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Dental considerations in pregnancy and menopause

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Abstract

The present study offers a literature review of the main oral complications observed in women during pregnancy and menopause, and describes the different dental management protocols used during these periods and during lactation, according to the scientific literature. To this effect, a PubMed-Medline search was made, using the following key word combinations: "pregnant and dentistry", "lactation and dentistry", "postmenopausal and dentistry", "menopausal and dentistry" and "oral bisphosphonates and dentistry". The search was limited to reviews, metaanalyses and clinical guides in dental journals published over the last 10 years in English and Spanish. A total of 38 publications were evaluated. Pregnancy can be characterized by an increased prevalence of caries and dental erosions, worsening of pre-existing gingivitis, or the appearance of pyogenic granulomas, among other problems. Although routine dental treatment is generally safe in pregnant patients and posteriorly during the lactation period, certain dental procedures can have potentially damaging effects, such as the use of ionizing radiations, the administration of drugs, or the generation of pain and stress. In postmenopausal women, alterations of the oral cavity are related to the hormone alterations that characterize these patients and to physiological aging of the oral tissues, potentially giving rise to periodontitis, burning mouth syndrome and xerostomia. As a result of the development of osteoporosis, these patients may be receiving treatment with oral bisphosphonates, which in turn may require changes in the dental management plan.

Key words: *Pregnancy, lactation, menopause, postmenopause, dental management, oral bisphosphonates.*

Introduction

Pregnancy and the menopause are physiological changes in women that give rise to adaptive changes at both systemic and oral level.

During pregnancy, women may experience systemic disorders such as *respiratory alterations*: dyspnea (60-70% of all pregnant women), hyperventilation, snoring, an upper ribcage breathing pattern, chest widening and rhinitis (1-3); *hemodynamic alterations*: elevation of coagulation factors V, VII, VIII, X and XII, and reduction of factors XI and XIII, with increased fibrinolytic activity to compensate for the increased clotting tendency; *gastrointestinal alterations*: increased intragastric pressure and a reduction in lower esophageal sphincter tone secondary to inhibition of the production of motilin peptide hormone due to the rise in progesterone concentrations observed in this period – giving rise to heartburn (acidity) in 30-70% of all pregnant women – and an almost two-fold prolongation of gastric emptying time compared with non-pregnant women (2,3). Nausea and vomiting are experienced by 66% of all pregnant women, starting approximately 5 weeks after the last menstrual period, and reaching a maximum prevalence after 8-12 weeks. In this context, dental appointments in the morning are to be avoided in pregnant women with increased vomiting tendency due to pregnancy; *renal alterations*: increased renal perfusion particularly during the second half of pregnancy, giving rise to increased drug excretion in urine. Drug dosing adjustments are thus commonly required in such patients; and *endocrine alterations*: gestational diabetes is observed in 45% of all pregnant women. On the other hand, *decubitus hypotension syndrome* or vena cava syndrome is observed in the final stage of pregnancy in approximately 8% of all cases, as a result of difficulty in venous return to the heart caused by compression of the inferior vena cava by the gravid uterus. This condition manifests as a sudden drop in blood pressure with nausea, dizziness and fainting when the patient is in the horizontal position (1). In order to prevent this problem, pregnant women should keep the right hip slightly raised (10-12 cm) or inclined to the left while seated in the dental chair. At oral level there may be an increased risk of caries, periodontal disease and pyogenic granulomas.

During menopause it is possible to observe *metabolic alterations*: climacteric hyperthyroidism and parathyroid gland hyperactivity (due to the lack of estradiol) leading to calcium and phosphorus mobilization in the context of osteoporosis (4); *cardiovascular alterations:* hypertensive crises (often associated to headache), tachycardia and arrhythmia due to the lack of estrogens; *renal disorders* associated to estrogen dependency (interstitial cystitis) and diminished bladder capacity; *bone alterations:* loss of bone mass with osteoporosis, secondary to the reduction in estrogen levels (observed in 25% of all menopausal women, and reaching 52% after 65 years of age) – with an increased risk of hip and forearm fractures in the late climacteric period (5-7); *psychological and neurological disorders:* irritability, insomnia, anxiety, depression, neuralgias, paresthesias, headache and restless legs syndrome due to the effect of estrogen depletion upon mental function. Hot flashes are the most common manifestation, with a frequency of 50-80% during climacterium, and are produced by the dilatation of small blood vessels (a vascular phenomenon, but characterized by a strong neurovegetative component) (4); and *skin alterations* in the form of epidermal atrophy, diminished thickness of the dermis and decreased elasticity, perspiration and nail growth. At oral level, a worsening of periodontal conditions can be seen, with the appearance of burning mouth syndrome, xerostomia (dry mouth) or maxillary osteonecrosis among women receiving treatment with bisphosphonates.

