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Prevention of Medication-Related Osteonecrosis of the Jaw (MRONJ): Updated Recommendations for Dental Hygienists from the Italian Consensus

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ABSTRACT

Aim of the study: Primary prevention and early diagnosis of Medication-Related Osteonecrosis of the Jaw (MRONJ) are essential to reduce the incidence and progression of the disease. In this context, dental hygienists play a central role, although to date only a few publications have proposed standardized protocols dedicated to dental hygienists for MRONJ prevention. The aim of this article is to provide an updated recommendation concerning the role of the dental hygienist in the prevention of MRONJ.
Materials and Methods: This work represents an update of the best practices defined and shared during the 2021 ONJ Consensus Conference (ONJ update, May 9, 2021, www.onjupdate.it), which involved 11 Italian experts (i.e., dental hygienists representing the main scientific societies – AIDI and UNID – as well as oncologists, maxillofacial surgeons, and dentists, promoters of the 2020 recommendations) and was published in 2022 in English in the international journal Supportive Care in Cancer.
Results: The described protocol focuses on the role of the dental hygienist in managing patients at risk of or with confirmed MRONJ and involves three main steps: primary prevention, secondary prevention, and support for MRONJ treatment. For each step, specific indications and procedures for the dental hygienist are provided.
Conclusions: In all steps, the authors confirm that periodontal examination is the fundamental procedure underlying any specific intervention and can be supported by various indices. In particular, the authors consider the use of PSR (Periodontal Screening and Recording) very useful for defining personalized periodontal strategies for patients at risk of MRONJ.

Keywords Dental Hygienists, MRONJ, Osteonecrosis of the Jaw, PSR, Prevention, Risk Factors, Oral Health

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INTRODUCTION

Medication-Related Osteonecrosis of the Jaw (MRONJ) is defined as a "drug-related adverse reaction characterized by the progressive destruction and necrosis of the mandibular and/or maxillary bone in subjects exposed to treatments with drugs known to increase the risk of disease, in the absence of prior radiotherapy" (1–3).
The medications associated with MRONJ risk are Bone Modifying Agents (BMA), such as bisphosphonates or denosumab, and/or anti-angiogenic agents (AA), such as bevacizumab and others (4–10).
In recent years, the categories of patients at risk for MRONJ have gradually changed due to the introduction of new drugs to the market and the approval of new indications for drugs already in use. Patients at risk of developing MRONJ are now classified into two major categories based on their use of 1) high-dose BMA and/or AA versus 2) low-dose BMA. Patients who typically take BMA are (3, 10–12):

1. Oncological patients with bone metastases (Bone Metastasis, BM) or multiple myeloma, treated with high doses of BMA (HD-BMA);
2. Patients with Giant Cell Tumor of Bone (GCTB) treated with monthly denosumab injections (HD-BMA);
3. Patients with breast or prostate cancer, usually without BM and undergoing hormone therapy, treated with low doses of BMA (LD-BMA) at the same dosage as osteometabolic patients, to prevent cancer treatment-induced bone loss (CTIBL) (10);
4. Osteometabolic patients receiving LD-BMA therapy.

Medication-Related Osteonecrosis of the Jaw is a condition that can significantly compromise the quality of life of affected patients (3, 10). Although its pathogenesis is

still uncertain, the incidence, severity, and progression of MRONJ can be considerably reduced through primary and secondary prevention strategies (13–15).
The management of patients at risk of developing MRONJ, or already affected by the disease, is multidisciplinary since multiple healthcare professionals are involved (e.g., oncologist, bone specialist, dentist, oral or maxillofacial surgeon, dental hygienist). Although, theoretically, the role of the dental hygienist is fundamental for MRONJ prevention, to date only two studies have investigated this topic. One analyzed the awareness of dental hygienists regarding MRONJ, and the other focused on their role in MRONJ prevention, particularly in cases associated with ill-fitting removable prostheses (16–18).
The Italian Society of Orthopaedics and Traumatology (SIOT) and the Italian Society of Periodontology and Implantology (SIdP) have also contributed by publishing a Joint Report with recommendations for good clinical practice aimed at achieving an integrated approach (e.g., prescriber, dentist, periodontist, and dental hygienist) to the management of periodontitis patients undergoing LD-BMA therapy for osteometabolic disorders to reduce the risk of MRONJ (19).
In 2021, a Consensus Conference (https://www.onjupdate.it) was held with the participation of 11 Italian experts (i.e., dental hygienists belonging to the main technical-scientific associations – Associazione Nazionale di Rappresentanza degli Igienisti Dentali (AIDI) and Unione Nazionale Igienisti Dentali (UNID) – and the authors of the Recommendations of the Italian Society of Oral Pathology and Medicine (SIPMO) and the Italian Society of Maxillofacial Surgery (SICMF)). This multidisciplinary board, taking into account the best practices outlined in the 2020 SIPMO-SICMF Italian Recommendations on MRONJ and the Italian Consensus Conference (20), discussed specific issues regarding MRONJ. The results concerning the dental hygiene profession were published in 2022 in English in the international journal Supportive Care in Cancer (21). This article is drafted in Italian, updated, revised, and unanimously approved by the board.
For better understanding, knowledge of the categories of patients at risk for MRONJ, risk factors (e.g., drug-related, systemic, and local), clinical and radiological diagnostic criteria, and disease staging is indispensable. Information regarding these topics is described in the 2020 Clinical-Therapeutic Recommendations for Medication-Related Osteonecrosis of the Jaw (ONJ) and its Prevention, freely available online (https://www.sipmo.it/versione-2-0-delle-raccomandazioni-clinico-terapeutiche-sullosteonecrosi-delle-ossa-mascellari-onj-farmaco-relata-e-sua-prevenzione/) (23).
The importance of prevention and multidisciplinary management of this condition is now widely demonstrated; therefore, this study aims to collect and analyze the best clinical practices available in the literature, with particular attention to the 2024 Italian Position Paper (the English-language update of previous Italian Recommendations) and the SIOT-SIdP Joint Report (19, 21). The first study analyzes all categories of patients at risk for MRONJ, providing guidance on primary, secondary, and tertiary prevention (21). The second study focuses exclusively on patients receiving LD-BMA therapy for osteometabolic disorders, emphasizing primary prevention (19).

