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The importance of welcoming the pediatric special needs patient in a hospital dental setting: the role of the dental hygienist

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ABSTRACT

Patient reception in a dental practice is fundamental for fostering patient loyalty. The creation of this relationship is also influenced by the practice's design and architecture, along with other strategies such as background music and aroma diffusers.
The initial patient interaction occurs at the reception desk; it is essential to make the patient feel at ease immediately by visually conveying serenity and empathy. For this reason, interactions among dental team members must promote cohesion rather than conflict, as the professional's mood is perceived by the patient. In this context, greater challenges were identified in the public-facing aspects compared to private settings.
The impression of the dental practice also depends on accessibility and promotional visibility, including business cards, advertising billboards, and social media presence.
This study aims to assess patient perception in the Dentistry Department of Piove di Sacco Hospital by administering a questionnaire to caregivers of patients scheduled exclusively with the dental hygienist and collecting reporting forms issued by Veneto region. A total of 67 questionnaires collected between April and June 2022 and 57 reporting forms gathered from January 2019 to June 2022 were analyzed.
The analysis revealed that, based on both questionnaires and reporting forms, the majority of patients reported satisfaction with the reception received in the department and their interaction with the dental hygienist.

Keywords Dental Hygienist, Reception, Dental Facility, Dental Hygienist, Reception, Dental Practice

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INTRODUCTION

The first impression a patient forms upon entering a dental practice significantly influences their perception of the treatment session. Aspects such as the practice's design and architecture must not be underestimated: from a regulatory standpoint, treatment rooms require at least one window, while the waiting area should be spacious to allow for chair distancing and ensure patient privacy. Wall colors in various practice areas have been shown to affect patient perception and emotions. To reduce patient anxiety, soundproofed walls, background music, and aroma diffusers—particularly lavender—are recommended. The practice's geographic location must also be considered, including access to public transportation, parking availability, street visibility, and promotional efforts such as business cards, websites, and social media. Accessibility for patients with disabilities is crucial, prioritizing ground-floor locations or the presence of elevators or stairlifts. While aesthetic and structural elements are important, the relationship with the dental team—starting from reception and extending to healthcare professionals—is equally critical. Team cohesion is vital to avoid unnecessary conflicts, as the dental team's mood is perceived by the patient. Analysis indicates that the dental hygienist is the professional who interacts most regularly with patients. Therefore, this role must establish trust and empathy to alleviate anxiety through active listening. This study analyzed reception perception and interactions with the dental hygienist in the Dentistry Department of Piove di Sacco Hospital.

MATERIALS AND METHODS

The investigation involved administering a questionnaire and collecting reporting forms issued by Veneto region.
The questionnaire was distributed between April and June 2022 to caregivers of special needs pediatric patients attending the Piove di Sacco pediatric section for appointments exclusively with the dental hygienist. It consisted of

20 questions, each with four response options and space for additional comments. Unlike the questionnaire, reporting forms are completed at the user's discretion to submit complaints, appreciations, or suggestions. The form comprises three sections: the first for patient demographics; the second indicating the type of report; and the third for detailed motivations.

RESULTS

Analysis of questionnaire responses

A total of 67 questionnaires were completed; results for individual questions are detailed below.

Question 1: how do you rate the comprehensibility of directions to reach this outpatient clinic?
The graph shows that 75% of respondents rated the comprehensibility of directions to the department as excellent; 22% as good; 3% as fair; and none (0%) as poor.

Question 2: how do you rate the visibility of internal hospital signage to reach this outpatient clinic?
The graph indicates that 75% rated internal hospital signage visibility as excellent; 21% as good; 4% as fair; and none (0%) as poor.

Question 3: how do you rate the courtesy of administrative staff over the phone?

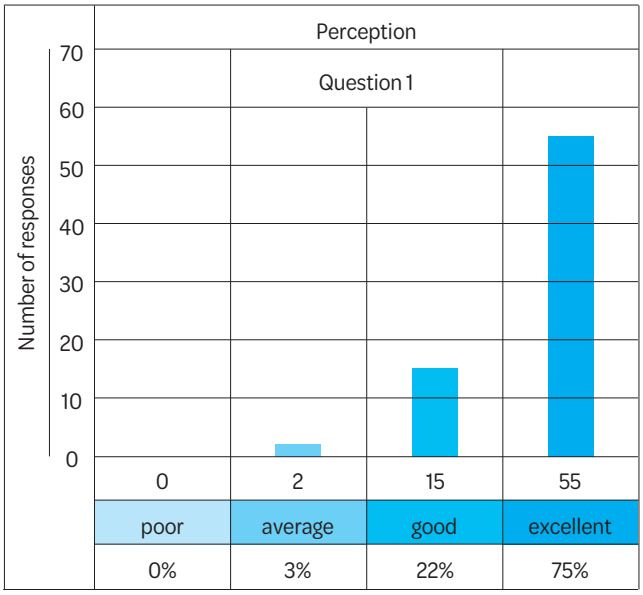

Fig. 1 Graph representing the responses to question number 1 of the questionnaire: *"How do you rate the comprehensibility of the information for reaching this clinic?"*

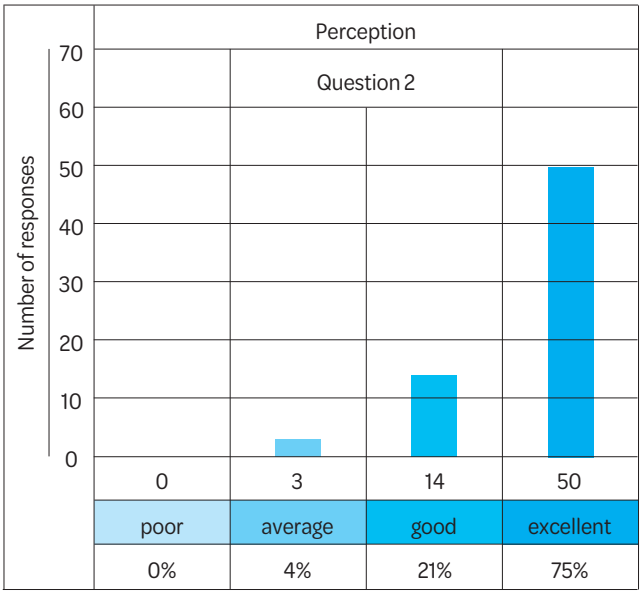

Fig. 2 Graph representing the responses to question number 2: *"How do you rate the visibility of the internal hospital signs for reaching this clinic?"*

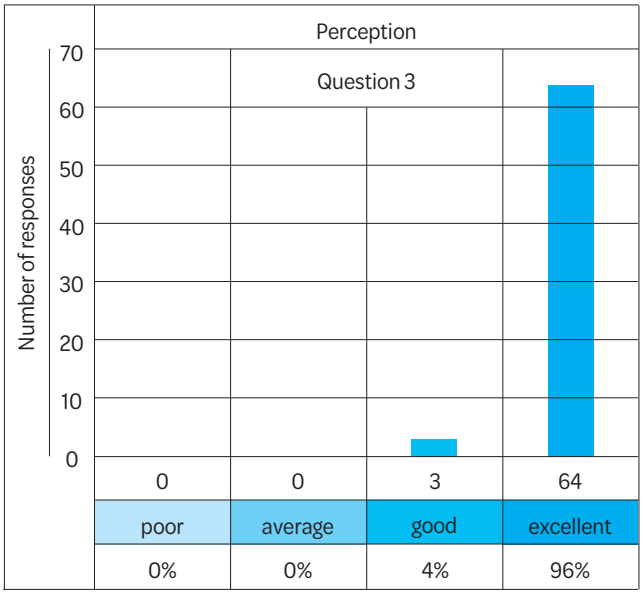

Fig. 3 Graph representing the responses to question number 3: *"How do you rate the courtesy of administrative staff on the telephone?"*

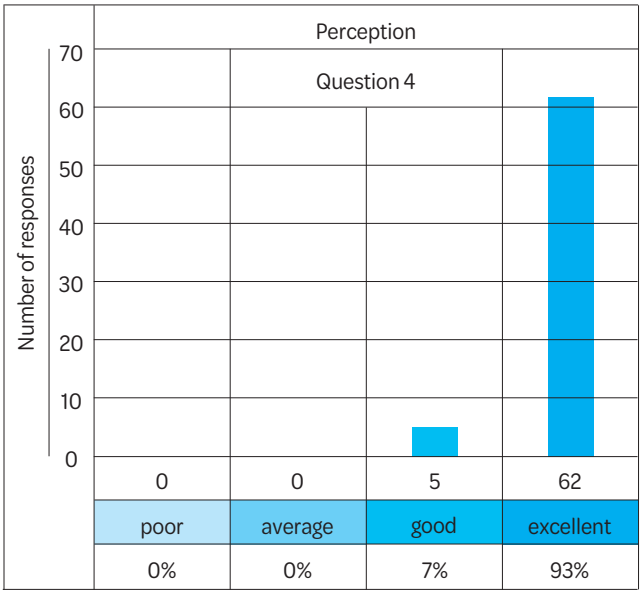

Fig. 4 Graph showing the responses to question number 4: *"How do you rate the courtesy of the administrative staff at the counter?"*

The graph reveals that 96% rated administrative staff courtesy over the phone as excellent; 4% as good; and none (0%) as fair or poor.

Question 4: how do you rate the courtesy of administrative staff at the desk?

The graph shows that 93% rated administrative staff courtesy at the desk as excellent; 7% as good; and none (0%) as fair or poor.

Question 5: how do you rate the availability of administrative staff at the desk?

The graph indicates that 94% rated administrative staff availability at the desk as excellent; 6% as good; and none (0%) as fair or poor.

Question 6: how do you rate the furnishings and comfort of the waiting area?

The graph shows that 96% rated the waiting area furnishings and comfort as excellent; 6% as good; and none (0%) as fair or poor.

Question 7: how do you rate the waiting time for the appointment?

The graph indicates that 80% of respondents rated the waiting time for the appointment as excellent (0-5 minutes); 17% as good (5-10 minutes); 3% as fair (10-15 minutes); and none (0%) as poor (>15 minutes).