Material and methods

The present study offers a literature review of the main oral complications observed in women during pregnancy and menopause, and describes the different dental management protocols used during these periods and during lactation, according to the scientific literature. To this effect, a PubMed-Medline search was made, using the following key word combinations: "pregnant and dentistry", "lactation and dentistry", "postmenopausal and dentistry", "menopausal and dentistry" and "oral bisphosphonates and dentistry". The search was limited to reviews, metaanalyses and clinical guides in dental journals published over the last 10 years in English and Spanish. A total of 108 articles were identified. After examining the titles and abstracts, this number was finally reduced to 35 articles, and after compiling information from each of them we added three further articles (two clinical trials and a case-control study), due to their relevance. Thus, a total of 38 publications were finally considered.

Results

DENTAL CONSIDERATIONS IN PREGNANCY

1) Oral alterations during pregnancy

At oral cavity level, pregnant women may suffer a series of alterations such as caries, gingivitis, periodontal disease, or pyogenic granuloma.

Caries

Pregnancy is characterized by an increased prevalence of dental alterations, including caries (99.38%) and erosions (8). This increased risk is mainly due to the increase in caryogenic microorganisms produced by the nutritional changes and to lesser attention to oral health, coinciding with a drop in salivary pH and buffer effect. These changes in salivary composition are observed in advanced-stage pregnancy and during lactation, and

may temporarily increase vulnerability to both caries and enamel erosion (9).

Gingivitis / periodontitis

Gingivitis is the most common oral disorder during pregnancy, with a prevalence of 60-75% (9). Approximately 50% of all women with pre-existing gingivitis suffer worsening of the condition during pregnancy, as a result of the fluctuations in estrogen and progesterone levels, in combination with changes in the oral flora and a diminished immune response (9,10). Gingivitis tends to appear in the second month of pregnancy, coinciding with an increase in estrogen and progesterone concentration. The maximum intensity is observed in the eight month, after which gingivitis decreases. Other factors such as the accumulation of dental plaque and deficient oral hygiene may be regarded as causal or aggravating factors.

Periodontitis affects approximately 30% of all pregnant women (9). In a study carried out by Diaz-Guzman et al. (8) in 7952 women (93 pregnant and 5537 non-pregnant subjects), no significant differences were observed in the prevalence of gingivitis (54.54% and 50.50%) and periodontitis (31.82% and 31.75%) between the study and control groups, respectively. However, the severity of periodontitis was significantly greater among the pregnant women (18.18% versus 9.88%). On the other hand, periodontal disease during pregnancy has been identified as a risk factor for premature delivery or low infant weight at birth (8,11-14). During the second trimester of pregnancy, the proportion of anaerobic gramnegative bacteria increases with respect to the aerobic bacteria in dental plaque. Lipopolysaccharides (bacterial components) can activate macrophages and other cells, causing them to produce and secrete a broad range of molecules, including cytokines IL-1β, TNF-α, IL-6 and PGE_2, and matrix metalloproteinases. If these compounds reach the general circulation and cross the placental barrier, the levels of PGE_2 and TNF-α in amniotic fluid may increase and premature delivery may result. The studies published to date only report an association between these two conditions, but do not indicate a causal relationship. In any case, the inflammatory mediators produced in periodontal disease have been found to also play an important role in the onset of labor – thus suggesting that such biological mechanisms may serve to link the two conditions (12-15).