Primary Prevention

A correct preventive approach represents the most effective strategy to safeguard the oral health of patients who are about to take, are taking, or have taken BMA and/or AA (22–24).

Patients	Group	Timing of the dental hygienist's action
HD-BMA	Pre-therapy (R_0)	ALWAYS BEFORE therapy
	During therapy (R+, R++)	As soon as possible, if not undergoing a pre-therapy visit. Periodic follow-up (every 4 months)
LD-BMA	Pre-therapy (R_0)	Within 6 months of starting therapy
	During therapy (RX)	As soon as possible. Periodic follow-up (every 6 months)

NB: Oncology patients are classified, based on their different risk (R), into 3 subgroups: HD-BMA-R0 (if ONJ-related drug administration is planned, but not yet started); HDBMA-R+ (if ONJ-related drug administration has been started); HD-BMA-R++ (if concomitant or subsequent administration of drugs with anti-angiogenic activity and/or in the presence of local and/or systemic risk factors). Patients with osteometabolic disease or oncology patients without bone metastases undergoing LD-BMA therapy for Cancer Treatment Induced Bone Loss (CTIBL) at risk of MRONJ must be divided into two subgroups: LD-BMA-R0 (subjects without risk); LD-BMA-Rx (subjects with potentially increased risk compared to LD-BMA-R0, even if not definable as "x").

Tab. 1 Timing of dental hygienist action in patients at risk of MRONJ.

Subject: **OPINION ON ORAL HEALTH STATUS FOR THE START OF THERAPY WITH LOW-DOSE DRUGS ASSOCIATED WITH THE ADVERSE EVENT KNOWN AS OSTEONECROSIS OF THE MAXILLARY BONES (ONJ)**

We certify that the patient
☐ does not require any dental treatment
☐ requires professional oral hygiene
☐ requires non-invasive dental treatment that can also be performed after starting the medication (indications provided in a letter to the patient's dentist)
☐ requires essential dental/alveolar surgery (indications provided in a letter to the patient's dentist) aimed at resolving endo-periodontal diseases.

In the absence of risk factors, these procedures should preferably be performed within 6 months (see AIFA Note No. 79) or, alternatively, no later than 3 years after starting treatment with ONJ-related drugs.

☐ Next appointment date in ☐ 6 months ☐ 4 months

Opinion based on current oral health status for taking the anti-resorptive drug(s) for which the patient underwent examination:

☐ FAVORABLE ☐ NOT FAVORABLE

In the event of an unfavorable opinion, the patient will be re-evaluated for a new opinion at the end of the therapies indicated by the dentist. Please note that it is recommended to postpone the start of therapy with drugs associated with the risk of ONJ for 45 days after the last surgical treatment and after a clinical and radiological check-up to assess the absence of any ongoing infection.

Please note that the start of administration of the drug associated with ONJ is at the discretion of the prescribing physician, depending on the conditions related to the primary disease.

Good oral health, no lesions or infections present.

Suboptimal oral health with problems that can be resolved through conservative (non-invasive) treatment; **some teeth are compromised but with a favorable prognosis**.

Suboptimal oral health with problems that can be resolved through invasive procedures; **some teeth are compromised** and have a **poor prognosis**.

Fig. 1A Dental opinion regarding oral health status for initiation of LD-BMA therapy.

Subject: **OPINION ON ORAL HEALTH STATUS FOR THE START OF THERAPY WITH HIGH-DOSAGE DRUGS ASSOCIATED WITH THE ADVERSE EVENT KNOWN AS OSTEONECROSIS OF THE MAXILLARY BONES (ONJ)**

We certify that the patient
☐ does not require any dental treatment
☐ requires professional oral hygiene
☐ requires non-invasive dental treatment that can also be performed after starting the medication (indications provided in a letter to the patient for their dentist)
☐ requires essential and urgent dental/alveolar surgery (indications provided in a letter to the patient for their dentist), aimed at resolving endo-periodontal pathologies.

☐ Next appointment in 4 months _____

Opinion based on current oral health status for taking the anti-resorptive drug(s) for which the patient underwent examination:

☐ FAVORABLE ☐ UNFAVORABLE

In the event of an unfavorable opinion, the patient will be reevaluated for a new opinion at the end of the treatments indicated by the dentist. Please note that it is recommended to postpone the start of therapy with drugs associated with the risk of ONJ for 45 days after the last surgical treatment and after a clinical and radiological check-up to assess the absence of any ongoing infection.

Please note that the start of administration of the drug associated with ONJ is at the discretion of the prescribing physician, depending on the conditions related to the primary disease.

Good oral health, no lesions or infections present.

Suboptimal oral health with problems that can be resolved through conservative (non-invasive) treatment; **some teeth are compromised but with a favorable prognosis**.

Suboptimal oral health with problems that can be resolved through invasive procedures; **some teeth are compromised** and have a **poor prognosis**.

Fig. 1B Dental opinion regarding oral health status for initiation of HD-BMA therapy.

