjects; and elders tend to take more medications that can affect bone tissue.

In their discussion, the authors concentrated on osteoporosis, the most common bone disease affecting the elderly. In osteoporosis, more marrow spaces are present and the bone trabeculae are thinner. One might predict that teeth would move faster through this bone. Indeed, animal models have shown an increase in the speed of tooth movement in osteoporotic dogs[5] and rabbits.[6] The differences in the speed of orthodontic tooth movement (as well as dental relapse) reported in these animal studies suggest that osteoporosis may influence the speed of tooth movement in elderly patients. Caution is required when transferring the results of animal studies to human orthodontics. While rat maxillae can be excised, powderized, and analyzed, orthodontists must rely primarily on various radiographic methods to establish osteoporosis in the alveolar bone. Several procedures have been suggested (all require specific software to analyze the radiographs) that measure a specific aspect of bone density/mineralization. However, no data are available that relate the level of decrease in bone density to the rate of increase in tooth movement. In a patient with 50% less alveolar bone density, teeth can be expected to move faster, but we do not know to what extent overall treatment time may be reduced.

Also, humans rarely have only one condition affecting bone tissue. The patient described in this case report is a good example of this. She had prior alveolar bone loss (periodontal disease), is taking estrogen, and underwent chemotherapy as well as vitamin C treatment. All of these factors can influence bone metabolism and possibly the rate of tooth movement. Other issues of interest: Does this patient smoke? What about calcium intake?

Various factors affecting the biology underlying tooth movement will influence how fast teeth move in response to our appliances. When treating an older subject, we are working with bone and a periodontal ligament different from that in children and adolescents.

Clinical studies are needed to provide epidemiological data to give more insight into the age-related differences affecting orthodontic treatment.

Anne-Marie Bollen, Department of Orthodontics, University of Washington, Seattle, Wash.

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Author's response

We appreciate the comments by Dr. Anne-Marie Bollen. She asked two questions about the patient: Does she smoke? Did she take calcium supplements? The answer to both questions is no. She did not smoke and she never took calcium supplements.

Various kinds of hormones and drugs are being used by patients who are undergoing orthodontic treatment. We reported on an older female patient who took estrogen supplements during her orthodontic treatment. But as we stated at the end of the discussion, younger females who take oral contraceptives, and indeed any patient who takes any hormone or drug therapy, may require special attention during orthodontic treatment.

Kuniaki Miyajima