Pyogenic granuloma

Pyogenic granuloma of pregnancy, also known as epulis, or pregnancy tumor or granuloma, is a benign, reactive inflammatory lesion composed of proliferating capillaries, observed in 5% of all gestating women during the second trimester of pregnancy (9,10,14). Estrogens and progesterone do not intrinsically induce these lesions; rather, they increase the vascularity of gums which are already affected by gingivitis and periodontitis (8). The inflammation retards the metabolism of progesterone, increasing the presence of the hormone in its active form in these tissues. As a result, in the presence of local irritative factors such as trauma or bacterial plaque, the development of pyogenic granuloma is facilitated (8). Clinically, the latter manifests as an asymptomatic, red, smooth or lobulated, sessile or pediculate mass located on the papillary gingival tissue and, less frequently, on the lip or cheek mucosa or tongue. The lesion bleeds easily and shows rapid growth. After delivery it decreases in size and in some cases disappears entirely.

Other alterations associated to pregnancy

Other alterations that can appear during this period are: *aphthae*, which should be monitored, though no type of treatment is required; *salivary changes,* including variations in pH and composition; an increased frequency of *temporomandibular joint disorders*, though these seem to be more related to dental losses, malocclusions or poorly executed fillings during this period (16); *melasma* (in 75% of all pregnant women)*,* a skin alteration that usually improves after delivery, though it may reappear during successive pregnancies; and *hirsutism*, among other disorders.

2) Dental management during pregnancy

The treatment recommendations during pregnancy should be viewed as general orientations, not as strict rules. Interconsultation with the obstetrician or physician is very useful for knowing the medical condition of the patient, her dental needs and treatment options (17-19).

Modifications in the dental treatment plan

Phase 1: Prevention program

The most important consideration in the planning of dental treatment in pregnant women is to ensure the learning of adequate oral hygiene (use of interproximal brushes, dental floss, brushing frequency and technique), with a view to reducing gingival inflammatory response to the local irritants usually associated to the hormonal changes observed during pregnancy. In addition, emphasis should be placed on the advisability of reducing the consumption of refined carbohydrates (15).

The use and benefits of fluoride administered during the prenatal period for the subsequent prevention of caries in deciduous teeth is the subject of intense debate. Fluor is clearly able to cross the placental barrier and is absorbed by the fetus, though its true efficacy is not clear. In this context, Leverett et al. (20) analyzed the effect of prenatal fluor upon the incidence of caries in deciduous teeth and on the appearance of fluorosis. They administered 1 mg of fluor daily in the form of tablets to a group of pregnant women during the last 6 months of pregnancy, while the control group received placebo. The subsequent incidence of childhood caries was analyzed after three and 5 years, together with the presence or absence of fluorosis after 5 years. The caries levels were very low in both groups (91% and 92% of the children

in the treatment group and control group without caries, respectively), and mild fluorosis was recorded in only a small proportion of children. These results do not confirm the hypothesis that prenatal fluor is closely related to the appearance of fluorosis or that it has a strong caries-preventing effect. In addition, it should be noted that for ethical reasons both groups were encouraged to use postnatal fluor, and this could have contributed to the diminished presence of caries in both patient populations (20).

Phase 2: Programming of treatment during pregnancy

Fetal organogenesis takes place in the first three months of pregnancy, and is very sensitive to external factors (drugs, maternal stress, irradiation). Over the next trimesters the fetus grows and becomes less sensitive – though a number of factors can still exert an influence, such as infections or certain drugs such as the tetracyclines (Fig. 1)(21).

- During the *first trimester* (from conception to week 14) only emergency dental treatment is indicated, avoiding elective dental procedures because of the vulnerability of the fetus. Oral hygiene should be reinforced, with plaque control and tartrectomy where required.
- The *second trimester* (from week 14 to week 28) is the safest period for elective dental treatment. It is advisable to avoid X-rays during this period, though if they prove necessary, they should be obtained under specific protective measures. It is preferable to postpone extensive reconstructions or major surgical procedures until after delivery.
- The first part of the *third trimester* (from week 29 to delivery) is still a good period for elective dental treatment. Keeping the patient sitting for long periods of time is not advisable, since supine hypotension syndrome might develop. However, in the second half of the third trimester, all elective dental treatments should be postponed, due to the risk of premature delivery.