1	Patient interview, evaluation of clinical and radiological documentation
2	Decontamination of bacterial load with chlorhexidine-based mouthwashes (to be repeated before any therapeutic and/or evaluation procedure) (37)
3	Clinical evaluation, and possible updates to the patient's record, with:
	Screening of periodontal tissue and dental conditions (e.g., PSR)
	Screening of other local risk factors (e.g., dentures)
	Screening of oral mucosal lesions
4	Motivation and instruction in the use of home oral hygiene tools and early attention to the signs and symptoms of MRONJ
5	Professional oral hygiene (supra- and subgingival debridement and/or deplaquing)
6	Application of remineralizing agents
7	Counseling regarding recreational habits (e.g., smoking and/or alcohol) (if necessary)
8	Scheduling of personalized periodic follow-ups

Tab. 2 Sequence of primary prevention actions carried out by the dental hygienist.

Specifically, the goal of primary prevention is to control (limit/eliminate) local risk factors for MRONJ both before and during exposure to ONJ-related drugs.
Primary prevention, performed periodically (not just before starting the drug), is aimed at maintaining and/or restoring good dental and periodontal health in the patient to achieve two objectives (3, 21):

- Conservative (non-invasive) procedures performed by the dentist and dental hygienist to reduce the risk of onset or progression of infectious/inflammatory events (local risk factors for MRONJ);
- Invasive procedures (e.g., dental extractions) performed by the dentist when teeth show dubious or poor prognosis (not treatable with conservative procedures).

Another aim of primary prevention is counseling, which is the responsibility of the dentist and dental hygienist. Through counseling, the patient is informed about the risk of developing MRONJ and made aware of its possible clinical manifestations, enabling timely alert and early diagnosis and treatment.
Any condition that directly or indirectly compromises optimal oral health, especially dental and periodontal health, making the jaw bones more susceptible to infection, including chronic mechanical stresses, should be regarded as an important risk factor for MRONJ, particularly in patients undergoing HD-BMA or LD-BMA therapy for more than three years (2, 6, 25, 26).
Therefore, the dental hygienist plays a central role in MRONJ prevention, as during routine recalls, in addition to professional oral hygiene, the hygienist will also:

- Check local risk factors;
- Maintain and/or restore dental and periodontal health;
- Maintain/improve adherence and concordance to home oral hygiene practice.

In patients undergoing HD-BMA therapy, primary prevention procedures should always start before therapy begins, as per Ministerial Recommendations (27, 28), and continue during and after treatment (28). In patients on LD-BMA, given the low risk of developing MRONJ, it is recommended to start primary prevention within no more than 6 months after the beginning of ONJ-related drug therapy (Table 1)

Exposure of necrotic bone in the oral cavity
Halitosis
Odontogenic abscess
Mandibular asymmetry
Dental and bone pain
Mucosal fistula
Extraoral fistula
Failure to heal the mucosa of the post-extraction site
Rapid-onset tooth mobility
Paresthesia/lip dysthesia (Vincent's sign)
Fluid discharge from the nose
Purulent discharge
Spontaneous sequestration of bone fragments
Trismus
Soft tissue swelling

Tab. 3A Clinical signs of MRONJ.

(2). According to the SIOT and SIdP Joint Position Paper, osteoporotic patients who are about to start LD-BMA must be referred for comprehensive dental and periodontal examination before starting treatment, and periodontal therapy must be performed before LD-BMA therapy begins (19). During this pre-therapy visit, the dentist will provide the patient with a report on their oral health status and the prognosis of diseased dental elements (e.g., caries, periodontitis), indicating any urgent treatment required, along with an opinion on suitability to begin BMA therapy (Figure 1a and 1b).

Operative Steps for Primary Prevention in Patients Awaiting ONJ-Related Drug Therapy (Pre-Therapy Primary Prevention)

	OPT Visible if extended	TC
Thickening of the alveolar ridge and lamina dura		
Thickening of the inferior alveolar nerve canal		
Sequestration		
Persistence of the post-extraction socket		
Periosteal reaction		
Widening of the periodontal space		
Pathological fracture		
Diffuse medullary sclerosis*		
Focal medullary sclerosis*		
Cortical erosion		
Osteolytic changes		
Trabecular thickening		

Tab. 3B Radiological signs of MRONJ (* Focal medullary sclerosis with trabecular disorganization and poor corticomedullary differentiation).

During the first visit, primary MRONJ prevention measures will be established based on an assessment of the patient's oral health (periodontal health, gingivitis, periodontitis) (Table 2). Acquisition of the clinical and radiological documentation available from the patient will provide the first indications about their health status (29). Clinical evaluation therefore begins with screening the health status of periodontal tissues and dental elements. The board recommends using the Periodontal Screening and Recording (PSR) (30). This method enables rapid differentiation between clinical presentations and the identification of any signs of periodontitis (e.g., periodontal charting). The PSR is effective and applicable to all patients (31). For this purpose, either a WHO periodontal probe or a North Carolina probe may be used (Table 3). During screening, the dental hygienist may also identify carious lesions, promptly reporting them to the dentist.

SIOT and SIdP also recommend acquiring a recent orthopantomogram for comprehensive assessment, followed by the recording of probing depth (PD), bleeding on probing (BOP), and radiographic bone loss (RBL) to complete the periodontal diagnosis. The oral hygiene index, indicating the patient's degree of home biofilm control, must also be evaluated. Subsequently, grading and staging should be defined to establish appropriate periodontal therapy and achieve inflammatory control (19). It is widely agreed that, in the presence of teeth with poor prognosis, all necessary surgical procedures should be completed, where possible, before initiating BMA therapy (19, 21).

After evaluating oral health status, a reassessment of all (potential or present) local risk factors is recommended. If the patient uses a removable prosthesis, the fit, stability, and maintenance (absence of roughness, integrity of prosthetic work) must be evaluated (2, 32). For fixed prostheses, the marginal seal (e.g., overhanging margins, secondary caries), the relationship between pontics (if present) and soft tissues, and the patient's ability to perform correct home oral hygiene must be assessed.