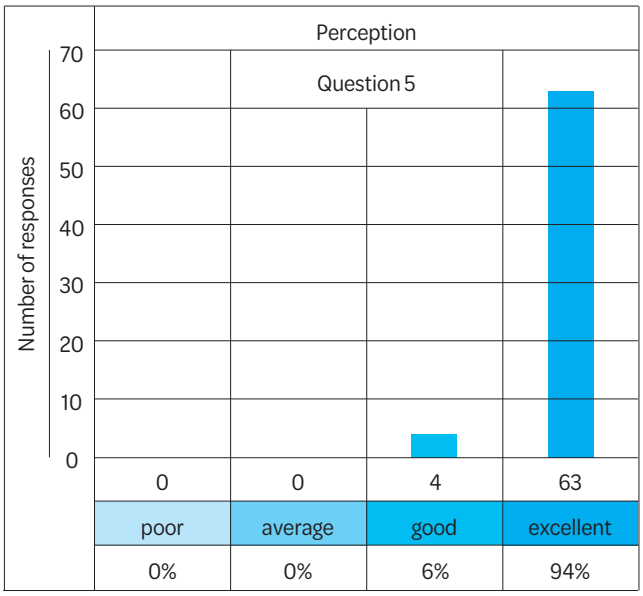

Fig. 5 Graph representing the answers to question 5: *'How do you rate the availability of the administrative staff at the counter?"*

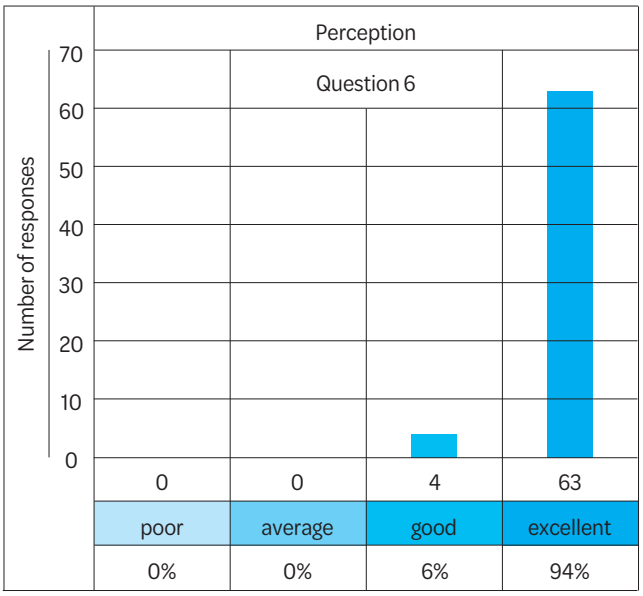

Fig. 6 Graph representing the answers to question number 6: *"How do you rate the furnishings and comfort of the waiting room?"*

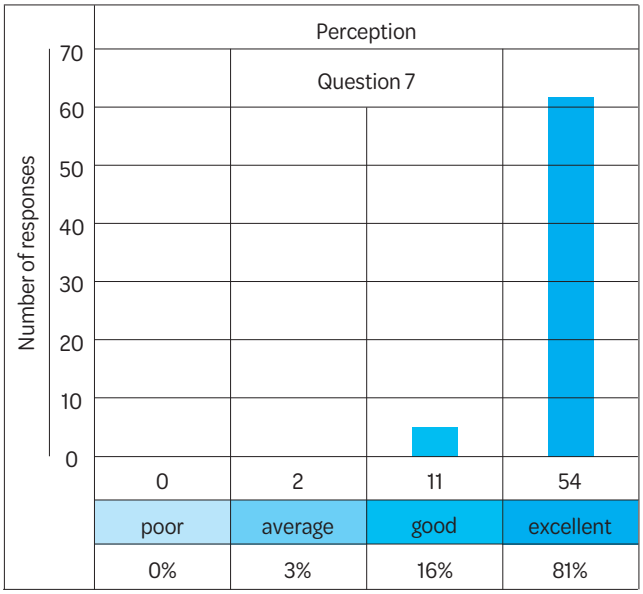

Fig. 7 Graph showing the responses to question 7: *"How would you rate the waiting time for the appointment?"*

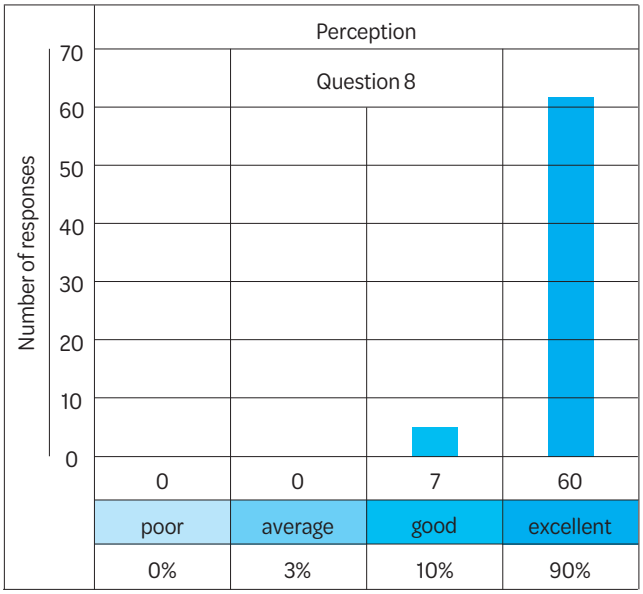

Fig. 8 Graph representing the responses to question number 8: *"How do you rate the furnishings and comfort of the clinics?"*

Question 8: how do you rate the furnishings and comfort of the outpatient clinics?

The graph reveals that 90% of respondents rated the furnishings and comfort of the outpatient clinics as excellent; 10% as good; and none (0%) as fair or poor.

Question 9: how do you rate the courtesy of healthcare staff inside the outpatient clinics?

The graph shows that 94% of respondents rated the courtesy of healthcare staff inside the outpatient clinics as excellent; 6% as good; and none (0%) as fair or poor.

Question 10: how welcomed did you feel inside the department?

The graph indicates that 85% of respondents perceived an excellent welcome; 15% a good welcome; and none (0%) reported an impersonal welcome or feeling unwelcomed.

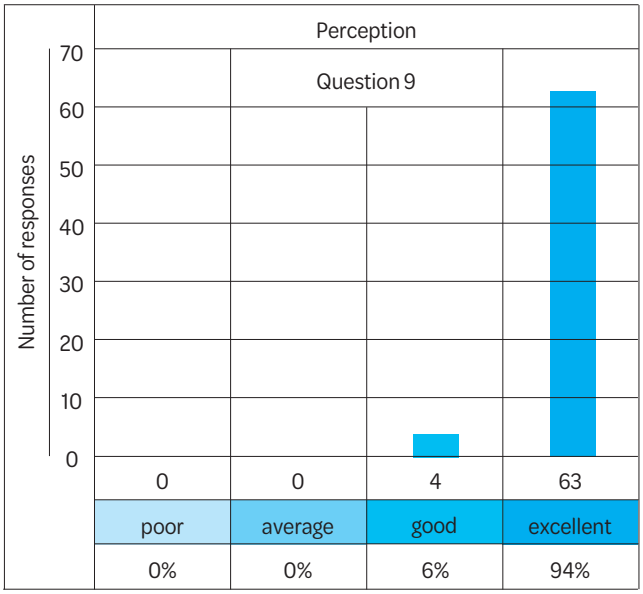

Fig. 9 Graph representing the responses to question number 9: *"How do you rate the healthcare personnel within the clinics?"*

Question 11: did the healthcare staff listen to your needs?

The graph reveals that 99% of respondents rated that healthcare staff listened very attentively to their needs; 1% as moderately attentive; and none (0%) as poorly attentive or not at all.

Question 12: was the child agitated inside the department?

The graph shows that 54% reported the child was not agitated inside the department; 33% that the child was slightly agitated; 7% moderately agitated; and 6% very agitated.

Question 13: would you recommend this outpatient clinic to friends and acquaintances?

The graph indicates that 97% of respondents would certainly recommend the outpatient clinic to friends and acquaintances; 3% would yes recommend it; and none (0%) would perhaps or not at all.

Question 14: if you could go back, would you choose to return to this department?

The graph shows that 100% of respondents would certainly choose to return to this department; and none (0%) selected "yes," "perhaps," or "not at all."

Question 15: during the oral hygiene session, how listened did you feel as a caregiver by the dental hygienist?

The graph reveals that 92.5% of respondents as caregivers felt certainly listened to; 7.5% yes felt listened to; and none (0%) felt perhaps or not at all listened to.

Question 16: did the dental hygienist reassure/ calm the child during the session?

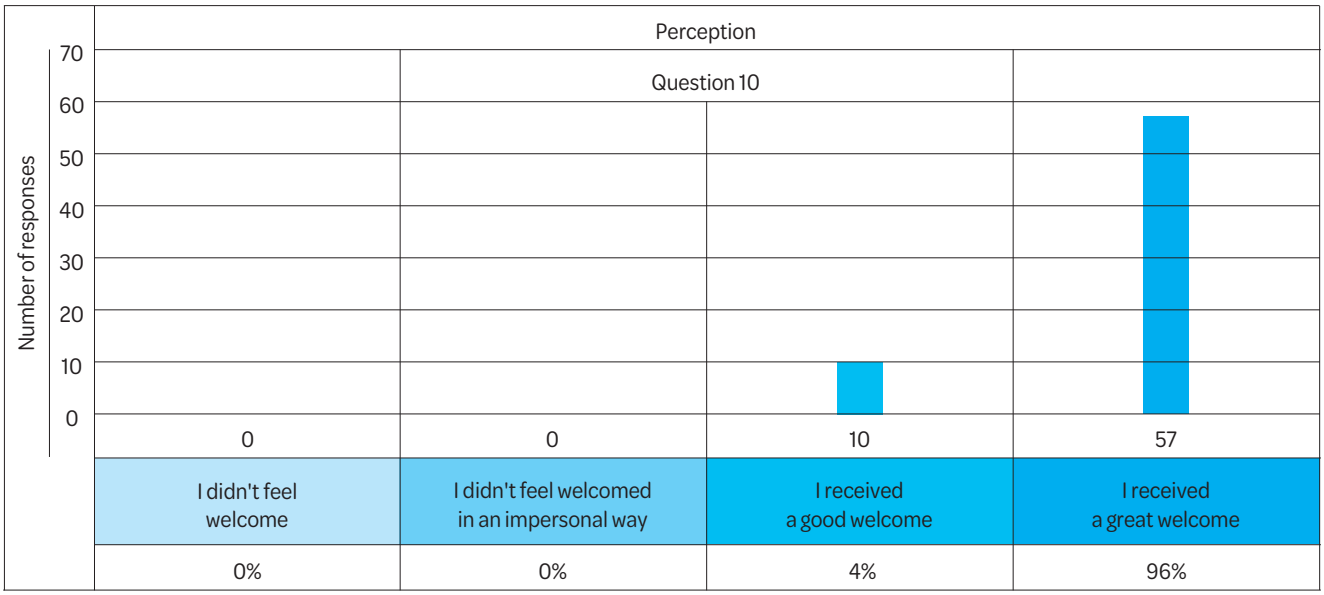

Fig. 10 Graph representing the answers to question number 10: *"How did you feel welcomed within the department?"*

The graph shows that 94% of respondents certainly affirmed that the dental hygienist reassured/calmed the child during the hygiene session; 6% that yes, the dental hygienist did so; and none (0%) that perhaps or not at all.