Another subject of controversy is the use of *dental X-rays*. Irradiation is to be avoided during pregnancy, particularly in the first trimester (2,9). However, if X-rays prove necessary, they should be obtained under adequate safety conditions (beam collimation, high-speed film, filter, lead protection, high kV setting or constant beams, in-use quality program), and only selected periapical or bitewing images should be contemplated in most cases.

Regarding *drug use during pregnancy*, the main concern is the possibility that fetal toxicity or teratogenicity may result if the drug is able to cross the placental barrier. Polytherapy is to be avoided, and any necessary prescription should be decided administering the least effective dose for the shortest period of time possible. In any case, medication should be avoided in the first three months of pregnancy. Before prescribing or administering a drug to a pregnant patient, the dental professional should know the classification of the United States Food and Drug Administration (FDA) for the prescription of drugs to pregnant women according to the risk of fetal damage. This classification contemplates 5 categories (A, B, C, D

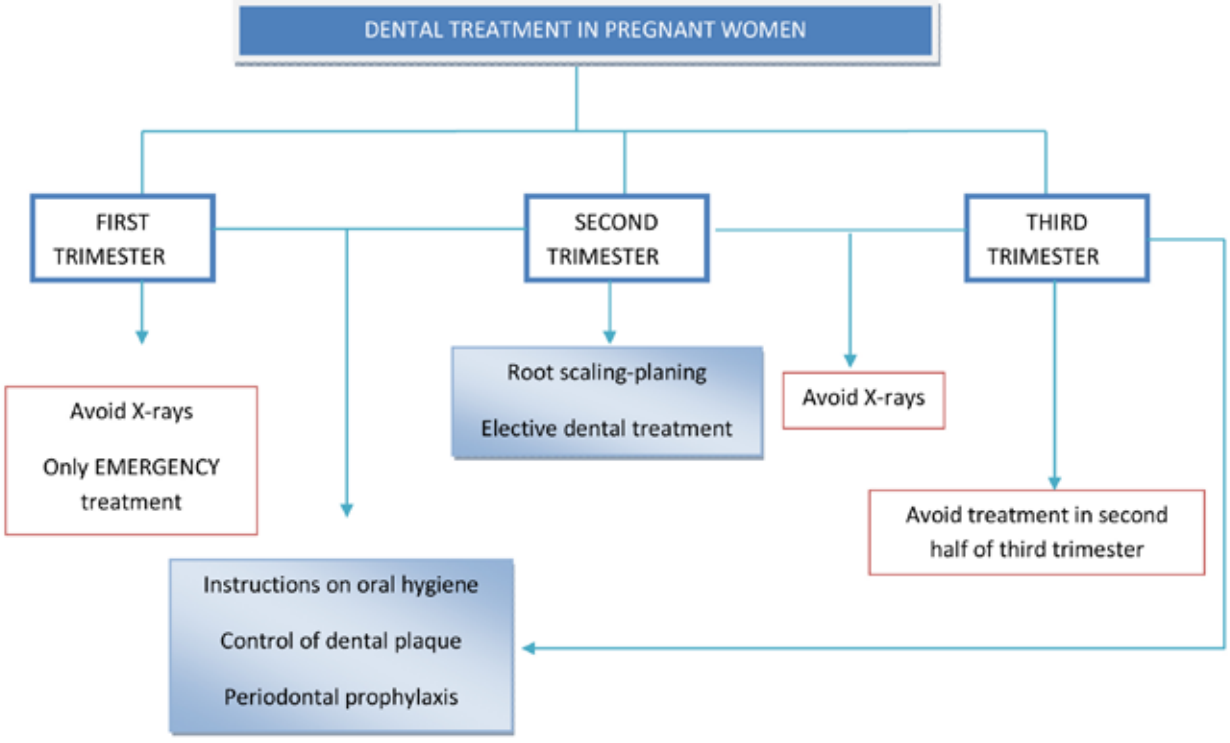

Fig. 1. *Algorithm for dental management in pregnant women.*

DRUG	FDA CATEGORY	USE DURING PREGNANCY
Local anesthetics:		
• Lidocaine	B	YES
• Mepivacaine	C	YES (with caution)
• Prilocaine	B	YES
• Bupivacaine	C	YES (with caution)
• Ethidocaine	B	YES
Analgesics:		
• Acetylsalicylic acid	C/D	NO
• Acetaminophen	B	YES
• Ibuprofen	B/C	Avoid in third trimester
• COX-2 inhibitors	C	Avoid in third trimester
• Codeine	C	Can be used in second and third trimester
• Oxycodone	B/C	YES
• Morphine	B	YES
• Fentanyl	B	YES
• Naproxen	B/D	NOT in second half of pregnancy
Antibiotics:		
• Amoxicillin	B	YES
• Metronidazole	B	YES
• Erythromycin	B	YES
• Penicillin V	B	YES
• Cephalosporins	B	YES
• Gentamycin	C	YES
• Clindamycin	B	YES
• Cephalosporins	B	YES
• Tetracyclines	D	NO
• Chlorhexidine	B	Not described
Corticosteroids:		
• Prednisolone	B	YES
Antifungals:		
• Nystatin	B	YES
• Clotrimazole	B	YES
• Fluconazole	C	With caution
• Ketoconazole	C	With caution
Sedatives:		
• Hypnotics, benzodiazepines	D	NO, risk of craniofacial anomalies
• Barbiturates	D	NO, risk of craniofacial anomalies
• Nitrous oxide	Not designated	Controversial

Table 1. *Classification of the drugs most widely used in dental practice according to the fetal risk categories of the United States FDA.*

and X)(1,2,9). In this context it is advisable to prescribe drugs belonging to groups A and B. However, many group C drugs are also administered during pregnancy (Table 1).

Phase 3: Lactation period