It is also advisable to evaluate the oral mucosa to identify any lesions/new formations, to be recorded and documented photographically. If mucosal lesions and/or opportunistic infections are present, the dental hygienist will refer the patient to a dentist with expertise in oral medicine, an oral surgeon, or specialized MRONJ diagnostic and treatment centers (21). Much of the success of preventive measures depends on the dental hygienist's ability to engage the patient and induce behavioral changes necessary for controlling modifiable local and systemic risk factors (33, 34). The patient, if properly motivated and instructed, can effectively carry out home oral hygiene practices (2). Therefore, strong observation, listening, and communication skills are critically important (30).

Instructions for home oral hygiene techniques will be defined based on the overall clinical condition, oral and dental morphology, gingival phenotype, patient cooperation, and manual skills. The choice and use of home hygiene tools must be agreed with the patient, taking into account the learning period, as well as the necessity, methods, and means to be used (30).

Brushing—manual or electric (soft bristles)—should be the main means of plaque control. In the presence of gingival inflammation, interproximal cleaning, preferably with interdental brushes, should be directly taught to the patient. The clinician may recommend other interdental cleaning devices/methods (e.g., dental floss, single-tuft toothbrush) tailored to the case (35).

Toothpaste choice should ensure appropriate mineral supplementation; a specific toothpaste is recommended according to need (e.g., fluoridated, desensitizing, with enzymes, with probiotics) (30).

Chemical plaque control as an adjunct to mechanical control should use antibacterial mouthwashes/gels as

indicated depending on the therapeutic or maintenance phase. The literature demonstrates the effectiveness of various substances, and it appears that chlorhexidine-based antiseptic mouthwashes positively modulate the oral microbiome (36, 37).

For non-removable prostheses, patients should be instructed to use dental floss with a threader or a semi-rigid end to allow insertion under the prosthesis and/or an irrigator, as food debris and plaque can accumulate below the prosthesis where brushing alone may not be effective (21).

For implants, home-care devices should not have metallic components that may cause roughness and favor plaque and tartar accumulation. For removable prostheses, daily cleaning with dedicated brushes and products should be recommended. In the case of removable prostheses on implants (i.e., overdentures), the patient should be instructed in cleaning all components (fixtures, abutments, attachments) as well as the prosthesis (21).

The dental hygienist must ensure patients are aware of the importance of self-evaluation for early detection of MRONJ signs/symptoms (e.g., sudden tooth mobility, abscesses, pain, halitosis), enabling them to promote early diagnosis themselves (2, 12).

For patients with risk habits (e.g., smoking), the dental hygienist should implement dedicated counseling techniques (21). The next phase is professional oral hygiene procedures. Scaling includes removal of plaque and calculus as well as identification of retention factors (e.g., overhanging fillings) that could impair hygiene practices (21).

During professional treatment, choice of instruments and techniques should always favor minimally invasive actions respectful of oral tissues and tailored to clinical conditions. Proper working-end selection is important for both manual and mechanical (e.g., sonic/ultrasonic) instrumentation. To date, ultrasonic non-surgical periodontal therapy is effective in calculus removal (35). For biofilm removal (deplaquing), new-generation devices (e.g., air polishing) using low-granulometry powders are effective (38, 39). They are also indicated for implant-supported prostheses. Disclosing agents (preferably bi- or tri-phase coloring) can help identify and remove biofilm

