

# Medication and Positive Remodelling of Osteoporotic Jaws

## SUMMARY

*Osteoporosis causes micro-degradations and jaw-bone reduction. Initial positive turnover and bone recover should make hasten by local medication of osteoporotic jaws. The aim of this study was to present improvement of jaw pattern by local application of calcitonin and calcium throughout prosthetic treatment of selected osteoporotic patients. Patients undergoing study were osteoporotic and toothless (9 males and 27 females), with no malignancy. Non-osteoporotic complete denture wearers, 7 men and 7 women were controls. DPX-L (Lunar) was used in detection of skeletal degradations. Panoramic radiographs (Orthopantomograph 10, Siemens) and digital densitometer DT II 05 (England) were used in the analysis of bone density. T-results indicated systemic osteoporosis.*

*After application of calcium and calcitonin in solutions, moderate increase of density ( $p < 0.05$ ) was verified, compensating up to 3% of total mandibular loss. The second section of results was restorative effect of prosthetic treatment of osteoporotic patients. In this study, osteoporosis affected women patients earlier than men.*

*Regardless the necessity of careful selecting of patients for this kind of treatment, calcitonin and calcium in solutions should be considered as the priority of local therapy in osteoporotic toothless patients, providing positive bone remodelling, as well as success at the second level of therapy - positioning of dentures.*

**Keywords:** Jaw; Osteoporosis; Calcitonin; Bone Remodelling

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## Introduction

Osteoporosis is the most common type of bone disease over the lifetime, affecting human bones indiscriminately and haphazardly. A variety of micro-structural osteoporotic degradations and macroscopic resorption of oral bones was very well evidenced<sup>3,4,6,7,10-12,14,17</sup>. Moreover, it was reported that osteoporosis of human oral bones damaged not only bone support of remaining teeth, but induced reductions of denture retention and stability, too<sup>17</sup>. Analysis of bone layer's appearance on panoramic radiographs is the valuable method of assessing bone changes in any of bone turnovers<sup>1,3,7,14,20</sup>.

Diet and nutritional factors are of extreme significance for prevention of osteoporosis, but minor results should be expected regarding initiation of positive remodelling of fragile osteoporotic bone<sup>8,10</sup>. Considering assorted literature data on multiple drug therapy and possibilities of

systemic medication, it could be of particular importance to focus dependable medical oral treatment approaches in osteoporotic affections<sup>4,16,17,19</sup>. Calcitonin accelerates influx of calcium, improving bone density and mineral content of bone, either in local, or systemic level<sup>7-9,10,14</sup>. This positive remodelling of osteoporotic bones could be finally reached in mandibular bone, as well as in other human bones<sup>2,5,7-9,15-19</sup>. The aim of this study is to present improvement of mandibular-bone pattern by local application of calcitonin and calcium throughout prosthetic treatment of selected osteoporotic patients.

## Material and Method

The experimental group comprised 9 men (aged 64-90; mean age 87 years), and 29 women (aged 56-81;

mean age 58 years), edentulous and osteoporotic, with no malignant diseases (Fig. 1). 7 toothless men and 7 toothless women patients were controls (Fig. 2). Patients were selected concerning dental-oral history, questionnaire (age, probable treatments of osteoporosis in the past, history of fractures, menopausal periods, calcium and microelements of plasma-blood, additional Pylinx-D and Prolagen-C tests), oral examination (bone consistency and resorptions) and skeletal density. 3 women from the experimental group (on estrogens) and 3 osteoporotic men patients were on systemic therapy of osteoporosis after hospitalization. DPX-L analysis (Lunar, U.S.A.) and T-results of patients were provided.

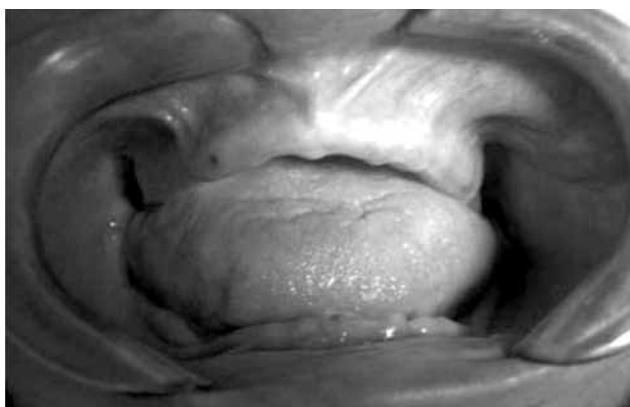


Figure 1. Oral status of osteoporotic patient of the experimental group before treatment

