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Correlation between the Bone Densities Jaws and Cervical Spine through the HU Scale Measured in Multislice Computed Tomography: Opportunistic Screening for Osteoporosis

Mayara De Cassia Cunha Cheade[2], Alan Grupioni Lourenço[3], Plauto Christopher Aranha Watanabe[1*]

[1*]Full Professor, School of Dentistry of Ribeirão Preto and Chief of Radiology and Radioprotection Section, University of São Paulo, Brazil.

[2]Master, School of Dentistry of Ribeirão Preto, University of São Paulo, Brazil.

[3]Professor, School of Dentistry of Ribeirão Preto, University of São Paulo, Brazil.

watanabe@forp.usp.br

***Corresponding Author:** Plauto Christopher Aranha Watanabe, Department of Stomatology, Public Oral Health and Forensic Dentistry, Ribeirão Preto School of Dentistry, University of São Paulo, Brazil.*

Abstract

Osteoporosis is a skeletal disease characterized by low bone mass, deterioration of the bone structure and an increased risk of fracture that also affects the bones of the jaws. Causes an increase in porosity that reflects the integration of quality and bone mineral density, hindering rehabilitation treatment with implants. Cervical osteoporosis affects the spinal vertebrae bones of the neck in particular the vertebrae bodies which form the spinal column. Your cervical vertebrae surround the spinal cord to protect it from damage. Cervical osteoporosis is a silent and gradual condition that emits no symptoms. The gold standard diagnostic tool is bone densitometry by dual energy x-ray absorptiometry (DXA), but the computed tomography (CT) also proves very effective in assessing bone quality through Hounsfield unit (HU). In this study, we evaluated the bone density of mandibular heads, regions of the teeth 13, 23, 36 and 46 and cervical vertebrae C1, C2 and C3, through Hounsfield scale CT scans, and correlated their values for diagnosis for possible evaluation of osteoporosis. We evaluated multi-slice CTs of patients who underwent both examinations of the maxilla and mandible. We use software to analyze and Efilm-investigated regions. The results show that the bone densities of the cervical spine (C1 and C3) were positively correlated with the mandibular heads (r = 0.2246, Pearson correlation coefficient), posterior region of the mandible (r = 0.2348,) and correlation with the anterior region of the maxilla (r = 0.40). Therefore we can conclude that there is a positive correlation between the cervical vertebrae and buccal sites, but this correlation is weak. Being that we found a moderate correlation of the cervical vertebrae with the anterior region of the maxilla was finded.

Keywords: *Osteoporosis, Computed tomography (CT), Hounsfield unit (HU), Bone mineral density (BMD).*

Statement of Clinical Relevance

When a computed tomography (CT) scan is available, for example to implant proccedings, dentists can use it as a screening tool for osteoporosis, **opportunistically,** which is a major public health problem among menopausal and postmenopausal women, without the need for expensive or complicated software or special training.

Introduction

In Brazil a life expectancy at birth it's almost 76 years old. With the increase of the average years lived by Brazilians, we can predict that in the future, gains in this indicator will not come as easily. More intervention will be necessary in the causes of death that affect the elderly, for example the osteoporosis, as well as more investments in prevention and treatment, becoming a major public health problem. With an aging population, osteoporosis is increasingly becoming a public health concern[14] Osteoporosis is typically characterized by an age-related reduction in bone strength that predisposes affected individuals to low-energy fractures. The osteoporosis is a skeletal disease characterized by low bone mass, deterioration of the bone structure, and an increased risk of fracture. In the spine, the incidence of osteoporotic vertebral fractures exceeds 1.4 million events annually.[1] Osteoporosis is a common disease with enormous implications for affected individuals and society as a whole. Measurements obtained from computed tomography (CT) examinations obtained for other reasons, may yield information regrading decreased bone mineral density, without added expense to the patient.[20,21]

Early diagnosis is essential. However, the silent nature of osteoporosis delays diagnosis.[2] Healthcare professionals should collaborate to create an opportunity for early detection, timely diagnosis, and appropriate treatment. In dentistry, early detection is important because patients with osteoporosis may suffer from higher failure rates of dental implants. Healthcare professionals should collaborate to create an opportunity for early detection, timely diagnosis, and appropriate treatment.