Question 17: did the dental hygienist appear adequately trained for approaching the child?

The graph indicates that 91% of respondents certainly affirmed the dental hygienist appeared adequately trained for child approach; 9% that yes, appeared adequately trained; and none (0%) selected perhaps or not at all.

Question 18: would you subject the child to another professional oral hygiene session with the dental hygienist?

The graph reveals that 90% of respondents would certainly subject the child to another professional oral hygiene session with the dental hygienist; 10% that yes, would do so; and none (0%) that perhaps or not at all.

Question 19: did the dental hygienist provide you comprehensively with instructions on the most suitable home oral hygiene methods for the child?

The graph shows that 97% of respondents certainly affirmed the dental hygienist provided comprehensive instructions on suitable home oral hygiene methods for the child; 3% that yes, provided them; and none (0%) that perhaps or not at all.

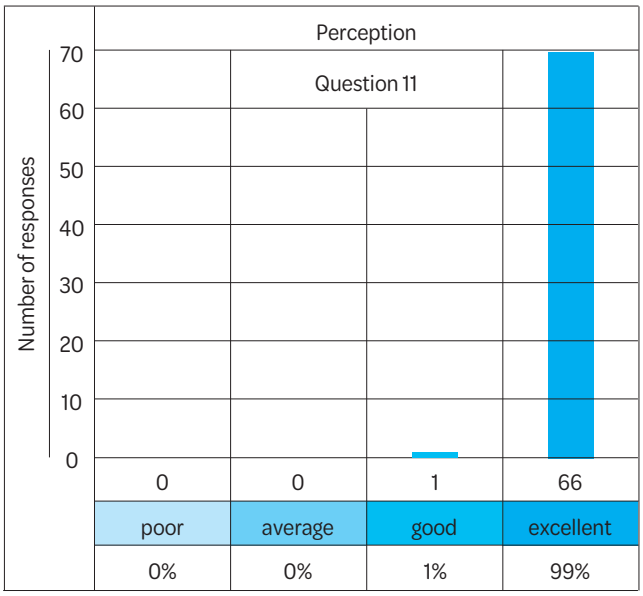

Fig. 11 Graph showing the responses to question 11: *"Did the healthcare staff listen to your needs?"*

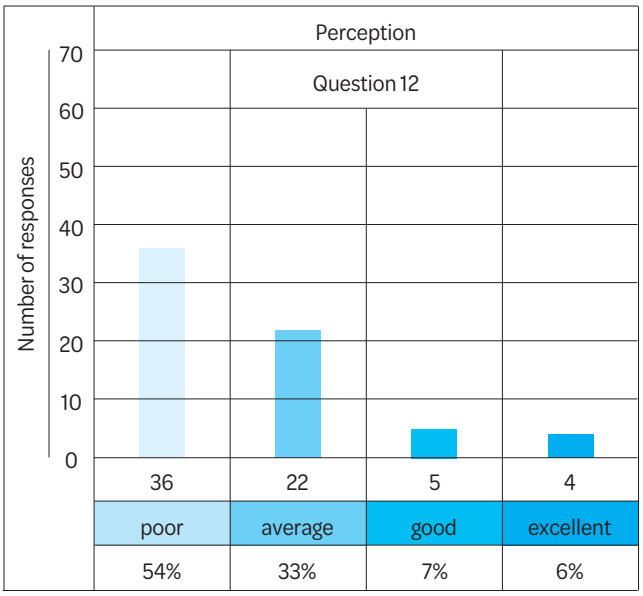

Fig. 12 Graph showing the responses to question 12: *"Was the child agitated in the ward?"*

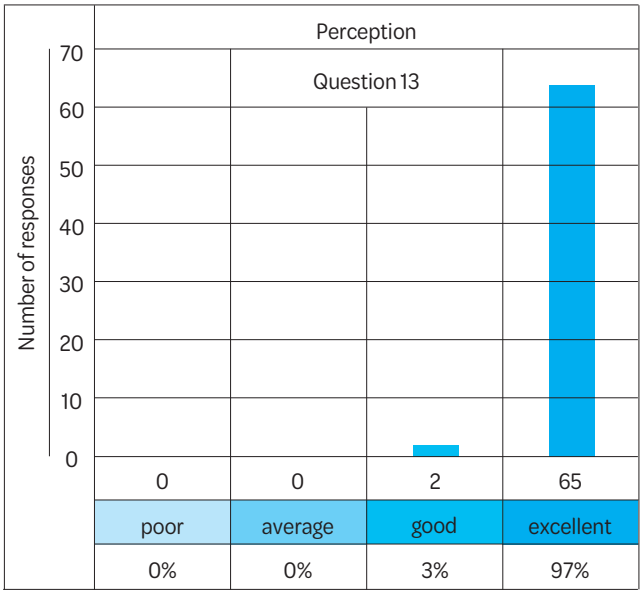

Fig. 13 Graph representing the responses to question number 13: *"Would you recommend this clinic to friends and acquaintances?"*

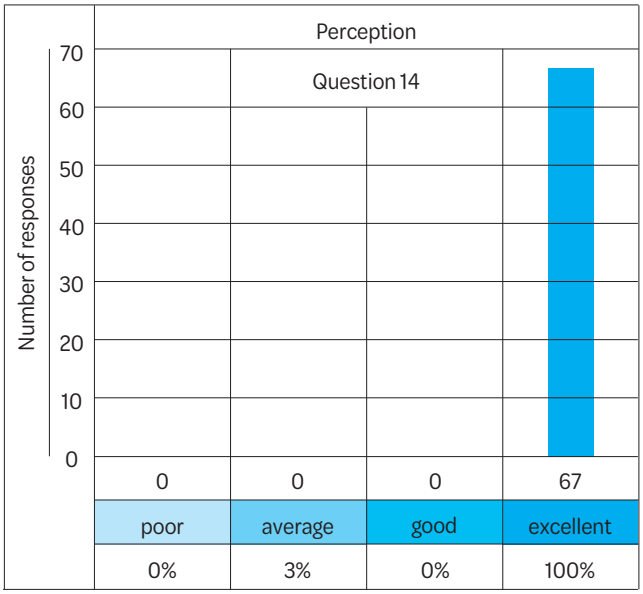

Fig. 14 Graph representing the answers to question number 14: *"If you could go back, would you choose to return to this department again?"*

Question 20: after the professional oral hygiene session, do you feel more motivated to perform daily home oral hygiene for the child?

The graph indicates that 87% of respondents affirmed being more motivated to perform daily home oral hygiene for the child; 13% more motivated but when possible; and none (0%) not always or not more motivated.

Reporting forms

Analysis of appreciations, suggestions, and complaints

The graph (Figure 22) shows that appreciations predominated across all three years. Specifically, in 2019 there were 16 appreciations, 0 suggestions, and 0 complaints; in 2021, 12 appreciations and 0 suggestions; in 2022, 17 appreciations, 0 suggestions, and 1 complaint.

Analysis of healthcare companies (ulss) participating in the evaluation forms of the community dentistry department at piove di sacco hospital

The graph (Figure 22) shows that in 2019, users completing the evaluation forms primarily originated from the local healthcare company (ULSS), with the remainder from other regional ULSS companies in Veneto region and two from out-of-region users. In 2021, there was a prevalence of users from the local ULSS, with the rest from other

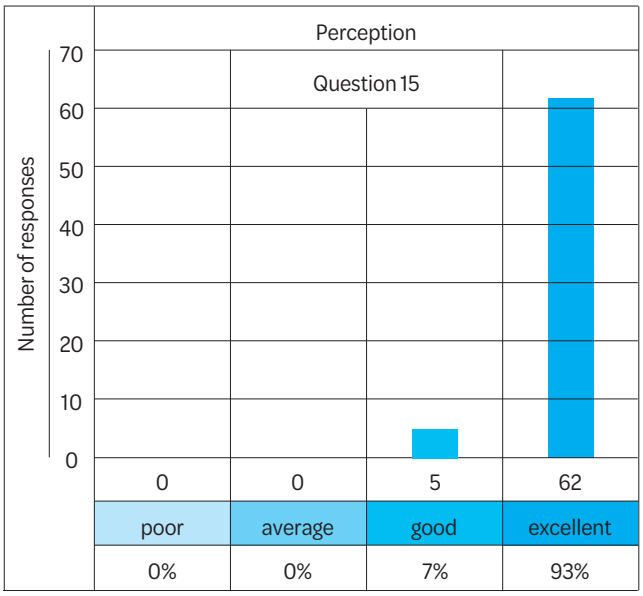

Fig. 15 Graph representing the answers to question number 15: *"During the oral hygiene session, as a caregiver, did you feel listened to by the hygienist?"*

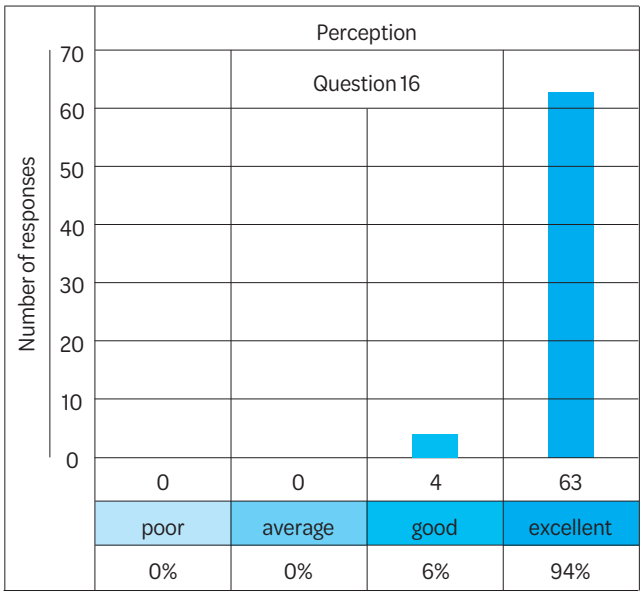

Fig. 16 Graph representing the answers to question number 16: *"Did the hygienist reassure the child during the session?"*