During the lactation period it is necessary to assess the possible risk of maternal drug use for the breastfeeding infant, and to evaluate the possible safer alternatives. If medication proves necessary, however, it should be administered after breastfeeding, in order to facilitate elimination of the drug before the next feeding time and thus minimize exposure of the nursing infant. It is advisable to administer the medication immediately after breastfeeding, and to avoid further medication for four hours or more in order to lessen the drug concentration in breast milk. Oral rinses containing ethanol are not recommended, since the latter can be excreted in milk. The existing information in the case of chlorhexidine rinses is limited, though the scant absorption of this drug makes problems for the nursing infant unlikely. Table 2 shows the drugs most commonly used in dental practice during lactation (21,22).

DENTAL CONSIDERATIONS IN MENOPAUSE

Menopause is a physiological process characterized by

	CATEGORY A	CATEGORY A/B	CATEGORY B	CATEGORY B*
NONSTEROIDAL ANTIINFLAMMATORY DRUGS	Paracetamol Diclofenac Ibuprofen Naproxen		Ketoprofen Rofecoxib Acetylsalicylic acid	
ANTIBIOTICS	Cephalosporins Erythromycin Amoxicillin Azithromycin	Amoxicillin-clavulanate Tetracyclines	Streptomycin Metronidazole	
ANTIFUNGALS	Fluconazole		Ketoconazole	
ANTIVIRAL AGENTS	Aciclovir			
ANTISEPTICS	Chlorhexidine			
SEDATIVES-HYPNOTICS			Diazepam Midazolam	Hydroxyzine

Table 2. *Drug classification according to compatibility with lactation. A: compatible; B: use with caution; B*: insufficient data on excretion; C: totally contraindicated.*

the permanent cessation of menstruation. As such, the term does not include interruptions in ovarian activity as a result of surgical interventions. Menopause usually occurs towards the fifth decade of life and has a series of physiological effects, with a reduction in estrogen output secondary to a loss of follicular function. It represents a step within the slow and prolonged process of reproductive aging.

1) Oral alterations during menopause

The alterations observed within the oral cavity are related to the hormone changes that take place in menopausal women, though physiological aging of the oral tissues also plays a role. The most common oral manifestations during menopause are detailed below.

Periodontitis

In women, increased bone resorption due to endocrine causes appears to be the main pathogenic mechanism underlying accelerated bone loss in postmenopause (23-27). However, no direct relationship has been observed between the two phenomena (24). The effects of 17-beta-estradiol deficit in menopause have been related to the inflammatory reabsorption of alveolar bone, though this association remains unclear – particularly because of a lack of longitudinal studies designed to evaluate the clinical signs of gingival inflammation and the progression of periodontitis (24). Another marker linked to bone turnover in periodontal disease is osteocalcin. Bullon et al. (23), in a study of 39 postmenopausal women, found low serum osteocalcin levels to be significantly correlated to a greater reduction in pocket depth and attachment loss after periodontal treatment.