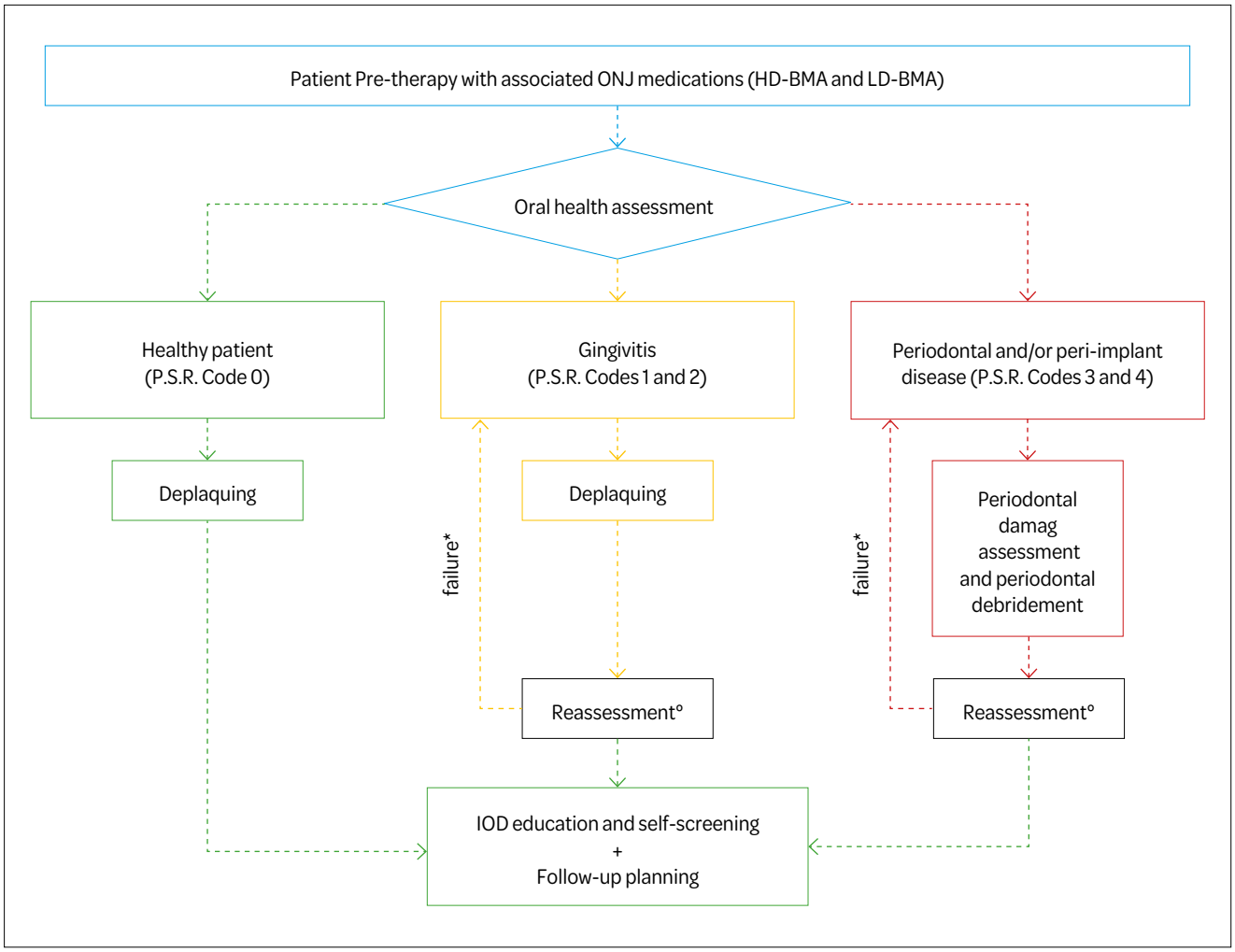

Fig. 2 Flow chart of the primary prevention pathway pre-therapy with associated ONJ drugs: patients candidates for therapy with LD-BMA and HD-BMA (modified from Mauceri et al) (21). IOD: home oral hygiene. ° Re-evaluation: no more than 30 days later. * If periodontal debridement does not lead to resolution, evaluate alternative primary prevention strategies.

PSR Codes				
Cod. 0	Cod. 1	Cod. 2	Cod. 3	Cod. 4
The colored portion of the probe remains fully visible even at the maximum probing point of the sextant. No calculus or overhanging restoration margins are detected. No bleeding is observed on probing. The patient is healthy.	As for code 0, but slight bleeding is observed. The patient has gingivitis.	As for code 0, but calculus and/or overhanging restoration margins are detected. Bleeding may be observed on probing. Patient with gingivitis.	The colored area of the probe is partially visible with the requirements of codes 1 and 2. Patient with periodontitis.	The colored area of the probe disappears within the sulcus, indicating a probing depth greater than 5.5. The patient has periodontitis. Any findings of mobility, furcation involvement, recession, or mucogingival problems are recorded with the symbol*.

Tab. 4 PSR codes.

before deplaquing.
In the presence of periodontal disease, the professional hygiene session must include subgingival debridement with minimally invasive instruments (e.g., thin tips, mini or micro-mini five curettes), with local anesthesia if needed (38, 39). In patients with comorbidities, the dentist should evaluate the need for antibiotic prophylaxis (e.g., risk of bacterial endocarditis) (40).
Based on the patient's general health, the operator will determine the treatment modality (by quadrant or full-mouth approach) (38, 39).
Patients with periodontitis undergoing pre-therapy professional hygiene should be re-evaluated within 30 days after treatment completion (2).
The expected clinical outcome is periodontal tissue healing, allowing follow-up every 4 months for those on HD-BMA and every 6 months for those on LD-BMA (Figure 2) (2). Based on PSR scores, personalized recall intervals can be scheduled (2). Since the effectiveness of oral inflammation control in reducing MRONJ risk is now well established, both the Position Paper for Dental Hygienists and the SIOT-SIdP Joint Position Paper adopt a patient risk-based approach in follow-up management (19, 21). However, the Position Paper for Dental Hygienists provides a protocol with more or less precise recall intervals (4–6 months depending on BMA dose and risk factors) (21), while the SIOT-SIdP Joint Position Paper allows for more flexibility in the recall schedule (19).
For clarity, typical periodontal conditions for BMA and/or AA therapy candidates, according to PSR codes (Table 4), are exemplified below.

Healthy Patient (PSR Code 0)

In the absence of clinical signs of inflammation, the patient is considered periodontally healthy (Code 0) (41–43). The patient should still be motivated regarding the importance of oral health maintenance and self-evaluation for early detection of MRONJ signs/symptoms. Patients on HD-BMA receive periodic dental check-ups every 4 months, while those on LD-BMA are recalled every 6 months (Figure 2).
Presence of Gingivitis and/or Mucositis (PSR Codes 1 and 2)
PSR codes 1 and 2 indicate inadequate oral health. After implementing measures described in Table 2, the patient should be re-evaluated approximately 30 days later (41–43). This check allows assessment of tissue response, plaque control technique efficacy, and, if necessary, further correction of inadequate maneuvers. For implant-supported prostheses, mucositis signs and symptoms (e.g., Bleeding on Probing, BoP) must be evaluated. The patient should be treated with appropriate hygiene instruments (e.g., Teflon tips) (44). If the measures prove effective, schedule long-term follow-up (HD-BMA every 4 months, LD-BMA every 6 months) (2). Otherwise, the hygienist must identify reasons for failure, correct them, and repeat preventive measures until proper prevention adherence is achieved (Figure 2).
Presence of Periodontal and/or Peri-Implant Disease (PSR Codes 3 and 4)
If the patient initially presents with clear symptoms of periodontal disease identified by codes 3 and 4, the dental hygienist should carry out a thorough periodontal evaluation (periodontal charting) (41–43). In this subgroup, treatment consists of conventional periodontal debridement. Tooth mobility can cause discomfort and may induce the patient to avoid using compromised teeth, leading to reduced cleaning. Depending on mobility and prognosis, splinting may be considered. Similarly, with peri-implantitis signs and symptoms, appropriate oral hygiene measures specific for this condition should be performed (45).
Re-evaluation after non-surgical periodontal therapy must occur within 30 days of treatment completion (2). If periodontal healing is achieved, the patient enters standard follow-up (every 4 months for HD-BMA, every 6 months for LD-BMA; Figure 2) (2). Persistent focal inflammation (probing ≥4 mm with positive BoP) requires repeating non-surgical therapies, reinforcing instructions/motivation, or, in agreement with the dentist, considering alternative prevention strategies, compatible with the patient's primary disease (21). For patients scheduled to start HD-BMA, the therapeutic pathway should begin as soon as possible to facilitate prompt commencement of oncological therapy (2). For patients scheduled to start LD-BMA, treatments can be carried out within the first six