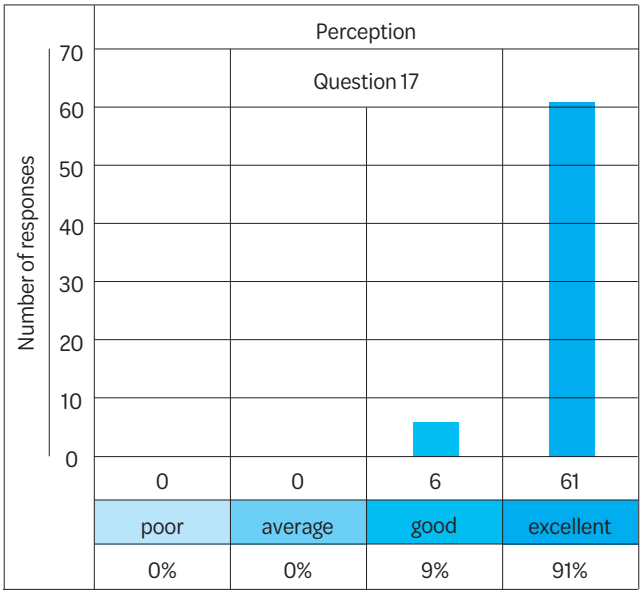

Fig. 17 Graph representing the responses to question number 17: "*Did the hygienist seem adequately trained to approach the child?"*

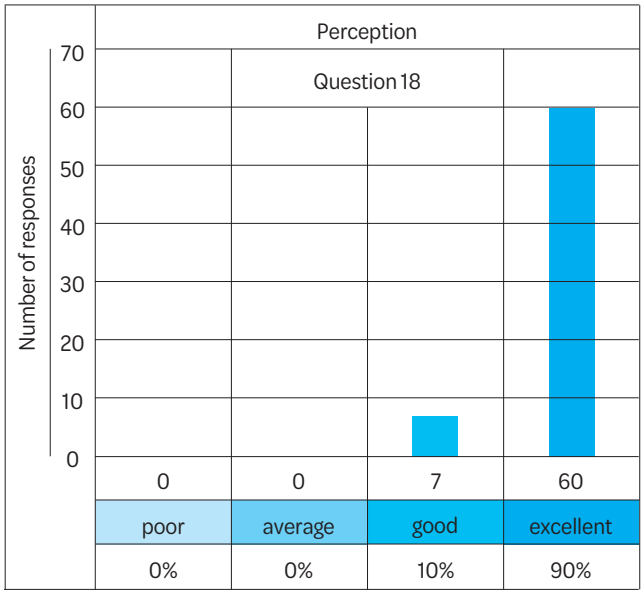

Fig. 18 Graph representing the answers to question number 18: *"Would you submit the child to a professional hygiene session with the hygienist again?"*

regional ULSS companies. In 2022, submissions were nearly evenly split between users from the local ULSS and those from other regional ULSS companies.

Discussion of questionnaire results

This study demonstrates high user satisfaction regarding the comprehensibility and visibility of directions to the Community Dentistry Department, with a strong proportion of positive responses (excellent-good), though a small percentage rated them as fair.

Courtesy and availability of staff received full satisfaction, with over 90% rating them excellent and the remainder positive (good). Waiting area and outpatient clinic furnishings also yielded high satisfaction, with predominantly excellent ratings. Comments on specific questions reinforced general satisfaction (Question 6: "Super nice!", "Child- and youth-friendly"; Question 9: "gentle manners suitable for putting children at ease").

Waiting times were well-managed, with 97% of users called within 10 minutes and 3% between 10-15 minutes, thereby enhancing satisfaction and reducing pre-treatment anxiety. Reception and listening by healthcare staff were highly rated, particularly listening (98% very attentive; 2% moderately), outperforming general reception (85% excellent; 15% good). Child anxiety levels varied: over 50% not anxious; 33% slightly anxious; a small percentage moderately or very anxious.

User appreciation is evident in responses to Questions 13

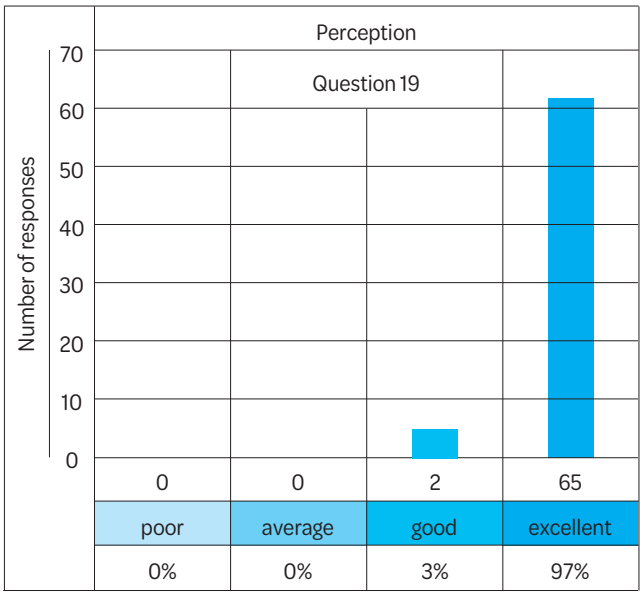

Fig. 19 Graph representing the answers to question number 19: *"Was the hygienist able to provide you with comprehensive instructions regarding the most appropriate home oral hygiene methods for your child?"*

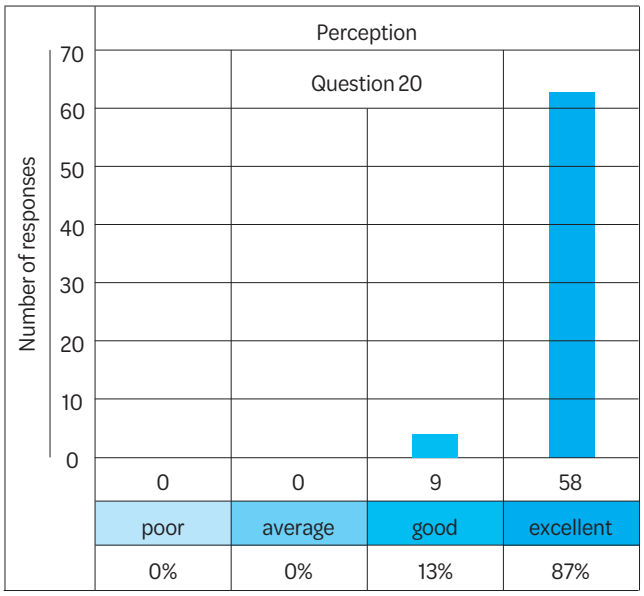

Fig. 20 Graph representing the answers to question number 20: *"After the professional oral hygiene session, do you feel more motivated to perform daily oral hygiene at home on your child?"*

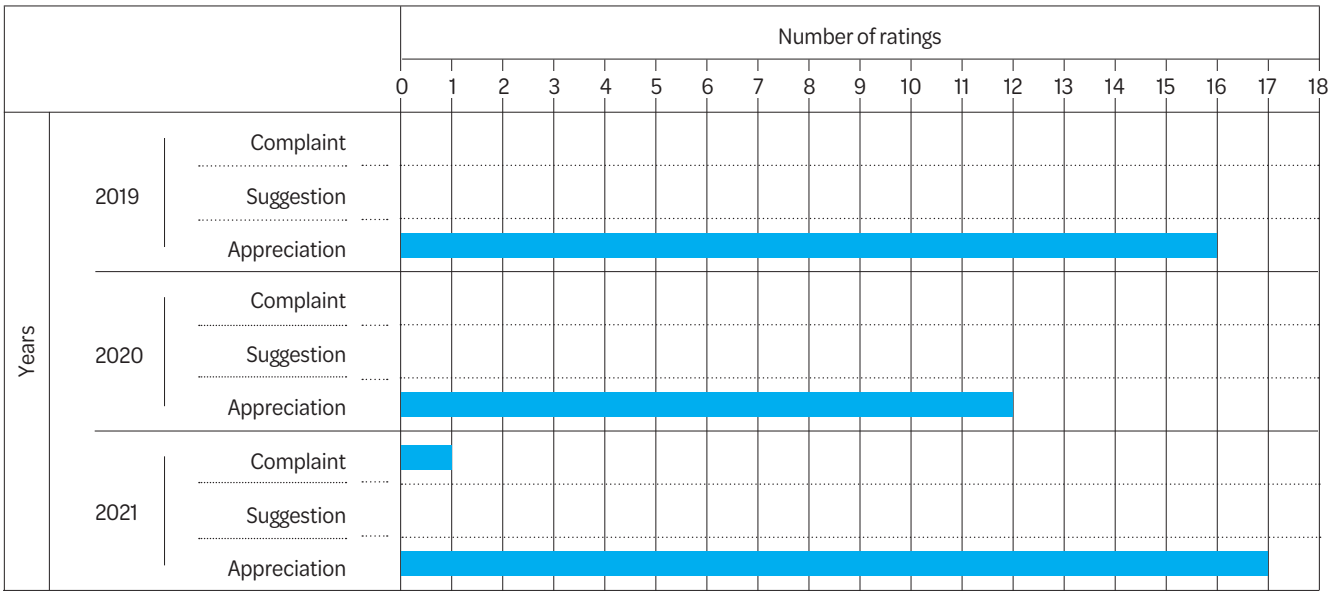

Fig. 21 Chart of complaints, praise, and suggestions for the years 2019, 2021, and 2022.

and 14, reflecting overall experience and word-of-mouth feedback. Dental hygienist evaluations were uniformly positive, especially on Question 19, where nearly all users found instructions on home oral hygiene comprehensive. Ratings exceeded 90% for child interaction and caregiver feedback. For home hygiene motivation, 87% responded decisively yes, while 13% affirmed but only when possible. Reporting forms from 2019, 2021, and January-June 2022 indicate majority appreciation for department management, with all but one containing positive notes; the exception included a complaint about long waiting times for sedation procedures alongside appreciation. Over 50% of reviews across years came from local ULSS users, with some from neighboring regions. Comments highlighted perceived professionalism, kindness, availability, sensitivity, understanding, attention, courtesy, patience, and competence of the dental staff, described as prepared, qualified, professional, and humane.

CONCLUSIONS

In conclusion, the Community Dentistry Department has received positive reviews for reception over the years. Users expressed general satisfaction with staff interactions, facility structure, and aesthetics.

Potential improvements include enhancing direction comprehensibility/visibility and reducing waiting times for sedation interventions. The study confirms that maintaining high-quality service requires spacious, clean outpatient environments and courteous patient relations from reception to dismissal.

The healthcare professional, particularly the dental hygienist who sees patients regularly, plays a central role in building empathy, especially with special needs patients. This study highlights that dental hygienists must be trained not only clinically but relationally to foster trust with both patient and caregiver in community dentistry settings for special needs cases.