Maxillary osteonecrosis

Osteonecrosis of the jaws is observed in patients treated with bisphosphonates (BPs). These drugs are endogenous pyrophosphate analogs that are able to affix to bone and inhibit osteoclast function, thereby lowering bone turnover and reducing active remodeling in those areas characterized by excessive bone reabsorption (28,29).

The BPs can be administered via the intravenous route (for the prevention of bone metastases in cancer patients, in malignant hypercalcemia, and in multiple myeloma patients) or via the oral route (for the prevention and treatment of osteoporosis, and in some bone disorders such as Paget's disease). Some examples of BPs marketed in Spain are alendronate *(Fosamax®, Fosavance®, Adrovance®, Alendrocare®, Bifoal®)*, risedronate *(Actonel®, Acrel®)*, etidronate *(Difosfen®, Osteum®)*, clodronate *(Bonefos®)*, tiludronate *(Skelid®)* and ibandronate *(Bonviva®)*.

Maxillary osteonecrosis produced by oral BP therapy is less frequent than that caused by systemic BPs, with an incidence of 1/10,000-1/100,000 in patients treated with oral BPs and 1-3% in patients treated with intravenous BPs (30). Although the risk of developing maxillary osteonecrosis in patients treated for osteoporosis is very low, a series of factors have been associated with an increased risk of maxillary osteonecrosis (Table 3). The risk predicting capacity of each of these factors has not been established but is extremely low in absolute terms (31). Among patients treated with BPs at the doses used for osteoporosis, the risk of developing maxillary osteonecrosis is greater in those with past antecedents of maxillary osteonecrosis, those receiving immune suppressive therapy, and those subjected to prolonged treatment

Chemotherapy	Cancer	Immunotherapy	Corticosteroids
Female sex: estrogens	Old age	Neurological damage	Variations in atmospheric pressure
Osteoporosis	Osteoarthritis	Hypersensitivity reactions	Hemodialysis
Blood dyscrasias	Vascular diseases	Coagulation alterations	Systemic lupus erythematosus
Alcohol abuse	Smoking	Hypothyroidism	Storage diseases
Arterial hypertension	Malnutrition	Infections	Diabetes mellitus
Chronic inactivity	Hyperlipidemia and adipose embolia	Drepanocytosis (sickle cell disease)	Gaucher's disease
Human immunodeficiency virus infection	Dental risk factors: periapical disease, periodontal disease, dental abscesses, surgery affecting bone, trauma caused by poorly fitting dentures, traumatizing exostosis		

Table 3. *Possible risk factors for the development of maxillary osteonecrosis (17).*

with BPs. The following criteria must be met in order to establish a diagnosis of maxillary osteonecrosis (32): current or past treatment with BPs; the presence of one or more ulcerated lesions on the alveolar mucosa, with the exposure of maxillary or mandibular bone (there also may be cases without bone exposure, or with pain or fistulas, that should be studied more in detail); exposed bone of necrotic appearance; spontaneous presentation of the lesions or, more frequently, manifestation after dental-alveolar surgery (particularly extractions); and the absence of healing for a period of at least 6 weeks.

Clinically, maxillary osteonecrosis is usually characterized by progressive and sustained pain requiring important analgesic doses (though the patient may be asymptomatic in the early stages), suppuration through gingival fistulas and the exposure of necrotic maxillary or mandibular bone (more frequent in the molar zone of the mandible) through the mucosa. In menopausal women with osteoporosis there have also been reports of oral mucosal ulcerations secondary to inadequate alendronate administration (28).

In relation to the management of maxillary osteonecrosis, Bagán et al. (33) in 2009 proposed a modification of the staging classification used up to that time. Table 4 shows the different clinical stages and the associated treatment options.