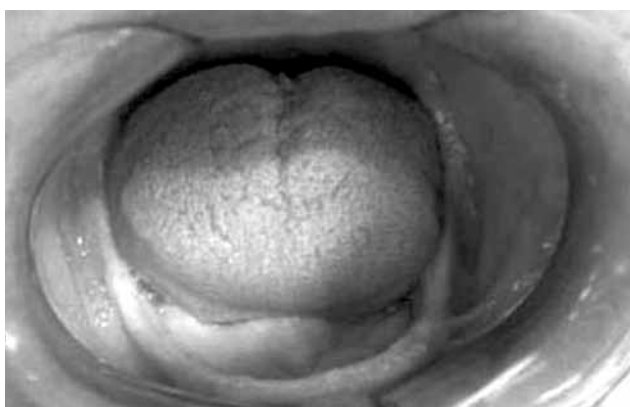


Figure 2. Non-resorbed jaw of the patient of the control group

Panoramic radiographs of each patient (Orthopantomograph 10; serial no. 01492; Siemens, Germany), focused osteoporotic remodelling of jaws (Figs. 3-5).

Calcitonin (Miacalcic, Novartis, Switzerland; Calcitonin Huber, Galenika AD, Serbia), and calcium gluconate (Sterop, Brussels, Belgium), or calcium glubionat (Calcium-Sandoz amp., Switzerland) were used

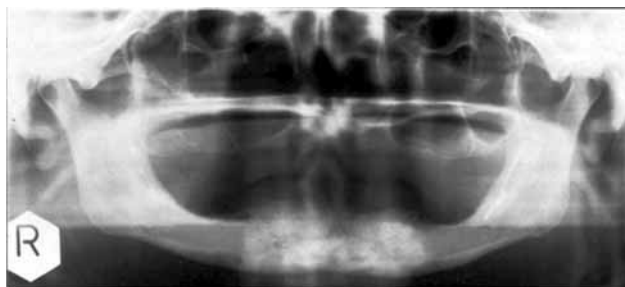


Figure 3. Panoramic radiograph of osteoporotic jaws of the patient of the experimental group

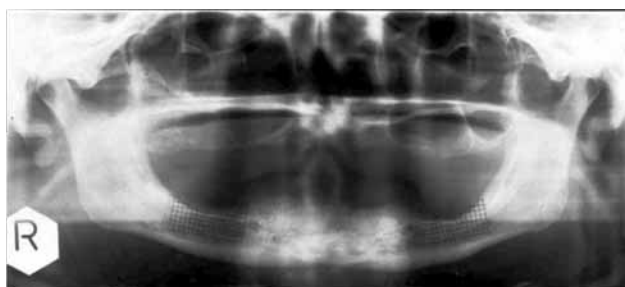


Figure 4. Grid positioned onto regions of particular interest of the osteoporotic mandible of the patient of the experimental group, prior to densitometric assessment

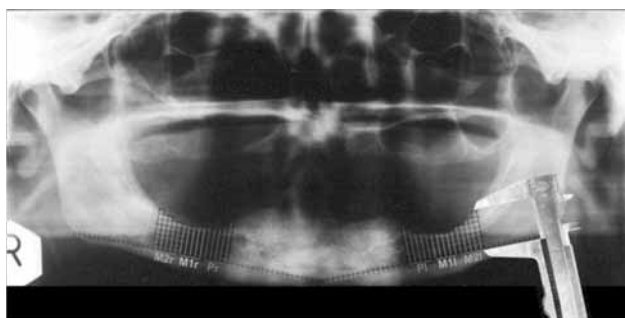


Figure 5. Determined regions of interest - Pr, M1r, M2r, Pl, M1l, M2l



Figure 6. Local application of anaesthetic on mucosal surface before injecting medication – solution of calcitonin with calcium



Figure 7. Submucous injection of therapeutic solution of calcitonin and ion calcium onto buccal bone surface of osteoporotic mandible of the patient of the experimental group



Figure 9. Complete dentures restored all of the supporting tissues and occlusion - dentures in the mouth, after necessary increments of bone density of the lower jaw