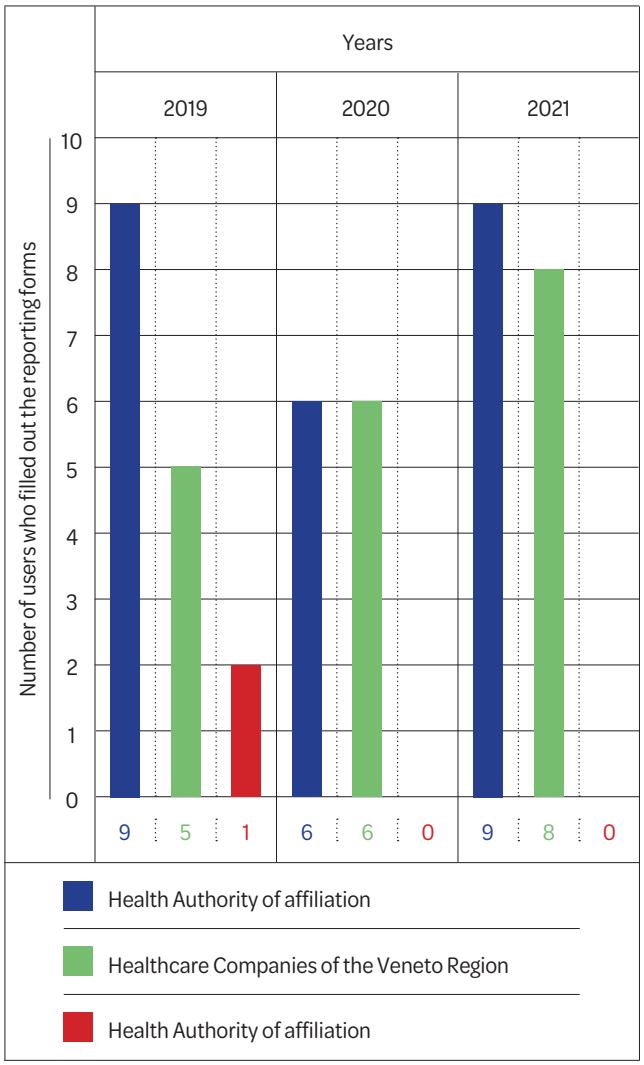

Fig. 22 Breakdown of users who filled out the reporting forms in 2019 based on the local health authority they belong to.

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Periodontitis and Rheumatoid Arthritis: Correlation and Identification of a Therapeutic Approach for Oral and Systemic Health

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ABSTRACT

Introduction: Oral health conditions can have repercussions on systemic health. The aim of this study is to evaluate the effectiveness of periodontal therapy (scaling and root planing, SRP) combined with pharmacological treatment in periodontal patients affected by rheumatoid arthritis (RA) in reducing clinical periodontal parameters.
Material and Methods: In this clinical study, patients underwent baseline periodontal parameter assessments, which were recorded in the periodontal chart (University of Bern). The patients were divided into three groups:
- Test group: patients with rheumatoid arthritis and periodontal disease treated with non-surgical mechanical therapy and pharmacological therapy;
- Control group I: patients with rheumatoid arthritis and periodontal disease treated with pharmacological therapy only;
- Control group II: patients with rheumatoid arthritis and periodontal disease treated with non-surgical mechanical therapy only.

Results: The findings indicate a significant improvement in clinical parameters in the group of patients treated with both therapies, with a p-value of 0.001 compared to Control Groups I and II (p-value 0.005).
Conclusions: The presence of periodontitis may contribute to the progression of RA, whereas RA may have little effect on accelerating the development of periodontitis.

Keywords: Oral Health, Rheumatoid Arthritis, Periodontitis

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INTRODUCTION

Recent studies have focused on the bidirectional relationship between oral and systemic diseases, reintroducing the hypothesis that oral health conditions can have systemic implications. Epidemiological studies indicate that more than 15% of the population in Western countries is affected by severe periodontitis. Periodontitis represents a risk factor for the progression of several systemic diseases, such as:
- Cardiovascular diseases;
- Diabetes mellitus;
- Metabolic syndrome;
- Obesity;
- Rheumatoid arthritis.

Rheumatoid Arthritis

Rheumatoid arthritis (RA) is a chronic systemic autoimmune disease (Fig. 1) characterized by widespread inflammatory alterations of connective tissue, particularly affecting the joints, leading to pain, swelling, and impaired mobility. Fortunately, with current pharmacological options, joint deformities have become rare.

The disease primarily affects women and can occur at any age, although it is most common between 30 and 50 years. The immune system—which normally defends the body against external aggression—mistakenly attacks healthy tissues. The primary target of the antibodies in this case is the synovial membrane, the inner lining of the articular capsule that extends to cover the articular bone surfaces. This membrane responds to inflammation by proliferating and forming a pannus, which expands and gradually destroys the cartilage. In severe cases, the proliferative process may extend to bone and surrounding tissues (subchondral bone, capsule, tendons, ligaments), resulting in disability in long-term sufferers. Possible environmental triggering factors include certain viral infections (Human Herpes Virus 6 and Epstein-Barr Virus), stress, tobacco smoking, and poor oral hygiene (periodontal disease associated with proliferation of *Porphyromonas gingivalis*). It is still unclear whether low vitamin D levels represent a potential risk factor or merely a consequence of the disease.

Diagnosis

RA can be difficult to diagnose because its onset may be

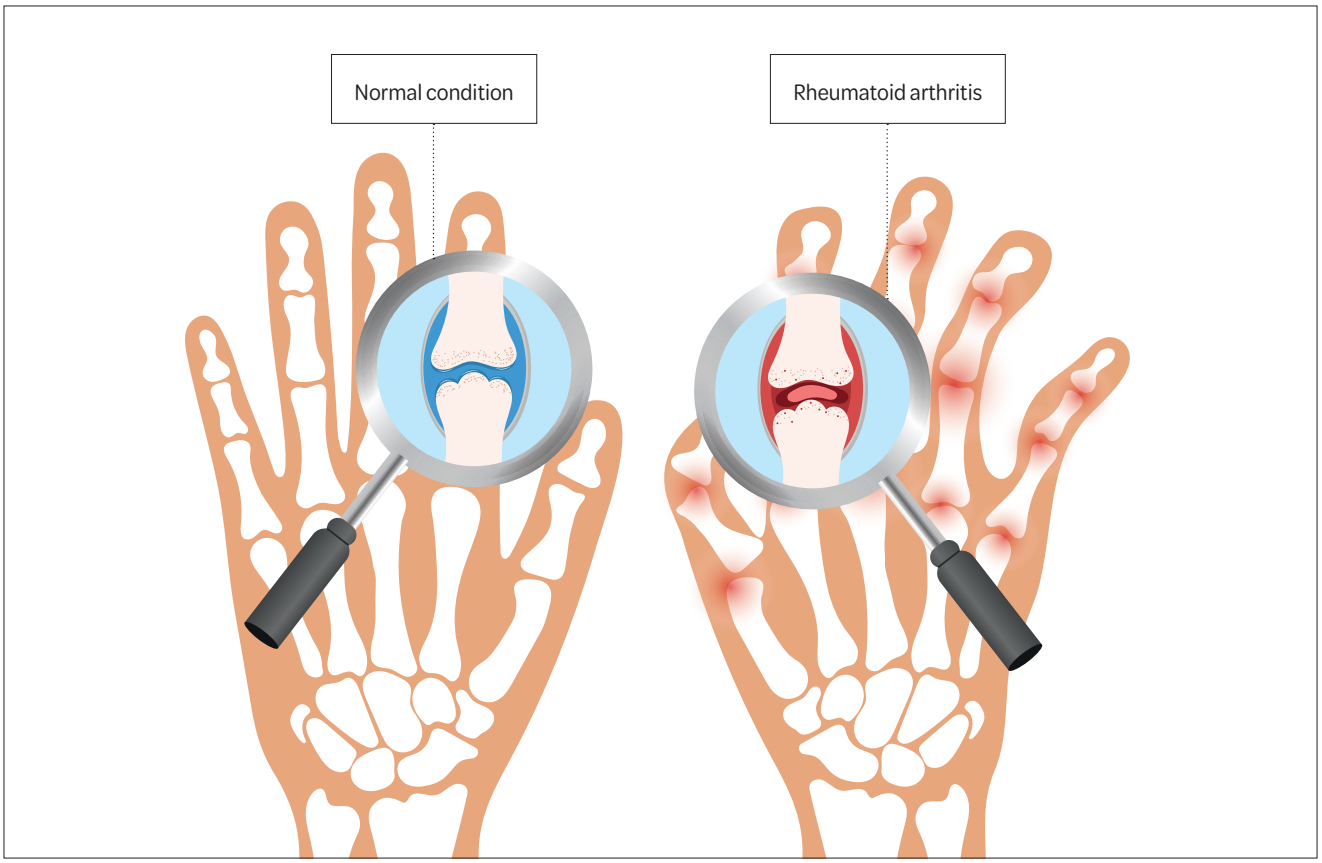

Fig. 1 Rheumatoid arthritis.

gradual and accompanied by nonspecific symptoms; indeed, many diseases, particularly in their early stages, can resemble RA.

The diagnosis of RA is based on the symptoms reported by the patient and on a rheumatological examination, which allows detection of pain, swelling, and warmth at the joint level. In addition, several laboratory tests assist in the diagnosis, including:

- Anemia;
- Rheumatoid factor;
- Anti-citrullinated peptide antibodies (anti-CCP antibodies, which are highly specific for RA);
- Elevated erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) levels.

It is important to note that no single test can definitively diagnose RA. Only a rheumatologist, by integrating the patient's symptoms, physical findings, laboratory results, and imaging (radiographs or joint ultrasounds), can establish the correct diagnosis.

Prognosis

The course of rheumatoid arthritis is unpredictable. It tends to progress more rapidly during the first six years—particularly in the first year—and 80% of untreated individuals develop permanent joint damage within ten years. RA reduces life expectancy by approximately three to seven years. Spontaneous remission of rheumatoid arthritis is rare. Treatment relieves symptoms in approximately three out of four patients; however, in at least 10% of individuals, the disease remains severely disabling despite comprehensive therapy.

Factors associated with a poorer prognosis include:

- Female sex, white race, or both;
- Presence of rheumatoid nodules;
- Older age at disease onset;
- Involvement of 20 or more inflamed joints;
- Tobacco use;
- Obesity;
- Elevated ESR;
- High levels of rheumatoid factor or anti-CCP antibodies.