Burning mouth syndrome

Burning mouth syndrome (BMS), also known as glossodynia or stomatodynia, mainly affects women in the fourth or fifth decade of life. The disorder shows a clear female predominance (7/1 over males)(34). BMS is described as a burning sensation affecting different areas of the oral cavity (tongue, palate, lips, areas of denture support). It is often bilateral, and is characterized by

CLINICAL STAGE	MANIFESTATIONS	TREATMENT
STAGE 1	Bone exposure with necrotic bone or a small ulceration of the oral mucosa without exposure of necrotic bone. Both asymptomatic.	Daily 0.12% chlorhexidine rinse and follow-up.
STAGE 2A	Bone exposure with necrotic bone or a small oral fistula without exposure of necrotic bone but exhibiting symptoms. Controlled with antibiotics and antiseptics, and the lesions do not worsen.	Daily 0.12% chlorhexidine rinse, antibiotics, analgesics and follow-up.
STAGE 2B	Bone exposure with necrotic bone or a small oral fistula without exposure of necrotic bone but exhibiting symptoms. Not controlled with drug treatment, the lesions worsen, and pain is difficult to control.	Daily 0.12% chlorhexidine rinse, antibiotics, analgesics and surgery, with elimination of the necrotic bone.
STAGE 3	Mandibular fracture, extraoral fistula, osteolysis extending to inferior margin.	Daily 0.12% chlorhexidine rinse, antibiotics, analgesics and wide surgery with bone resection.

Table 4. *Proposed new classification of maxillary osteonecrosis due to bisphosphonates and its treatment.*

the absence of pathological findings. The accompanying symptoms may include dry mouth sensation or alterations in taste sensation (34-37). The underlying causes remain unclear. It has been suggested that female sex hormones and neuropathic factors may be implicated, possibly through small-fiber sensory neuropathy of the mucosa oral (34). Normal clinical tests and explorations distinguish primary BMS from secondary stomatodynia. Treatment consists of low-dose topical (without swallowing) or systemic clonazepam. The association of this drug to tricyclic antidepressants has afforded variable results.

Xerostomia

Xerostomia is another frequent manifestation in postmenopausal women. The patients typically report a decrease in salivary flow, though in only one-third of all cases is hyposialia actually present (24). In a case-control study of 46 postmenopausal women (38 with dry mouth sensation and 38 without xerostomia) published by Agha-Hosseini (24), a negative correlation was found between the severity of dry mouth sensation and the salivary concentration of 17-beta-estradiol. In these patients abundant water intake is to be recommended, together with sugar-free sweets or chewing gum to increase salivation. In some cases sialogogues such as pilocarpine, bromhexine or bethanechol may be indicated.

Other disorders

Oral lichen planus, benign mucosal pemphigoid and Sjögren's syndrome are all disorders that have been reported with increased frequency in menopausal women.

2) Dental management during menopause

A full clinical history should be compiled in all postmenopausal women, together with a thorough evaluation of the mucosal membranes, the periodontal and dental conditions, and salivary flow (quantity and quality). The pertinent complementary tests (X-rays, periodontal probing, sialometry) are also indicated. It is very important to maintain low levels of dental plaque by introducing adequate oral hygiene (use of interproximal brushes, dental floss, brushing frequency and technique), together with the use of chemotherapeutic agents such as chlorhexidine. This substance reduces the accumulation of dental plaque, improves periodontal disease and prevents caries (elimination of much of the presence of *Streptococcus mutans*), particularly root caries, which are more frequent in elderly individuals (23,29). The use of toothpastes, varnishes or gels containing fluor is also advised for the prevention of dental caries.

Dental management of patients receiving treatment with oral bisphosphonates

The oral management of these patients requires no special protocols. Conservative dental treatment can be provided at any time without having to suppress bisphosphonate therapy. In this context, tartrectomy, fillings, endodontic procedures, reconstructions and bridges can be indicated without having to adopt any specific preventive measures. Regarding orthodontic treatment, the reduction or abolition of osteoclast function may seriously compromise the results obtained. While such treatment can be considered, the patient informed consent document must explain that treatment failure is possible. In addition, such procedures should aim to minimize the number of extractions, dental movement and pressure upon the tissues during treatment and retention (38). In reference