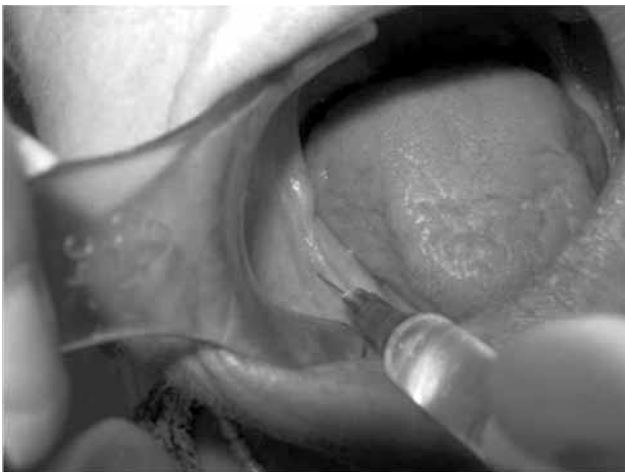


Figure 8. Injection of therapeutic solution of calcitonin and calcium to the right side of the buccal mandibular osteoporotic surface

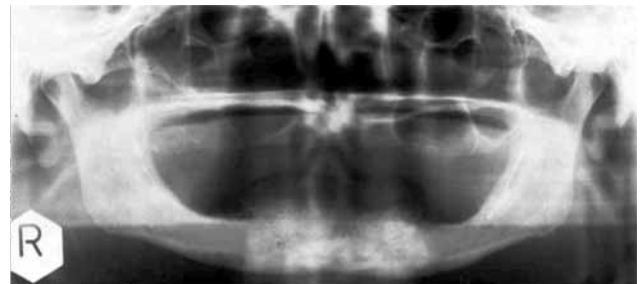


Figure 10. Panoramic radiograph of the patient after local increase of density of the edentulous mandible

locally to improve bone pattern in osteoporotic patients. Up to 1.5 ml of calcitonin and calcium solution (1:2) was injected submucously onto mandibular bone surfaces (Figs. 6-8). Complete dentures were fabricated for each of the patient of the experimental group (Fig. 9).

Digital densitometer DT II 05 (England, UK) was used in the analysis of mandibular segments' bone density at panoramic radiographs after the therapy (Fig. 10)<sup>10,15</sup>.

## Results

T results indicated systemic osteoporosis. The numerical values of T result ranged from -2.4 to -2.6 for male patients, and -2.5 to -2.6 for female patients.

The results of medication of supporting bone tissues primarily affected by osteoporosis were favourable in this study. Increase of density of mandibular segments after the therapy was significant, particularly for Pr and Pl segments ( $p < 0.01$ ). Following application of calcium and calcitonin in solutions, moderate increase of jaw-bone density was observed ( $p < 0.05$ ), compensating up to 3% of total mandibular-bone loss (Tabs. 1 – 3).

The second section of results were restorative effects of oral-prosthetic treatment of the selected osteoporotic patients. Edentulous osteoporotic patients were rehabilitated in the observation period (Fig. 9).

Table 1. Increase of mandibular density of the experimental group and bone pattern improve

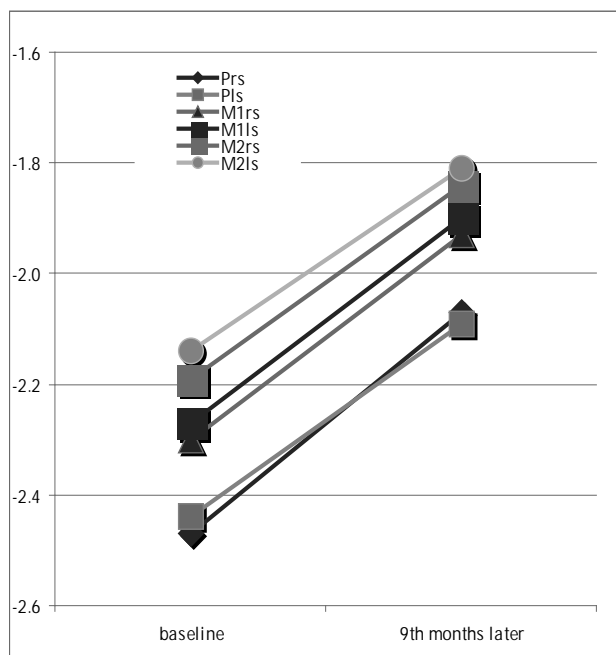


Table 2. Statistical significance and differences of numerical values of mandibular density between the control and the experimental group

Segment	Differences of numerical values of optical density regarding the baseline of the control group and the baseline of experimental group
Pr	P < 0.01
Pl	P < 0.01
M1r	P < 0.05
M1l	P < 0.05
M2r	P < 0.05
M2l	P < 0.05

Table 3. Percentage of increase of density within mandibular segments using 7 week interval of application of solution of calcitonin and calcium