In dentistry, early detection is important because patients with osteoporosis may suffer from higher failure rates of dental implants.[3] Dentists are commonly consulted by a large segment of the population. Dental radiographs are used for diagnosis of conditions affecting teeth and jaws. These radiographs may offer an opportunity to detect osteoporosis and have been suggested as a screening tool for the disease.[4]

Dual X-ray absorptiometry (DXA) is currently the standard for assessing osteopenia and osteoporosis or bone mineral density (BMD) and has been tightly correlated with fracture risk and treatment efficacy.[5] The use of Hounsfield unit (HU) from CT scanning to assess BMD of the vertebrae has recently been described, and several subsequent studies exploring its utility in assessing fracture risk and prognostic success.[6] As described by Pickhardt et al., when CT scans are obtained for other clinical indications, they may also be used for "opportunistic screening for osteoporosis."[7] Anderson & Schreiber[8], and Tay et al[9] concluded that the values shown in CT scans for low bone mass diagnoses have a high correlation with the values found in the DXA, and these two systems can be used together, offering additional information for the early diagnosis of osteoporosis. Barngkgei et al investigated the use of cone beam computed tomography (CBCT) for predicting osteoporosis based on the cervical vertebrae CBCT-derived radiographic density (RD) using the CBCT-viewer program. This authors finded a strongest correlation between the C1 and C2 vertebrae RD values and the lumbar T-scores (r = 0.747) and moderate correlations were found between all cervical vertebrae radiographic density values and the femoral neck T-scores (r = 0.5-0.6). So, this authors suggests that cervical vertebrae CBCT-derived radiographic density values can predict osteoporosis status in menopausal and postmenopausal women with use of the associated CBCT-viewer program.[6]

This can also be seen in the maxillomandibular region, most obviously in the mandible, with decreased cortical thinning and inferior mandibular body, for example. Rehabilitation through dental implants has been a good alternative for the population worldwide, and this technique is evident in dentistryand is at its peak in Brazil. The bone quality and bone quantity are factors considered fundamental in the diagnostic evaluation of this rehabilitation procedure to consolidation of the bone-implant interface and that can influence surgical technique[10,11]. The classification of bone quality proposed by Lekholm and Zarb[12], which is mainly based on the subjective feeling of the surgeon during drilling. So, numerous studies report implant treatment outcome by using other approaches to assess bone tissue before and during implant treatment. To evaluate the bone mineral density of the patient through DXA or HUare methods used before and after procedures to enable correct postoperative results[13,14]

The use of Hounsfield units (HU) from CT scanning to assess regional BMD of the column has recently been studied and the correlations between HU and bone mineral density have been established[16], mainly because they are directly related to tissue attenuation coefficients. The information provided by a simple HU measurement can alert the treating physician to decreased bone quality, which can be useful in both medically and surgically managing these patients with a view to implant procedures. As described by Pickhardt et al., when CT scans are obtained for other clinical indications, they may also be used for "opportunistic screening for osteoporosis." The CT is currently the only diagnostically justifiable imaging technique that allows at least rough conclusion about the structure and density of the jaws bone, for assessing the relative distribution of compact and cancellous bone. Modern radiology imaging software programs allow the calculation of the region of interest (ROI) on CT scans without any additional cost or radiation exposure.[7]

Osseointegration underlies contemporary implantology and it occurs in a primary and secondary level[17]. The primary implant stability can be defined as the "biometric stability immediately after implant insertion"[18], a mechanical phenomenon that is related to the local bone quality and quantity, to the implant geometry (i.e., length, diameter, and type), and to the placement technique used. The primary implant stability has always represented one of the essential prerequisites for performing and maintaining osseointegration[19], for it prevents micromovement and the formation of fibrous scar tissue at the time of implant loading.

Osteoporosis being a systemic skeletal disease will also affect bone density and bone structure in the jaws. Articles describing the use of dental radiographs for diagnosing osteoporosis are given in several reviews[20,21,22]. Reduced bone mass of the jaws of osteoporotic subjects has been reported[23,24,25,26,]. Mandibular cortical width and shape have been studied in relation to osteoporosis[27,28,29,30]. Alveolar ridge height has been studied as well[31]. With respect to the structure of the trabecular pattern on dental radiographs some studies have explored the use of fractal dimension as a predictive parameter for osteoporosis[27,32]. Extensive morphologic analysis of the trabecular pattern on dental radiographs in relation to osteoporosis is also described[33,34].The correlation between bone densitometry and UH with tomographic images may be a method of diagnosing patients with mineral bone disease and assessing risk factors for fracture.[35]According to Naitoh, there is a strong correlation between the BMD of the cervical vertebrae and the lumbar vertebrae, also between the BMD of the cervical vertebra and mandible.[36]Yet, abdominal CT images obtained for another reasons could identify patients with osteoporosis BMD without additional radiation exposure or costs.[37]

So, opportunistically we will evaluate aspects inherent to osteoporosis, correlating bone densities of sites in the maxilla and mandible, and in the cervical vertebrae, through computed tomography with multislice CT(Hounsfiled scale).