months after therapy commencement (2).
The Board considers that, for patients about to start HD-BMA, dental and periodontal health status must ALWAYS be assessed BEFORE starting ONJ-related drugs, through clinical and radiological evaluation. Any periodontal diseases must be promptly treated to reduce MRONJ risk.
For those awaiting LD-BMA therapy, initial dental assessment is not mandatory before starting these drugs, but is recommended WITHIN THE FIRST SIX MONTHS of therapy. The need for ongoing motivational reinforcement and patient instructions for self-monitoring is also emphasized.

Operative Steps for Primary Prevention During Therapy with ONJ-Related Drugs (In- Or Post-Therapy Primary Prevention)

If the patient presents for dental consultation while receiving (or after) ONJ-related drug therapy, as usual, the dentist obtains a medical history and performs a clinical and radiological examination, assesses MRONJ risk, and determines the presence of local risk factors (2).

As for pre-therapy patients, the dental hygienist should repeat the steps already outlined in Table 2. Importantly, in patients who have taken ONJ-related drugs, secondary prevention measures should be implemented alongside primary prevention (2).
Based on PSR scores, targeted preventive measures will be initiated, and tailored periodic follow-up visits scheduled. At every recall, the medical history, specifically regarding ONJ-related drug use, must be updated (21).
For clarity, the following are typical periodontal conditions by PSR code found in patients undergoing ONJ-related drug therapy.

Healthy Patient (PSR Code 0)

In the absence of gingival inflammation, follow-up is every 4 months for HD-BMA and every 6 months for LD-BMA (Figure 3) (2).

Patient with Gingivitis (PSR Codes 1 and 2)

For gingivitis (Codes 1 and 2), prompt intervention is

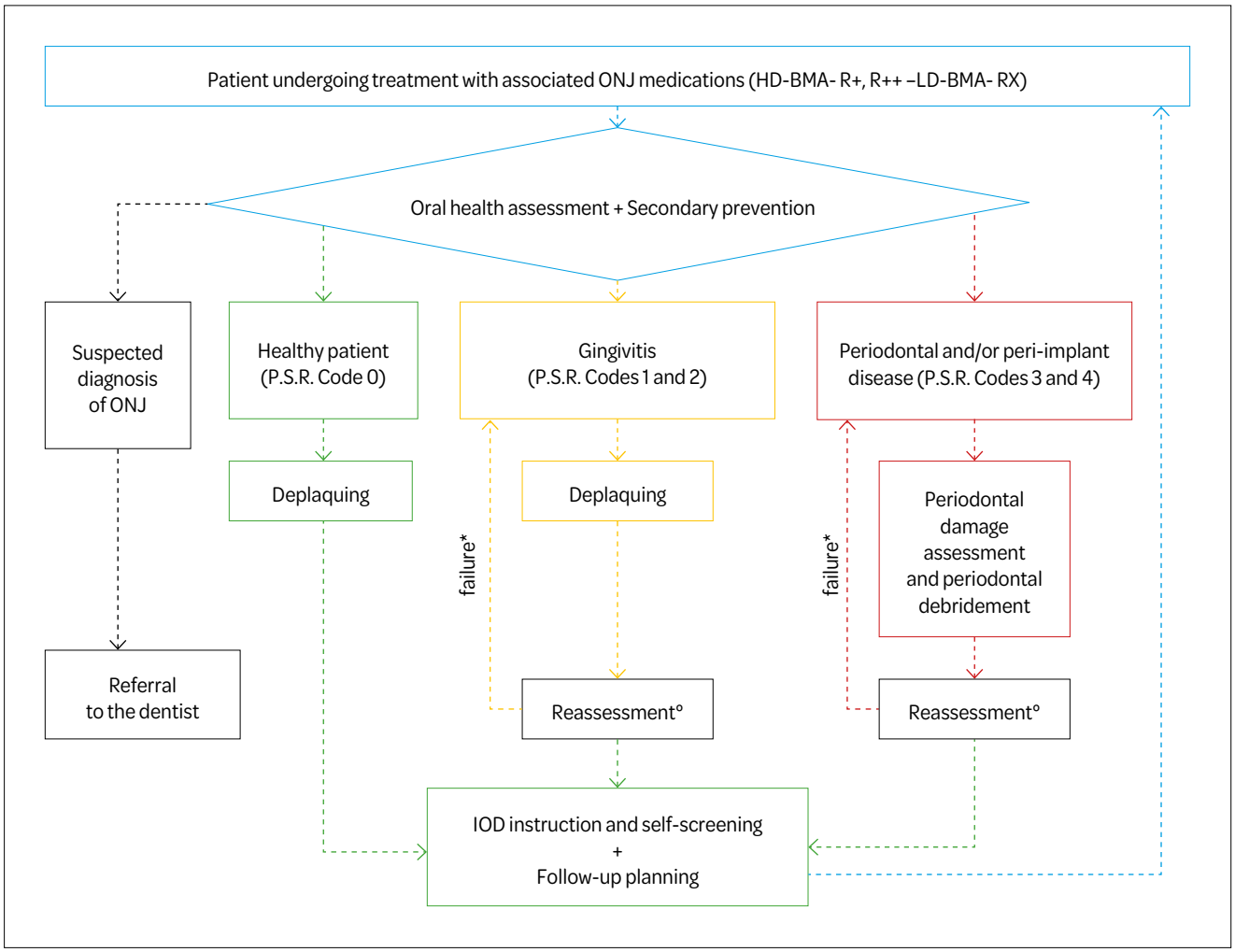

Fig. 3 Flowchart of primary prevention pathway during therapy with associated ONJ drugs: HD-BMA- R+, R++ and LD-BMA-Rx patients (modified from Mauceri et al) (21). IOD: home oral hygiene. ° Re-evaluation: no more than 30 days later. * If periodontal debridement does not lead to resolution, evaluate alternative primary prevention strategies.