Treatment

With appropriate treatment aimed at reducing inflammation—and consequently pain—patients can live with the disease and maintain a good quality of life. Therapeutic options include conservative and pharmacological measures as well as surgical treatments. The simplest measures aim to relieve symptoms and include rest, an appropriate diet, and physiotherapeutic interventions. A diet rich in fish (omega-3 fatty acids) and vegetable oils but low in red meat may partially alleviate symptoms in some patients.

Physiotherapy

Along with pharmacological therapy to reduce joint inflammation, the management plan for rheumatoid

arthritis should include non-pharmacological treatments such as physical activity, physiotherapy (including massage, traction, and deep-heat treatments), and occupational therapy (including self-assistance tools).
Inflamed joints should undergo moderate stretching movements to prevent "freezing" in a fixed position.
Thermotherapy can be highly beneficial, as it improves muscle function while reducing stiffness and spasm.
When inflammation subsides, regular exercise can also be helpful.

Correlation Between Periodontitis and Rheumatoid Arthritis

The relationship between RA and periodontitis was proposed more than 200 years ago, as noted by Rutger et al. (2012). Rheumatoid arthritis (RA) and periodontitis (PD) are complex multifactorial diseases characterized by common pathogenic mechanisms involving chronic inflammation and bone destruction. Furthermore, these two prevalent diseases share several risk factors, particularly smoking. Observational studies based on clinical cohorts have suggested that the prevalence of RA is higher among patients with periodontitis than among those without it, and vice versa. This indicates that patients with RA may have a higher frequency of moderate-to-severe periodontitis compared to healthy controls. Recognizing the association between RA and PD and understanding the potential biological mechanisms involved in their pathogenesis are crucial for managing patients who require both periodontal and arthritic treatment. This implies that the clinical management protocol for RA patients may need to be modified to include periodontal examination, and, in cases of confirmed PD diagnosis, the treatment protocol may incorporate resolution of periodontal inflammation through non-surgical periodontal therapy (NSPT). Conversely, periodontal patients diagnosed with RA may experience improved periodontal status due to medications prescribed for arthritis, such as biologic disease-modifying antirheumatic drugs (DMARDs) or nonsteroidal anti-inflammatory drugs (NSAIDs), owing to their immunomodulatory effects on both diseases.

Pathological and Clinical Similarities

The relationship between periodontal disease (PD) and rheumatoid arthritis (RA) has been emphasized in numerous clinical studies.
Both diseases are described as chronic, destructive inflammatory conditions that share significant pathological and clinical similarities at cellular and molecular levels.
Among their pathological and immunological features are:

- Increased infiltration of inflammatory and immune cells, including neutrophils, monocytes, and T and B lymphocytes;
- Elevated release of proinflammatory mediators such as tumor necrosis factor-alpha (TNF-α), interleukin-1β (IL-1β), interleukin-6 (IL-6), and matrix-degrading enzymes (MMPs, cathepsins);
- Upregulation of the receptor activator of nuclear factor kappa-B ligand (RANKL) pathway induced by soluble mediators released from immune cells, leading to osteoclast differentiation and maturation.

Patients with rheumatoid arthritis are more likely to exhibit severe periodontitis or missing teeth than healthy controls.
Similarly, individuals with periodontal disease have been shown to be more susceptible to RA than healthy individuals. A dose-dependent association model has been demonstrated between periodontitis severity and RA disease activity. Moreover, non-surgical periodontal therapy has been shown to have a positive effect on rheumatic disorders, and conversely, RA treatment has demonstrated a beneficial impact on periodontal status.
The chronic inflammation characteristic of both RA and PD is similar in terms of the predominant adaptive immune phenotype, the imbalance between pro- and anti-inflammatory cytokines, and the influence of smoking and genetic background as shared risk factors.
Despite the distinct etiologies of RA (autoimmune) and PD (dysbiotic microbial biofilm), similar biological processes are involved—such as citrullination, autoantibody response, and the role of bacterial dysbiosis—which may represent a direct link between the two conditions.
The common onset of periodontal dysbiosis in RA suggests that oral pathogens may trigger the production of disease-specific autoantibodies and arthritis in susceptible individuals. Periodontitis is characterized by the presence of citrullinated autoantigens, which serve as primary immune targets in RA. Citrullination patterns in periodontitis mirror those observed in rheumatoid joints, implicating the oral mucosa as a potential site involved in RA pathogenesis. Proteomic signatures of multiple microbial species have been detected in hypercitrullinated periodontitis samples. Among these, *Aggregatibacter actinomycetemcomitans* (Aa)—but not other candidate pathogens—was shown to induce hypercitrullination in host neutrophils. Special attention has been directed toward the periodontal pathogen P*orphyromonas gingivalis*, which has been implicated in the generation of anti-citrullinated protein antibodies (ACPAs) in RA patients, suggesting a direct biological intersection between PD and RA. However, further studies are warranted to confirm this association, elucidate the underlying mechanisms, and clarify the temporal relationships between RA and PD. Consequently, recent evidence has strengthened the hypothesis that PD is a potential risk factor for the development of RA. Researchers have shown that individuals at high risk of developing RA exhibit an increased prevalence of PD and periodontopathogenic bacteria (*P. gingivalis*), suggesting that PD is associated with disease onset and may represent a potential target for preventive interventions in RA.

Bacterial Connection

A study conducted by researchers at Johns Hopkins University provided new evidence of the link between these two diseases. Published in Science Translational Medicine, the study identified a bacterial connection

between the two pathologies: *Aggregatibacter actinomycetemcomitans* and *Porphyromonas gingivalis*.
The indirect involvement of *P. gingivalis* in RA pathogenesis—through the expression of peptidylarginine deiminase (PAD) and the process of citrullination—was first described in 2004. Citrullination is a post-translational modification process in which the amino acid arginine is converted into citrulline by PAD, an enzyme present in immune cells such as T and B lymphocytes, neutrophils, monocytes, and macrophages. This process leads to the production of anti-cyclic citrullinated peptide (anti-CCP) antibodies. When citrullinated proteins are overproduced, they may act as autoantigens, triggering the formation of autoantibodies that contribute to the pathogenesis of rheumatic diseases. P. gingivalis induces the production of proinflammatory cytokines (e.g., IL-6 and IL-1β) by immune cells. In this context, oral infection with *P. gingivalis* prior to RA onset may enhance immune reactivity by stimulating Th17 cell responses, potentially accelerating arthritis development. Furthermore, *P. gingivalis* has demonstrated the ability to invade primary human chondrocytes in vitro, influencing cellular responses that may contribute to tissue damage during RA pathogenesis.
These characteristics of *P. gingivalis* suggest that periodontal disease, particularly when associated with increased colonization by this microorganism, may influence RA development through citrullination processes and Th17-related immune pathways.
Although *P. gingivalis* is the most extensively studied periodontal microorganism in RA pathogenesis, recent research has identified another pathogen, *A. actinomycetemcomitans*, a Gram-negative coccobacillus, as a potential trigger for RA pathogenesis, providing a new microbial connection between PD and RA.

Effects of Periodontal Disease Treatment on Rheumatoid Arthritis

Several studies have demonstrated that treatment of PD improves clinical and pathological RA parameters (e.g., DAS28 score, CRP levels) and, conversely, that RA treatment can reduce periodontal inflammation. This evidence strongly suggests that PD and RA are interrelated and that their association involves reciprocal biological influences. zRA management includes various pharmacological approaches. Nonsteroidal anti-inflammatory drugs (NSAIDs), glucocorticoids (GCs), and both synthetic and biologic disease-modifying antirheumatic drugs (DMARDs)—including TNF-α inhibitors, interleukin-1 receptor antagonists (anakinra), and Janus kinase (JAK) inhibitors—are currently the most commonly prescribed medications for RA treatment.
These drug classes reduce pain, inflammation, and joint destruction, thereby improving clinical outcomes and overall quality of life. Long-term use of GCs and NSAIDs in RA patients, however, is associated with immunosuppression, which can result in oral alterations such as xerostomia and candidiasis. Although evidence from preclinical and clinical studies indicates that transient drug-induced immunosuppression may attenuate PD, prolonged immunosuppression is also associated with worsening periodontal conditions. Most studies investigating the influence of RA treatment on PD severity have focused on agents targeting specific molecular factors within the inflammatory cascade, such as biologic DMARDs. TNF-blocking agents used for RA treatment have been shown to significantly reduce biochemical markers of PD, including IL-1β and IL-8, in the gingival crevicular fluid (GCF) of patients with periodontitis. Similarly, anti–TNF-α therapy reduces both periodontal indices and TNF-α levels in the GCF of patients affected by autoimmune disease and periodontitis. These findings suggest that TNF-α inhibition in RA therapy may also benefit periodontal health. A systematic review confirmed that periodontal status was better in RA patients receiving antirheumatic medication than in untreated RA patients. These results support the beneficial effects of pharmacological therapy on clinical periodontal parameters, as evidenced by the reduction in gingival index (GI), bleeding on probing (BOP), and clinical attachment loss (CAL). Treatment of RA patients with DMARDs and anti–TNF-α agents reduced CAL severity compared with untreated patients.

Effects of Rheumatoid Arthritis Treatment on Periodontal Disease

The impact of rheumatoid arthritis (RA) treatment on periodontal disease (PD) remains a topic of great scientific interest. RA pharmacotherapy may indirectly affect periodontal tissues by modulating the systemic inflammatory response and immune cell activity. Methotrexate (MTX), one of the most commonly prescribed synthetic disease-modifying antirheumatic drugs (DMARDs), exerts anti-inflammatory and immunomodulatory effects by inhibiting purine synthesis and reducing cytokine production, particularly TNF-α and IL-6.Clinical studies have demonstrated that MTX therapy in RA patients can reduce gingival inflammation and probing depth when compared with untreated controls. Similarly, biological DMARDs—especially TNF-α inhibitors such as infliximab, etanercept, and adalimumab—have shown positive effects on periodontal parameters. These agents reduce both systemic and local inflammation, decreasing levels of proinflammatory cytokines within periodontal tissues and gingival crevicular fluid. A number of studies have also explored the effects of tocilizumab (an IL-6 receptor antagonist) and abatacept (a T-cell costimulation modulator), demonstrating improvement in periodontal indices such as bleeding on probing (BOP) and clinical attachment level (CAL). However, the immunosuppressive effect of RA pharmacotherapy—especially when prolonged—can increase susceptibility to opportunistic oral infections, including candidiasis and herpes simplex reactivation, and may lead to oral mucosal atrophy. Therefore, periodontal monitoring is recommended for RA patients under long-term immunomodulatory therapy.