Materials and Methods

We evaluated 79 multi-slice CTof patients who underwent both examinations of the maxilla and mandible on radiology department.The images were selected according to sex and age of patients, 35 males and 44 females, all with over 40 years of age. There was no selection for the type of dentition (dentate or edentulous).

Patients with diabetes, thyroid disorders, and bone diseases other than osteopenia or osteoporosis were excluded. None of the included women consumed excess alcohol; only 2 (2.53%) were smokers, during, on average 20 years. None of participants had suffered a previous fracture in either the lumbar vertebrae or the femoral neck. During the image acquisition of the maxilla and mandible, the regions of the cervical vertebrae C1, C2, C3, were also scanned. To carry out this study, the research project was submitted to the Research Ethics Committee of FOUSP (School of Dentistry of São Paulo), and approved.

These studies were performed in helical multi slice CT scanner Somatom Volume Zoom Siemens-brand window to 16 channels in bone tissue sections with 1.0 mm and time image reconstruction 16 images / second, the unit operates at 50KW. The images were acquired in DICOM format. In software *e-film* (eFilm,version 1.5.3, Merge Healthcare, Milwaukee, WI) and standardized for each region to be analyzed size 0.1 sq.cm area in the center of each section and consider the values of mean and standard deviation. All values were given in Hounsfield units, HU. The values were based on the table of values for bone tissue Hounsfield units for the classification of normal density, high density or low density, which may still be classified as osteopenia or osteoporosis.

Analysis of the CBCT Scans

In general for the tomographic technique the angulations of selected slices were adjusted manually to reduce the differences in head position among patient sample.

One examiner, a PhD candidate in Oral Radiology with 8 years' experience, carried out the aforementioned analysis of CT scans. This analysis was repeated for a randomly selected subsample of 8 CT images (about 10% of the overall study sample) to establish intraexaminer agreement. The following areas of each patient were measured: Cervical vertebrae: C1, C2, C3, in the mandible: mandibular heads and ascending branches D and E, regions of the teeth 46,36 and in the maxilla: regions of the teeth 13,23. The software generates images of axial, sagittal and coronal sections. The window showing the axial section shows two orientation lines showing the location of the axilla and coronal section. For each anatomical structure analyzed, a cut type was used, depending on what best showed the area of interest. In the axial sections, densities were not measured, only the anatomical structure and the reference cut were located. For example, for the regions of ascending branches of the mandible were made in the coronal sections, in the regions of the vertebrae, the sagittal cut was used (figures 1-2).

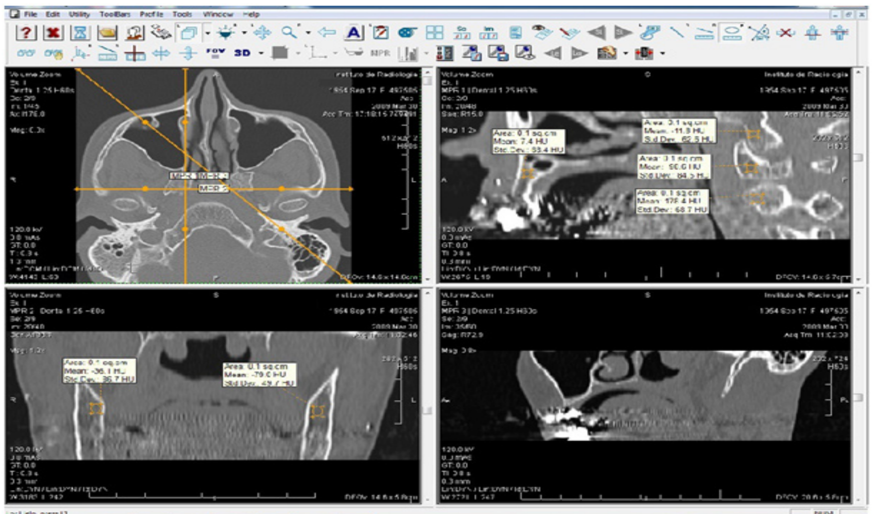

Figure 1. *E-film software window. In the axial cut there are 2 guidelines that show the sagittal and coronal sections. In the sagittal section are the regions of the cervical vertebrae C1, C2, C3 and the region of the tooth 13 and in the coronal the ascending branches, where the measurements were made (above right).The coronal section shows the measurements on the heads of the mandible (bottom left).*