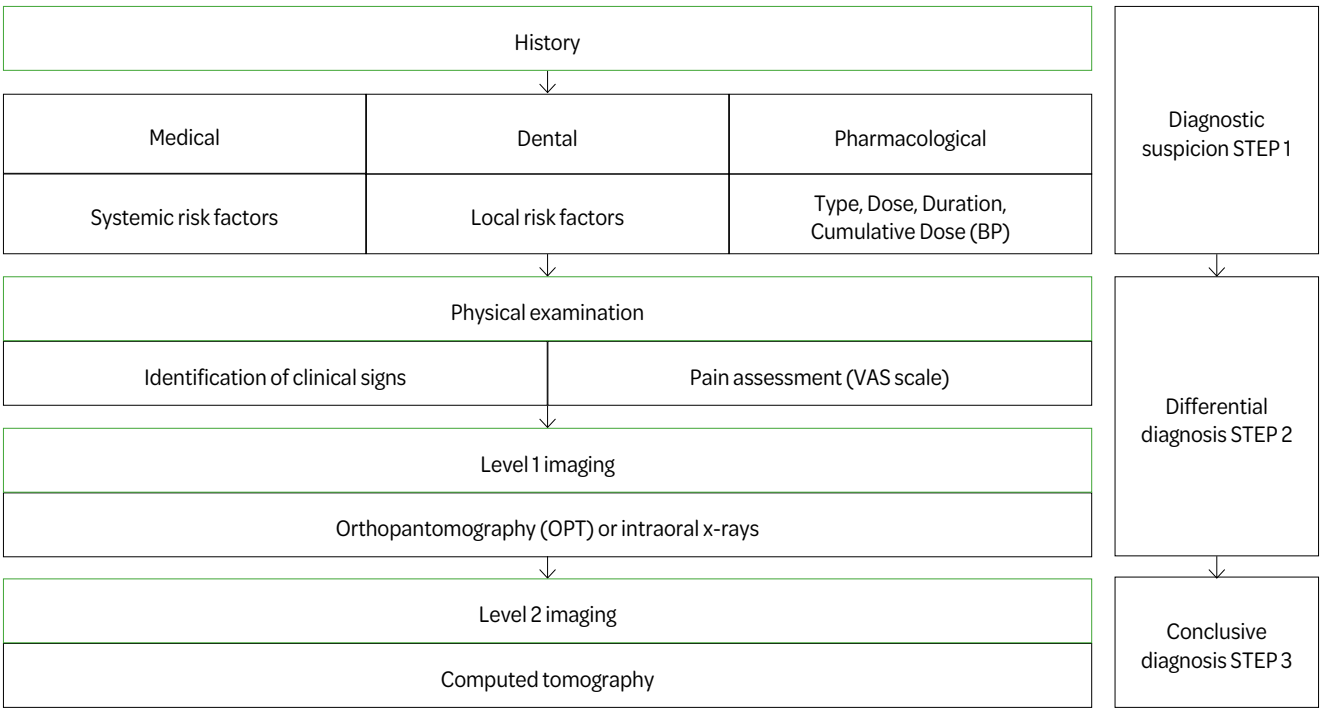

Fig. 4 Diagnostic workflow of drug-related ONJ (modified from Bedogni et al.) (3).

needed to resolve inflammation and prevent progression to periodontal disease (2). In the presence of plaque and calculus, mechanical and/or manual removal using minimally invasive techniques should be performed. Reassessment follows within 30 days; if successful, long-term follow-up (HD-BMA every 4 months, LD-BMA every 6 months) is scheduled (21). If gingivitis persists, further hygiene and oral hygiene instruction/motivation sessions are necessary (Figure 3).

Patient with Periodontal Disease (PSR Codes 3 and 4)

In patients in therapy for ONJ-related drugs with PSR codes 3 or 4, the dental hygienist must investigate the extent of tissue damage with periodontal probing (clinical attachment level/CAL, PPD, BoP) to gauge periodontal tissue loss (21).
Protocols are as described above for pre-therapy prevention. With comorbidities, the dentist decides on the need for prophylactic antibiotics (e.g., in risk of bacterial endocarditis). Health status should be re-assessed within 30 days following non-surgical periodontal therapy. Periodontal healing is expected, after which the patient is placed in standard follow-up (4 months for HD-BMA, 6 months for LD-BMA; Figure 3) (2). Persistent inflammatory foci require retreatment, with further instruction and motivational reinforcement. This educational process should remain dynamic, adapting to individual patient characteristics and learning difficulties as needed. Alternative primary prevention strategies (e.g., dental extraction), as well as attention to early clinical-radiological signs of initial MRONJ (secondary prevention; Table 3) (26, 45), should also be considered with the dentist.
The board emphasizes the importance of initiating primary prevention protocols for MRONJ-risk patients. Oral prevention pathways must always be undertaken, with choice of protocol determined by data gathered during the first dental visit (medical, dental-periodontal, and radiological) and patient-specific features (primary disease, medications, comorbidities).