Mandibular segments considered	Percentage of increase of density
Pr	0.8% ± 0.8
Pl	0.85% ± 0.6
M1r	0.84% ± 0.1
M1l	0.83% ± 0.2
M2r	0.84% ± 0.4
M2l	0.84% ± 0.3
$Pr+Pl+M1r+M1l+M2r+M2l \cong 3\%$	

## Discussion

In dental literature there were few reports on the treatment and local medication of jaw-bones. Based on certain medical studies and monographs, there were 2 major approaches to the treatment. The first treatment approach has been related to application of bisfosfonates<sup>4,7,10,17-19</sup>. The second approach considered calcitonin as the primary accelerator of calcium's influx to the bone<sup>4,10,17-19</sup>. Additionally, there were considerations of application of calcitonin, as well as bisfosfonates, locally to jaw-bones and denture-supporting areas<sup>2,5,7,9,10,15,16</sup>. Considering various facts on bisfosfonates - studies were mainly conducted on patients undergoing systemic therapy with bisfosfonates, and there is only a few of studies on application of bisfosfonates on the local (oral) level,

as well as the fact that certain interruptions of immune response were described as possible complication of the extended bisfosfonate usage - it seemed reasonable to apply calcitonin and calcium in solutions locally, *in vivo*, to osteoporotic jaws<sup>2,4,5,18,19</sup>. The effects of treatment is difficult to compare to different calcitonin effects as they were acquired in experimental animals, but not in humans<sup>9,10,15,16</sup>.

Calcitonin was described as the substance strongly regulating influx of calcium<sup>4</sup>. Calcium influx should have been provided by mobilization of "free" calcium ion from blood plasma, as well as by exchanging calcium ion of the medicament (calcium gluconate or calcium glubionas)<sup>4,10</sup>. Respecting specificity of blood flow to the human mandible, and the fact that mandible usually is not supplied by plenty of blood, it seemed reasonable

to assume that calcium ions from blood vessels do not provide a needed intensity of calcium influx towards osteoporotic degradations<sup>7,11</sup>. Furthermore, additional sources of calcium ion, directed towards credible local storage near enough to the mandible bone, should have beneficial effect.

There is not enough evidence in dental literature on local application of calcitonin and calcium into hard oral tissues. Because of that, it should be not possible to compare the results of the present study with results of credible studies regarding the percentage of calcium and calcitonin in train solution<sup>7,9,10,15</sup>. Moreover, in this point of view, it should not be possible to adjoin if the increment of concentration of calcium has to be applied to the surface of edentulous ridge, or the concentration of calcium in solution has to be ultimately changed (or decreased) in cases of persistence of roots of the remaining teeth.

Certainly, on the basis of the results of this study, it may be stated that calcitonin in calcium solution should have been applied to edentulous ridge prior to positioning of the denture onto supporting tissues, that is delivery of prosthesis. More precisely, it should be injected towards bone support in the initial steps of denture fabrication, i.e. taking preliminary impression, and previous to functional impression, or even in the procedure of determining jaw relations with occlusal rims.

Calcitonin and calcium liquid is not a „supernatural drop“ for instant recover of osteoporotic bone layers. However, careful selection of patients, as well as repeated application of calcitonin and calcium in solutions to bone layers, may significantly improve oral bone condition and ability to accept prosthetic restoration on denture-supporting areas.

The local application of calcitonin with calcium could be repeated, if necessary. However, there must be the necessity of careful selecting the patients, because of the fact that application of calcium should not be indicated for patients with heart disease, kidney disease or serious blood problems. Also, patients with malignant diseases must not be included in the local therapy of osteoporotic oral bones. In spite of the limitations, local application of calcitonin and calcium should be the absolute prerequisite of organizing positive bone remodelling and turnover of segments of jaws. Thus, these segments should be prepared for better acceptance of denture surface.

Edentulous osteoporotic mandibular bone should ultimately be the first of oral bones for application of calcitonin-ion calcium solution. Additionally, respecting levels of the concentration of the applied calcium ion, the osteoporotic maxillary bone could be treated with the solution of the same kind, in the prolonged period of time.

It seems that osteoporosis of the mandible affects women earlier than men. Also, osteoporosis was more frequent in women. Usage of calcitonin and calcium in solutions for osteoporotic toothless patients should be

considered as the priority of local oral treatment. In spite of the limited value of local application, calcitonin and calcium should be the absolute prerequisite for organizing positive bone remodelling and turnover of segments of jaws which should be, this way, prepared for better acceptance of denture surface. Regardless the absence of macroscopic evidence of bone tissue regeneration, local application of calcitonin with calcium could be crucial for the success at the first level of the treatment (turnover and positive bone remodelling), as well as for the second level of treatment (fabrication and positioning of dentures).

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