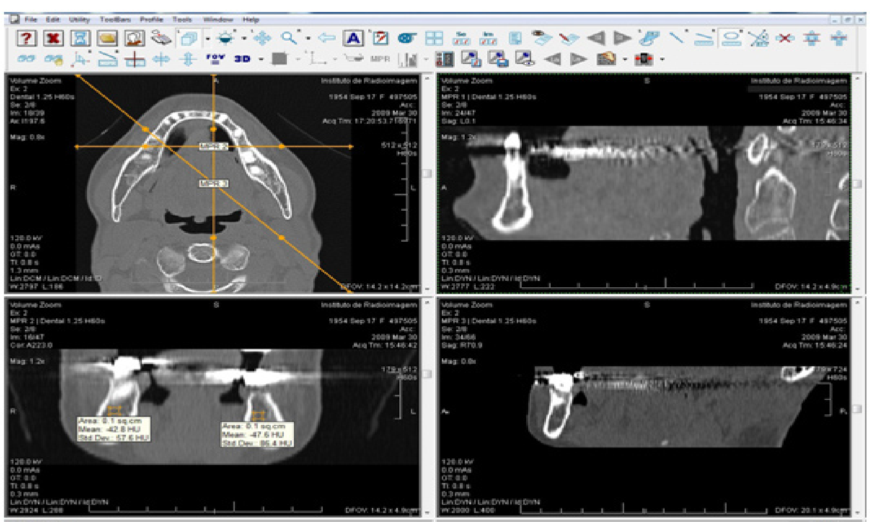

Figure 2. *E-film software window. In axial cut there are 2 guidelines that show the sagittal and coronal sections. The coronal section shows the measurements on The coronal sectionshows the measurements in the regions of the teeth 36 and 46.*

Reliability of HU Measurements

When the regions of interest had been selected on the CT images the selection procedure was repeated the same day until each region of interest had been selected 5 times. No efforts were spent to remember the exact position of the regions. Similarly, when 5 regions of interest were selected for each site on CT images had been selected, the procedure was repeated three times on the same day. The measurements have been normalized to account for the variation of the size of the regions of interest. All samples were stored on hard disk and subjected to a sequence of automatic measurement procedures. The measurements were grouped into simple, geometric, topological and directional measurements.

Statistical Analyses

The data are presented as mean and standard deviation. All analyzes were performed in the MedCalc program (Ostend, Belgium). Normality was evaluated for each outcome of the study after wich descriptive analysis were performed as appropriated including estimators such as as means, standard deviations, medians and quartiles (first quartile -Q1 and third quartile -Q3). Correlations were analyzed usig the Pearson coefficient values <0.05 were considered as statiscally significant.

Results

Most of the individuals studied are in the age range of 55 to 60 years, and it is possible to verify that the mean age was 58 years (40-84 y.o). The women were aged between 55 and 60 years, and the mean age presented was 58 years. The men examined were in the age range of 55 to 60 years, and the mean age was 57.8. The bone density data (HU) presented normal characteristics for the spine, heads and mandibular body. For the mandibular branch, and maxilla, the bone density data (HU) showed non-normality characteristics.

The strength of correlation was considered weak, medium, and Strong when correlation coefficient values were ($0.2 < r \leq 0.4$), ($0.4<r<0.7$) and ($r \geq 0.7$), respectively. Correlation coefficient values ranging between ($0 < r \leq 0.2$) were regarded as showing no correlation.[24]

The bone densities of the spine (C1 and C3) were positively correlated with the mandibular heads (r = 0.23), posterior region of the mandible (r = 0.23) (teeth 36 and 46), and strongest with the anterior region of the maxilla (r = 0.40) (teeth 13 and 23), as shown in table 1.