Secondary Prevention: The Role of the Dental Hygienist in Suspected MRONJ Diagnosis and Follow-Up Timing

The main objective of secondary prevention is early disease diagnosis.
Patients are defined as having MRONJ if they meet the following requirements (3):

- Ongoing or prior therapy with BMA and/or AA;
- Clinical and radiological diagnosis of progressive bone destruction and necrosis;
- Absence of prior or concurrent radiotherapy to the head and neck or of primary/mets affecting the jaw bones.

The diagnostic workup allows the clinician to make a suspected diagnosis (Step 1) and, via differential diagnosis (Step 2), reduce the time to definitive diagnosis (Step 3) (Figure 4) (2).

Step 1

The dental hygienist and the dentist are the key figures in early MRONJ diagnosis, being responsible for primary prevention and identification of local risk factors (12). MRONJ

Surgical Therapy	Surface osteoplasty
	Dentoalveolar curettage
	Sequestrectomy
	Resective surgery (marginal or segmental)
Medical Therapy	Antiseptic therapy
	Antibiotic therapy
	Pain relief therapy
	Suspending current drug therapy
	Teriparatide
	Biostimulation: • Ozone therapy • Laser therapy • Hyperbaric oxygen therapy

Tab. 5 Main therapeutic strategies for MRONJ (modified from Campisi G et al.) (2).

suspicion should arise whenever a patient under treatment (current or prior) with at-risk drugs presents oral signs or symptoms compatible with MRONJ. The presence of such clinical signs should prompt radiological investigations to confirm or rule out the disease (46).

Step 2

Differential diagnosis must consider all oral pathological conditions presenting with clinical/radiological signs or symptoms similar to early MRONJ (11). At this stage, the dental hygienist also plays an important role in differential diagnosis between periodontal disease, endo-perio abscesses, and early MRONJ, with referral as needed to the dentist or specialized MRONJ centers.

Step 3

The patient should be referred to specialized MRONJ treatment centers (e.g., dentists specialized in oral surgery, oral medicine clinics, oral surgery clinics, maxillofacial surgery), where more specific radiological/instrumental investigations, staging, and therapy can be conducted (2).

The Role of the Dental Hygienist in MRONJ Therapy

The dental hygienist is central to MRONJ therapy—regardless of whether a medical or surgical approach is chosen—since optimal oral hygiene is fundamental for treatment success.

A multidisciplinary visit including adequate medical and dental history, clinical and radiological examination (first- and second-level tests), MRONJ stage assessment, pain evaluation using the VAS scale, and complete photographic documentation is required for disease assessment (2).

Comprehensive assessment of periodontal health status (PSR, CAL, PPD) should also be documented in the periodontal chart (21).

Initial professional plaque control can:

a) reduce, when present, the pain experienced by these patients, preventing the symptoms from adversely affecting quality of life;
b) control superinfections, minimising disease progression.

Based on periodontal or peri-implant health and the overall clinical picture, minimally invasive professional oral hygiene measures aimed at restoring and maintaining optimal oral hygiene should be implemented. Chlorhexidine mouthwashes may be recommended at various concentrations depending on need. For conservative MRONJ treatment, the dental hygienist, together with the dentist, may play a central role in all tissue biostimulation procedures using ozone-generating instruments or laser therapy (Table 5) (47–50).

Ozone acts by stimulating or maintaining the endogenous antioxidant system, enhancing blood flow, triggering biological reactions, exerting a bactericidal effect, and reducing pain. Ozone may also promote sequestrum autoexpulsion (51).

Ozone therapy uses various tools and methods. Repeated insufflation appears to stimulate neoangiogenesis, with formation of granulation tissue that demarcates necrotic bone areas, leading to sequestrum expulsion, new epithelial tissue formation, and coverage of underlying bone without further surgery (47–50).

Laser therapy is based on photochemical and photobiological effects at the cellular and tissue levels. Cells, if stimulated at a mitochondrial level, produce more energy, enabling recovery of normal physiological processes in the presence of inflammatory, traumatic, or degenerative functional deficits. Laser also acts by raising pain perception thresholds through a direct action on nerve endings and indirectly by stimulating endorphin production; Low-Level Laser Therapy (LLLT) is a safe, minimally invasive, and well-tolerated technique (50, 52–55). Many authors

have reported clinical success in MRONJ management using LLLT with various wavelengths and parameters: Nd:YAG laser (1064 nm), diode (GaAs - 904 nm), (GaAs - 650, 904–910 nm) (56, 57).
Laser biostimulation (e.g., LLLT) appears valid for increasing organic bone matrix near the lesion and stimulating angiogenesis and lymphangiogenesis inside/outside the gingival sulcus, thus reducing pain and potentially decreasing the size of the adjacent bone exposure (56, 57).
For all patients scheduled for surgical MRONJ therapy, preliminary periodontal assessment is mandatory. As with all dental surgery, if needed, customized, minimally invasive professional oral hygiene sessions 7–14 days before surgery should be performed to reduce bacterial load and promote therapeutic success. During such visits, patients receive specific, individualized instructions on suitable plaque control tools and techniques (21).
Afterwards, patients undergo regular post-surgical check-ups, then re-enter standard primary MRONJ prevention follow-up schedules (Figure 3).
The Board holds that recent scientific evidence underscores the need to promptly undertake surgical MRONJ therapy. The dental hygienist's role is central in surgical preparation, maintaining patient oral health, applying any adjunctive healing therapies, and following up with patients with previous MRONJ or at risk of developing it.

CONCLUSIONS

In light of scientific literature, prevention remains the most effective strategy for managing patients at risk of MRONJ, and the dental hygienist's role is crucial in this context. Owing to specialized training and frequent check-ups, dental hygienists play a central part in identifying and monitoring local risk factors, thus actively contributing to the restoration and maintenance of oral health in this patient cohort. Recognizing the importance of the dental hygienist's role in the multidisciplinary approach is essential to ensure effective and timely management of the condition, reducing the incidence and complications of MRONJ.

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