Experimental Study

Objective

The objective of this study was to evaluate the effective-

ness of periodontal therapy (scaling and root planing, SRP) combined with pharmacological therapy in achieving clinical attachment gain in periodontal pockets of patients affected by rheumatoid arthritis (RA), compared with the results obtained in patients treated either with pharmacological therapy alone or with non-surgical mechanical therapy alone.

MATERIALS AND METHODS

Study Design

The study was designed as a prospective clinical trial.

Primary Outcome

The primary variable of this prospective study was probing depth (PD).

Secondary Variables

- Full Mouth Bleeding Score (FMBS);
- Full Mouth Plaque Score (FMPS);
- Gingival recession (REC);
- Tooth mobility;
- Clinical Attachment Level (CAL).

Inclusion and Exclusion Criteria

From a pool of patients attending the Department of Periodontology, University of Naples "Federico II," 30 patients were selected according to the following inclusion criteria:

- both sexes;
- diagnosis of periodontitis and rheumatoid arthritis;
- presence of at least one periodontal pocket greater than 5 mm in each quadrant.

Exclusion criteria:

- presence of systemic diseases other than rheumatoid arthritis;
- pregnancy or breastfeeding.

Protocol

During the first visit, after thorough anamnesis to verify inclusion and exclusion criteria, patients were informed about the clinical procedures to be performed and signed informed consent.
Patients were divided into three groups:

- Test group: patients with rheumatoid arthritis and periodontal disease treated with non-surgical mechanical therapy combined with pharmacological therapy;
- Control Group I: patients with rheumatoid arthritis and periodontal disease treated with pharmacological therapy only;
- Control Group II: patients with rheumatoid arthritis and periodontal disease treated with non-surgical mechanical therapy only.

A baseline periodontal charting was performed, including the evaluation of PD, FMPS, FMBS, bleeding on probing (BOP), gingival recession (REC), and tooth mobility. All collected data were recorded in the periodontal chart, providing an overview of the patient's periodontal status before treatment.
Patients in the test group underwent non-surgical periodontal therapy (SRP), consisting of one session of supragingival scaling and four sessions of root planing, each lasting approximately 30 minutes, in association with pharmacological treatment for rheumatoid arthritis. Patients in Control Group I continued their pharmacological therapy for RA but did not receive mechanical periodontal treatment. Patients in Control Group II received non-surgical mechanical therapy without pharmacological treatment for RA. A follow-up was performed at 3, 6, and 12 months to reassess the same clinical parameters recorded at baseline and to evaluate treatment outcomes over time.

Clinical Cases

Figures from 2 to 7.

RESULTS

Probing depth (PD) was measured at baseline and at 3, 6, and 12 months after treatment. Differences in parameters

Fig. 2 Control group II mechanical therapy baseline.

Fig. 3 Control group II mechanical therapy follow up.

Fig. 4 Control group I baseline drug therapy.

Fig. 5 Control group I drug therapy follow up.

Fig. 6 Mechanical therapy test group combined with baseline pharmacological therapy.

Fig. 7 Mechanical therapy test group associated with pharmacological therapy follow up.

between baseline and the three post-treatment evaluations are illustrated in Table 1. Comparisons across the follow-up periods revealed significant differences in clinical parameters after treatment.

DISCUSSION

In the present study, the clinical parameters PD and CAL were measured at baseline and 3, 6, and 12 months after treatment. The results indicate a significant improvement in these parameters in the group of patients treated with both periodontal and pharmacological therapies, with a p-value of 0.001, compared with patients treated either with pharmacological therapy alone or with non-surgical mechanical therapy alone (p-value 0.005). These findings suggest that the combined therapeutic approach produces superior clinical outcomes in the management of periodontal disease in patients affected by rheumatoid arthritis.

CONCLUSIONS

The presence of periodontitis may contribute to the progression of rheumatoid arthritis, whereas rheumatoid arthritis appears to have limited influence on the acceleration of periodontal disease. This study demonstrates that periodontal patients with rheumatoid arthritis receiving non-surgical periodontal treatment (NSPT) in addition to their pharmacological therapy experience a remarkable improvement in oral health, with reductions in both inflammation and pocket depth. The treatment protocol for RA patients could therefore be modified to include routine periodontal examination, and—if periodontitis is diagnosed—non-surgical periodontal therapy should be incorporated into the management plan to resolve local inflammation. Conversely, periodontal patients diagnosed with RA may experience improvement in their periodontal condition due to the immunomodulatory effects of RA medications, such as biologic DMARDs or nonsteroidal anti-inflammatory drugs (NSAIDs), which can exert beneficial effects on both diseases.

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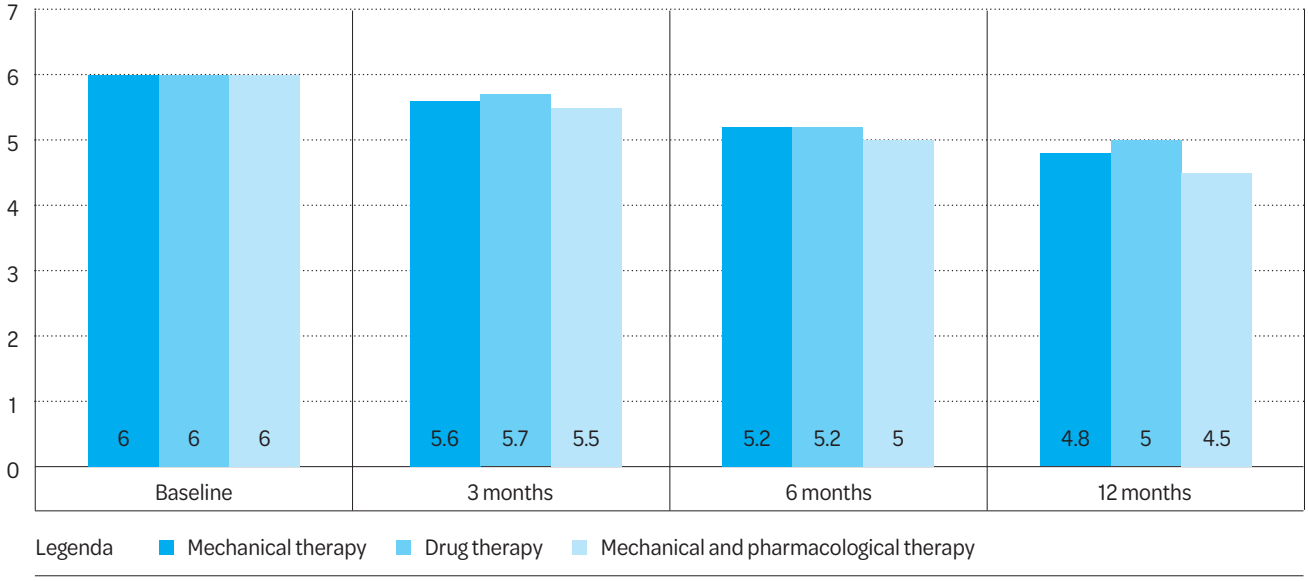

Tab. 1 The graph compares PD values over time (3, 6, and 12 months) following different therapies administered to patients with rheumatoid arthritis and periodontitis. The graph shows a significant final reduction in PD, especially when combining non-surgical mechanical therapy with pharmacological therapy.

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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

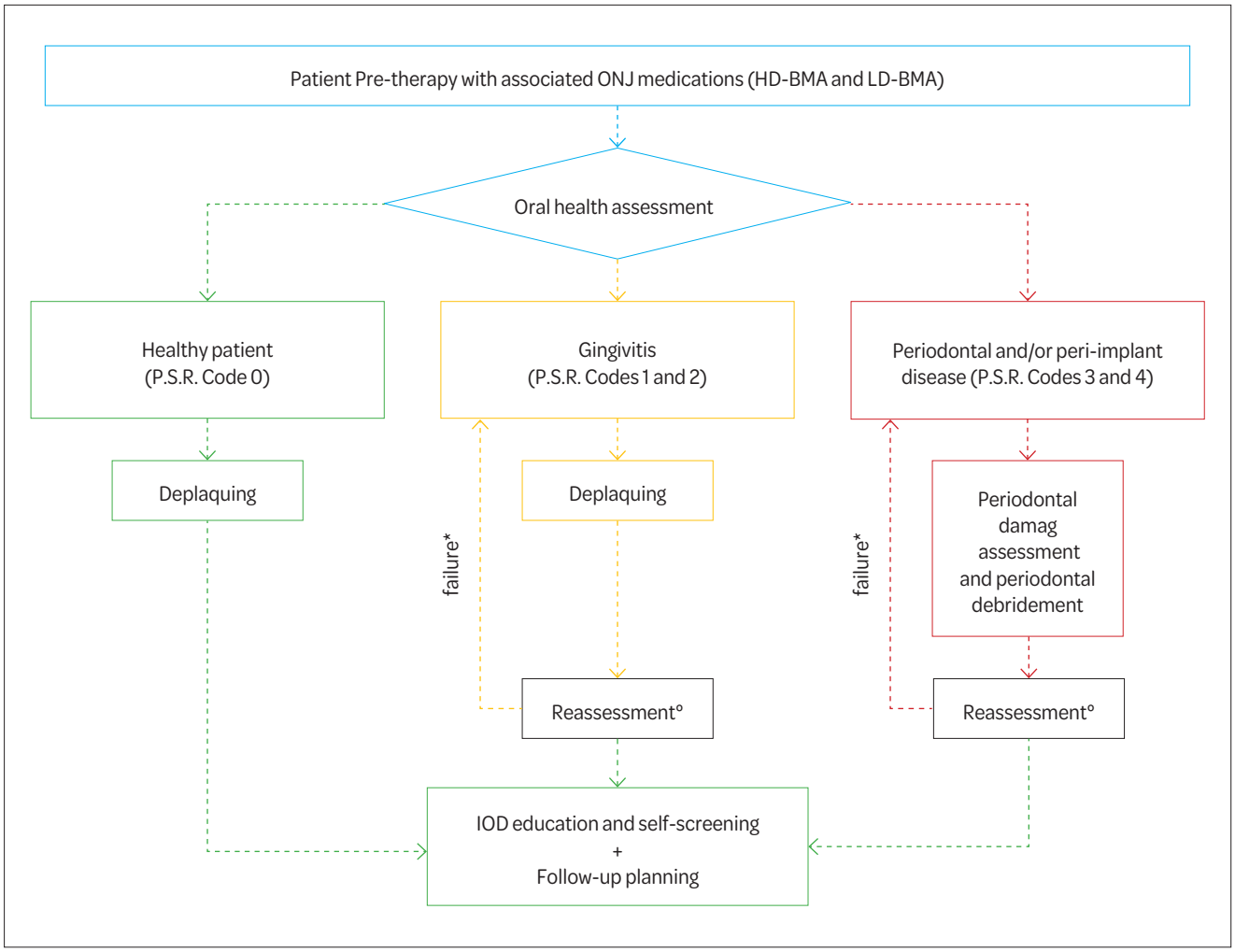

Fig. 2 Flow chart of the primary prevention pathway pre-therapy with associated ONJ drugs: patients candidates for therapy with LD-BMA and HD-BMA (modified from Mauceri et al) (21). IOD: home oral hygiene. ° Re-evaluation: no more than 30 days later. * If periodontal debridement does not lead to resolution,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