Table 1. *Correlation between the C1 e C3 vertebrae means (Hounsfeld scales) with means in different maxillo facial regions.*

	r	R^2	T test	P valor
Ascending ramus	0.19	0.04	1.71	0.09
Mandibular heads	0.22	0.05	2.02	0.05
Média 36 e 46	0.23	0,06	2.12	0.04
Anterior regions of the maxila	0.40	0.16	3.80	<0.0001

r: Pearson correlation coefficient; R^2: coefficient of determination.

The cervical vertebrae C1, C2, and C3 had an average density (in units of Housnfield (HU) values of 222, 258 and 393 respectively. In ascending ramus observed that mean the individuals involved in the analysis had an average bone density of 102 HU to branchD and 91 HU for branchE.In the mandibular heads,we find that on average bone density of the head D of all individuals in the analysis was 292 HU and average bone density for head E was 303.49 HU. For maxillo mandibular regions, we found that the average bone density of the tooth 46 was 181 HU; tooth 36 was 173 HU; tooth 13 was 378 HU and the tooth 23 was 349 HU. You can also notice that half of the individuals had lower bone density to 158 HU to tooth 46; 138 HU for tooth 36, 338 HU for tooth 13 and 353 for tooth 23, as show the table 2.

Table2. *Descriptive measures (HU) of variables C1, C2 and C3, Brach D and E, Mandibular heads D and E, and dental regions teeth: 36, 46, 13, and 23.*

	C1	C2	C3	Branch D	Branch E	Head D	Head E	Tooth46	Tooth36	Tooth13	Tooth 23
Mean	222	258	394	102	91	292	303,49	182	173	378	349
SD	143	159	174	221	210	136	135,45	181	175	223	252
CV (%)	64	61	44	216	230	46	44	99	101	58	72
Min	-48	-16	18	-323	-254	-26	-2	-128	-99	-9	-134
Max	591	703	994	1018	809	755	695	624	755	921	1092

SD: Standard deviation; CV: Coefficient of variation.

Furthermore, we could verify that the male individuals present a greater amplitude than the female individuals for the analysis in the C1 vertebra, in the mandibular branches (116,17 CV for females and 282,93 CV for male), and in the regions of the teeth 13 and 23 (179,73 CV for females and 237,84 CV for male). Already the means of the bone density in the masculine sex, are generally larger than in the female, in the various sites measured.

Correlation of the Variables among All the Individuals under Analysis

The table 3 shows the value of the correlation between the variables under analysis considering all individuals in general, that is, without taking into account the gender.

Table 3. *Individual Pearson correlation coefficient between variables with all individuals.*

	C1	C2	C3	Branch D	Branch E	Head D	Head E	Tooth 46	Tooth 36	Tooth 13	Tooth23
C1	1	0.26	0.39	0.17	0.23	0.11	0.19	0.22	0.19	0.12	0.37
C2		1	0.37	0.17	0.07	0.11	0.07	0.10	0.11	0.01	0.13
C3			1	0.03	-0.02	0.14	0.25	0.12	0.06	0.22	0.38
Branch D				1	0.51	0.16	0.08	0.29	0.37	0.27	0.19
Branch E					1	0.10	-0.07	0.39	0.43	0.19	0.24
Head D						1	0.76	-0.08	-0.18	0.09	0.09
Head E							1	-0.11	-0.07	0.26	0.27
Tooth 46								1	0.70	0.27	0.47
Tooth 36									1	0.39	0.39
Tooth 13										1	0.65
Tooth 23											1

Analyzing Table 2, we can verify how strong or not the correlation between the variables is for all individuals. Note that the variables that have a strong correlation are the variables Head D and Head E that correlate with a correlation coefficient of 0.76. There are also the variables Tooth 46 and Tooth 36 that correlate with a correlation of 0.7, and of the variables Tooth 13 and Tooth 23 with a correlation of 0.65. All these correlations are indicated as a strong correlation. Although slightly lower, the correlation of the variables ramus was also positive and moderate (r = 0.51).

It is important to note that there are variables that present a mean correlation as Branch E and Tooth 36, whose correlation coefficient between them is 0.43, and Tooth 46 and Tooth 23, which present a correlation coefficient of 0.47. On the other hand, the variables that did not correlate with each other were the variables C3 and BranchD, C3 and Branch E, with correlation coefficient of 0.03 and -0.02 respectively.