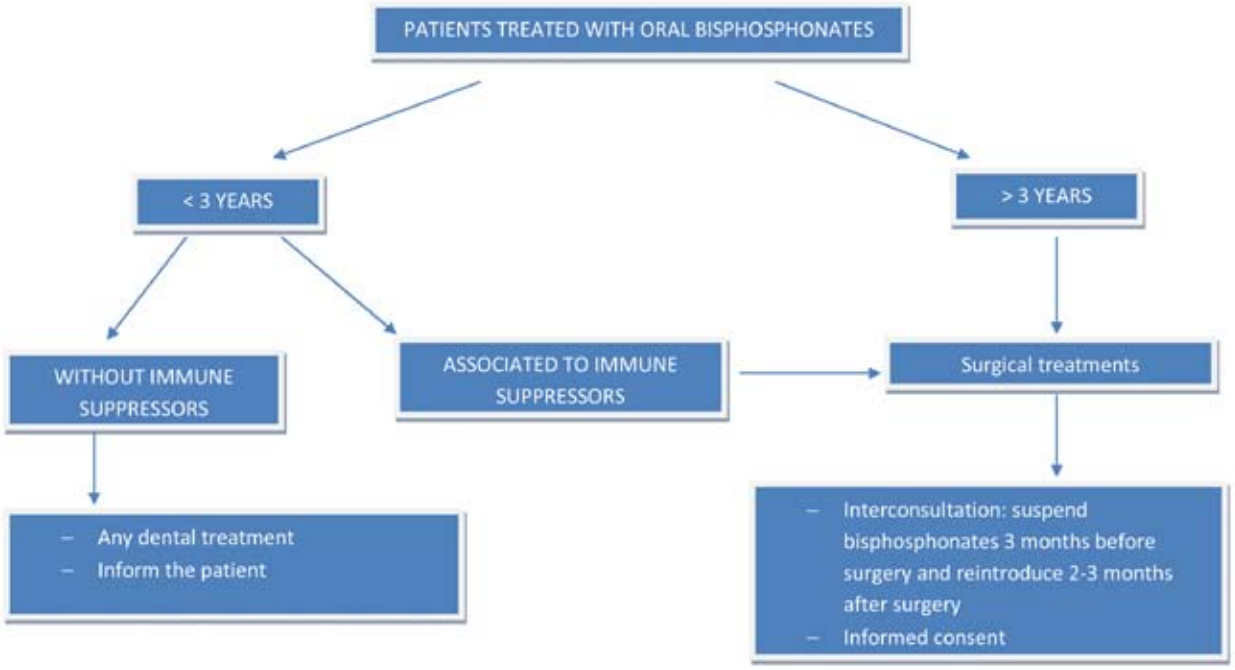

Fig. 2. *Algorithm for dental management in patients treated with oral bisphosphonates*

to surgery involving underlying bone (scaling and planing, periodontal surgery, implants and extractions), the following groups are established according to the risk of maxillary osteonecrosis in each patient (time elapsed from the start of treatment with BPs and concomitant administration of immune suppressors - corticosteroids, azathioprine, cyclophosphamide, etc.)(Figure 2):

- Group 1: Patients receiving oral BPs for at least three years without immune suppressors. Any type of treatment can be provided, without the need for specific preventive measures. It is advisable to inform the patient about the existence of maxillary osteonecrosis and its association to BPs and dental treatment, with signing of the corresponding informed consent document. In addition, periodic follow-up visits are required.
- Group 2: Patients receiving oral BPs for at least three years and who are also using immune suppressors, or patients receiving oral BPs for more than years. The prescribing physician should be consulted in order to evaluate the possibility of suspending bisphosphonate therapy at least three months before oral surgery, except if the patient fracture risk is high (age > 70 years, presence of previous fracture, densitometry with a T-score < -2.0) – in which case BP therapy should not be suspended. In the case of suspension, bisphosphonate treatment should be reintroduced as soon as healing is complete (2-3 months after).

Some authors have recommended the evaluation of serum CTX (collagen breakdown product released during bone remodeling and turnover), since bisphosphonate therapy reduces these levels; in this sense, CTX determination may be a reliable risk marker, though a number of studies have found no statistically significant relationship between serum CTX and the number of areas of exposed necrotic bone or the magnitude of maxillary osteonecrosis (30).

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