Discussion

Dental radiographs showing mandibular or maxillary bone may also be used for the diagnosis of bone-related diseases. Osteoporosis is a bone-related disease with increasing prevalence due to increasing age of the population. The general dental practitioner might fulfill the same role with respect to osteoporosis as with other diseases in the oral region, for example, oral cancer[21]. By recognizing the disease in its early phase and referring the patient to a specialist, the dentist could opportunistly help the patient greatly to increase the chances for a cure and a normal life, and help society to control the financial burden that is associated with osteoporosis.We found only a weak negative correlation of C3 densities with age, similar to what occurred when we verified the correlation of mean densities of C1, C2 and C3 with age. The genus also showed a weak negative correlation when compared to the cervical vertebrae.

The ability of the cervical spine to bear weight, move in 6 degrees of freedom, and provide passage for vascular and neural structures makes it the most complex articular system in the body. Much like bone in other parts of the spine, the cervical spine is affected by physiological processes such as aging and degeneration. In other parts of the spine, when fractures related to aging occur, the risk of future fractures increases.[7] As the population of the developed world ages, it is likely that fractures associated with aging will become more common. The effect of aging is readily demonstrated in the cervical spine. As people get older and their bone density decreases, fractures of the C-2 vertebra, in particular, increase in frequency.[8,9,10]

One of the main factors to which this phenomenon has been attributed is osteoporosis.[2] In terms of absolute frequency, cervical spine fractures are more common in the elderly than in younger adults. As osteoporosis is a slowly progressing disease with about annual bone loss between 1–5%, with the accuracy error of DXA techniques is 3–15% and the precision error is 1–3%[2,15,16,17]. High costs would be required to examine all patients in the DXA risk group. Therefore, there is a need for alternative methods and of several health professionals that can help on a large scale to monitor the skeletal status and to detect early signs of osteoporosis so as to select individuals for further BMD testing and possible treatment, even if opportunistically.

The currently most accepted method for measuring bone mass is Dual X-ray Absorptiometry (DXA or DEXA), gold pattern at the lumbar spine, forearm, heel or total body[2]. Although formal dual-energy x-ray absorptiometry (DXA) scanning is recommended for all women aged >65 years and all men aged > 70 years, less than 33% of women and 5% of men undergo screening after fractures caused by a low-velocity mechanism.[15] Given the increase in comorbid conditions associated with increasing age, imaging is performed frequently.

The correlations between osteoporosis and radiological measurements in dental radiographs are comparable with those reported for commonly used clinical screening instruments for osteoporosis such as the Osteoporosis Self-assessment Tool or the Simple Calculated Osteoporosis Risk Estimation with area under receiver operating characteristics (ROC) of about 0.8. However, most researchers concluded that these correlations do not yet enable the clinical use of dental radiographs for screening of osteoporosis[19,20,21,23,33,34]. Therefore we envisage the use of CT, through the HU. Therefore, we envisage the use of CT, through the Hounsfield Scale, seeking to find a positive correlation between the cervical vertebrae and buccal sites, opportunistically, since these exams became routine for the dental evaluation for the placement of implants.

The cervical vertebrae (C1, C2 and C3) can be measured opportunistically in CT examinations for evaluation of implants, and we found a mean density of 222, 258 and 393HU, respectively.

The mandibular condyles we find that on average bone density for the right condyles (RC) of all individuals in the analysis is 291 HU and average bone density for left condyle (LC) is 303 HU. Maxilla and mandibular regions average bone density is 182 HU to 46 tooth and 173 HU to 36 tooth, for tooth 13 is 378 HU and the tooth 23, 349 Hu. We must remember that the singular or complex geometry of the cervical vertebrae provides multiple locations where load may be applied to each vertebra, either through articulating joint surfaces or through muscle and ligament attachments. The asymptomatic neck is capable of a wide variety of movements. So, it is clear that the anatomical structures that comprise the cervical vertebrae are routinely subjected to diverse combinations of load.

Early diagnosis of osteoporosis by bone density measurements allows proper management of osteoporosis to reduce the risk of fractures and the risk of tooth loss[11,12,19,20,21,22]. Bone strength reflects the integration of bone mineral density (BMD) and bone quality, so osteoporosis must be detected and treated early to avoid fragility and fractures[1,2,13]. Brazil has more than 25 million edentulous people and has implantodontology as a strong possibility of recovering buccal health, even considering the socio-economic problems of this huge country.

Computed tomography (CT) is considered the method of choice for study of bone structures, one of its main advantages is three-dimensional information presented in a series of thin slices of the internal structure of the study, where the resulting information does not suffer by superposition anatomical structures[8,18,37]. Tay et al., 2012[9], correlated the values of bone density by Dual Energy X-ray Absorptiometry (DXA) with the values of the bone densities of CT and concluded that there is a strong correlation between the values assessed by two methods and they can be used together to diagnose osteoporosis. Anderson and Schreiber 2011[8], evaluated 25 patients, mean age of 71.3 years, with DXA and CT of the lumbar spine and was obtained correlation of the values and concluded that there is a strong correlation between the two osteoporosis diagnostic methods.In our study we found some positive correlation between the cervical vertebrae and sites in the maxilla and mandible, as was the case of the C3 vertebrae with the tooth region of the tooth 23 (0.38).

According to the classification of Lekholm and Zarb[12], the Bone type 4 (<200HU) requires a meticulous surgical technique. We finded this value to mandibular regions average bone density is 182 HU to 46 tooth and 173 HU to 36 tooth. Probably these regions would be edentulous regions of the alveolar ridge, being also atrophic. An important threshold based on these studies is an HU value of less than 120, which indicates likely bone insufficiency and suggest the need for further investigation.[18] Pickhardt et al[7] compared CT derived HU to DXA using the ROC analysis to determine cutoff values that optimize sensitivity and specificity. The results in a series of 1867 patients was that an HU threshold of 160 or less at L-1 was 90% sensitive for distinguishing osteoporosis from osteopenia, while an HU value of 110 was 90% specific. We have values cose to these in region of ramus (D and E), but we know that this region is practically, only cortical practically, very different from the region of the alveolar borders or of the vertebrae. So much so that the correlation of the cervical vertebrae was poor in highlight to the region of the Branch. Despite the positive correlation we found from the cervical vertebrae to this posterior region of the mandible, it is low (r=0,23).While future studies are needed to answer this question in the colunn, local HU values have been used in the field of dentistry for implant planning.

The DXA is used to quantify and qualify the bone density in the hip bone, femur, forearm and also when the jaw for evaluation of localized osteoporosis, showing that the disease is systemic bone by being in various places on the bones of the body[6,7,8,9] and CT proved as efficient as the DXA for diagnosis of bone densities in different bones in the body. Lee et al, 2013[35] valuated the lumbar spine 128 women who had CT and DXA, the trabecular portion of the L4 vertebra was analyzed and values in HU and BMO were determined and compared, showing a strong correlation between the two methods for osteoporosis diagnosis. In this study, correlated the densities of the jaws with the cervical spine, although little studied, is part of the spine, and found strong correlations when there are low densities in the jaw and spine, thus suggesting a classification of systemic osteoporosis for patients.

Another important finding found in our research is that there is a strong correlation between the bone densities of the different sides of the patients, as in the tooth regions of Teeth 36 and 46, Teeth 13 and 23, and mandibular heads, besides the moderate correlation in the mandibular branches. This demonstrates that for this sample, timely measurements on only one side could avoid higher doses doses of radiation exposure, eg when performing bone quality assessment.

In general, a diagnosis should primarily answer the question of whether a subject is healthy, diseased, or perhaps in an intermittent state. For this purpose, we need a definition of the disease. Then, diagnostic criteria must be specified for a given method, ideally assessing the severity of the disease by a quantitative scale. Ideally, treatment decisions based on this scale should be possible.

Assessing local bone quality on CT scans with HU quantification is being used with increasing frequency. Correlations between HU and bone mineral density have been established, and normative data have been defined throughout the spine. Recent investigations have explored the utility of HU values in assessing fracture risk, implant stability, and spinal fusion success. The information provided by a simple HU measurement can alert thetreating physician to decreased bone quality, which can be useful in both medically and surgically managing these patients. For example, it is suggested that the examination of the femoral area can comprehend the expected value to cervical area.[18]

When CT scans have been obtained as a opportunistic measure in preoperative evaluations, for implants, they may contain valuable information of regional and global bone quality at no additional cost. This information can be useful for appropriate patient counseling regarding perioperative risks, or it can be used to identify the need for additional studies or appropriate referral.

Like this, we do not believe that CT scanning should be used for osteoporosis screening purposes or as a substitute for DXA, but we believe that if you have available data about some another diagnosis exam, for example, of sites of the maxillomandibular complex, so, the data could be useful to identify at-risk patients.

So, we could conclude that Computed tomography used in dentistry appears to be a means of diagnosing osteoporosis located in the jaw or for speculation on systemic disease.

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