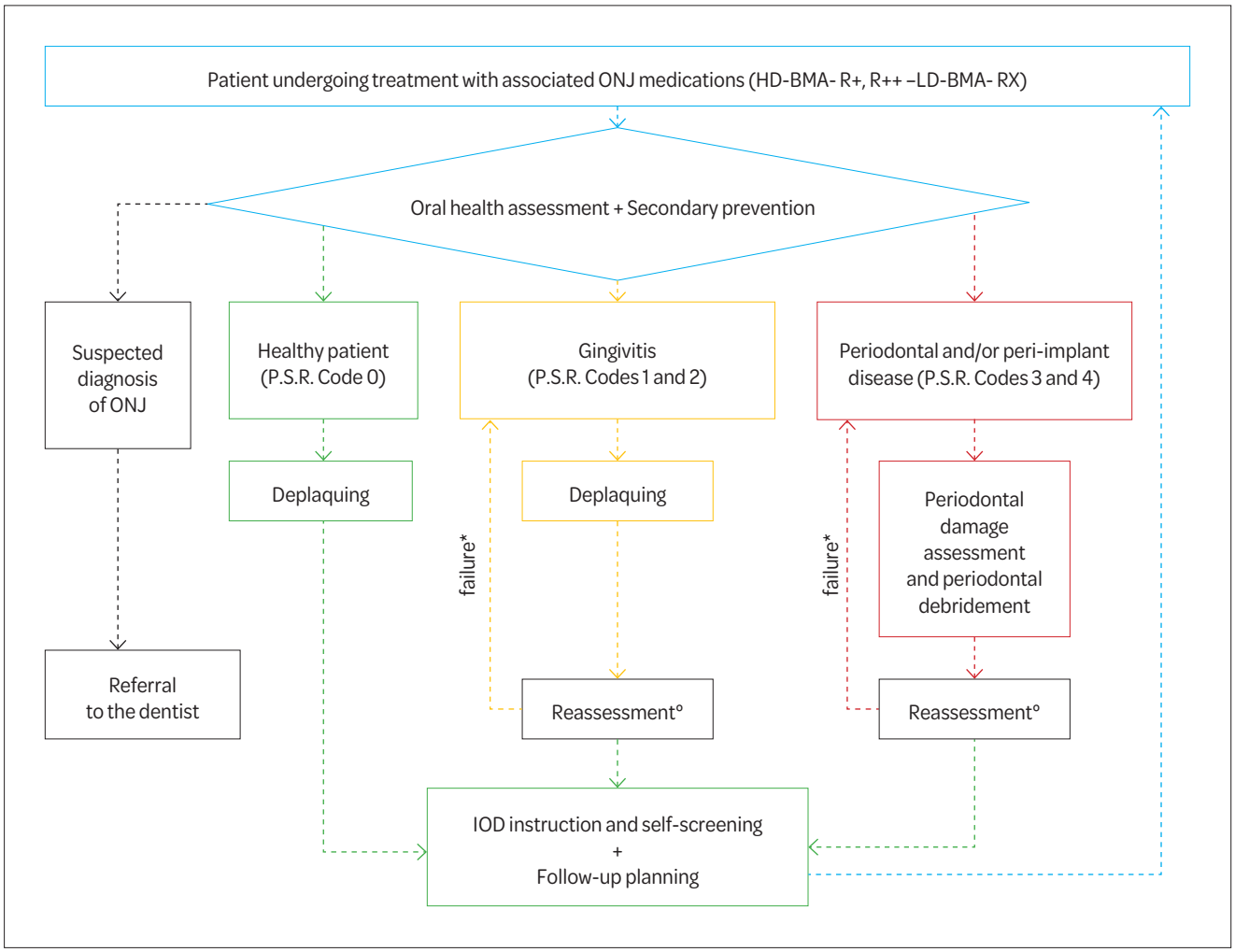

Fig. 3 Flowchart of primary prevention pathway during therapy with associated ONJ drugs: HD-BMA- R+, R++ and LD-BMA-Rx patients (modified from Mauceri et al) (21). IOD: home oral hygiene. ° Re-evaluation: no more than 30 days later. * If periodontal debridement does not lead to resolution, evaluate alternative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

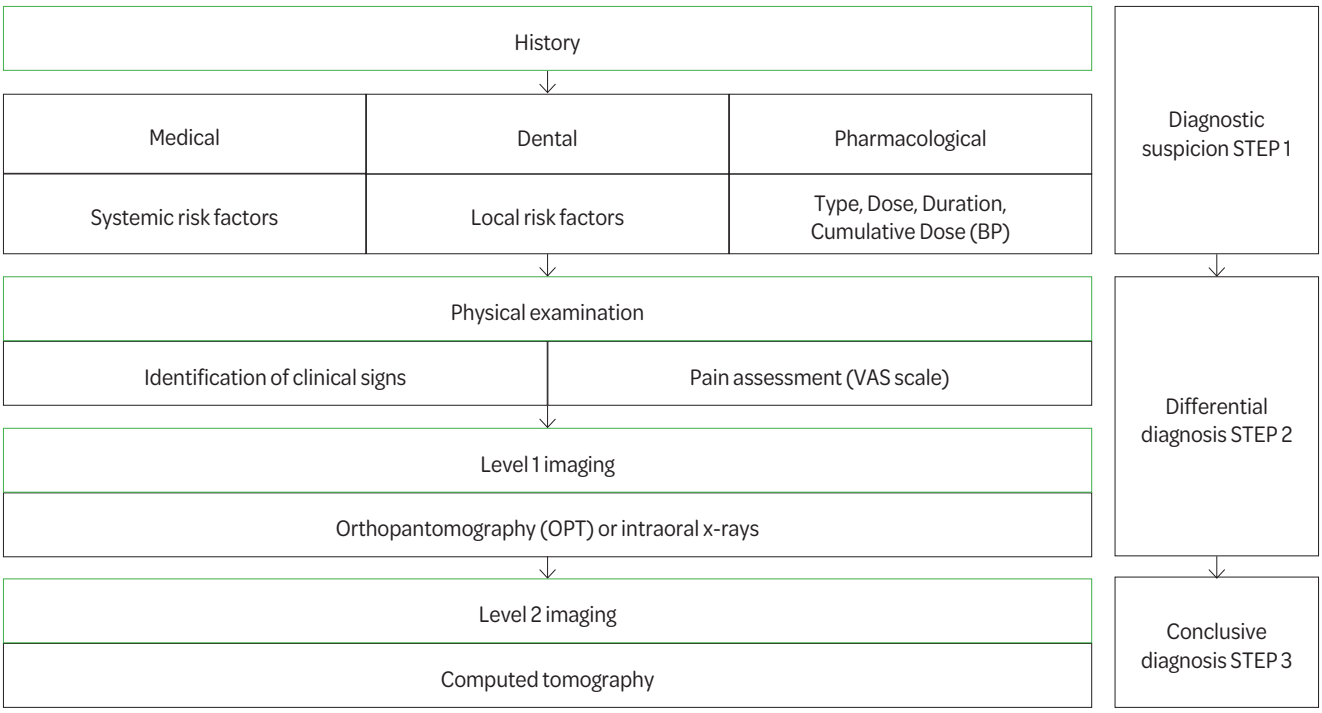

Fig. 4 Diagnostic workflow of drug-related ONJ (modified from Bedogni et al.) (3).

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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Oral Hygiene JOURNAL

Survey on Oral Health Prevention in Long-Term Care Facilities in Lombardy

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ABSTRACT

Aim of the Study To conduct a knowledge survey on the prevention of oral health among elderly residents in nursing homes (RSA) in Lombardy, with the aim of understanding the role of the dental hygienist in prevention and training within these facilities.
Materials and Methods A questionnaire was administered to the healthcare directors of nursing homes in Lombardy, after dividing them into three random samples (n=100) based on capacity. The responses received within the established time limits (n=33) were analyzed using descriptive variables with Excel software.
Results Oral health in nursing homes is a largely ignored but present issue. 37% of healthcare directors reported that between 50% and 75% of elderly residents in nursing homes have oral health problems, most commonly issues with dental prostheses, difficulties in chewing, difficulties in oral hygiene, and tooth loss. In 58% of facilities, there are no protocols for oral hygiene of patients. 76% of patients have never been assessed regarding their knowledge in this area. Preventive behaviors for oral health are scarce, and in no case was the presence of a dental hygienist observed within the facility, suggesting a therapeutic rather than preventive approach to oral health management.
Conclusions The role of the dental hygienist could be crucial for the promotion and maintenance of oral health among elderly residents in nursing homes and for the training of staff, favoring a shift from a therapeutic to a preventive approach and improving residents' quality of life.

Keywords Seniors, Dental hygiene, Nursing homes, Oral health

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INTRODUCTION

Oral Health: Global and Italian Overview

The World Health Organization (WHO) and the FDI World Dental Federation define oral health as "a fundamental component for essential functions, psychosocial well-being, and social participation" (1, 2, 3). However, oral health has long been neglected in the global health agenda (3, 4) and in health policy (5). Oral diseases are among the most common non-communicable diseases worldwide, affecting about 3.5 billion people. They are chronic, progressive, and cumulative (3), causing significant health and economic burdens and substantially reducing the quality of life of affected individuals (5). Most oral diseases can be prevented through personal care or treated with simple, evidence-based measures effective in various contexts, including low- and middle-income countries (3). However, oral health and related professions have become somewhat isolated and marginalized from the main developments in health policy and healthcare systems.
The current model of dental care and prevention policy does not address the global burden of oral diseases (5). Dentistry in the 21st century has largely failed to meet the global challenge of oral diseases (6, 7), representing a demand-driven service rather than a planned one, and thus poorly aligned with the oral health needs of the population (3, 8), a phenomenon defined as the "inverse care law" (9). Even in resource-rich contexts, dentistry does not meet the needs of large segments of the population and increasingly focuses on aesthetic treatments, largely driven by profit and consumerism (10). In these contexts, the current treatment-oriented approach, characterized by high technology and interventionism, does not address the underlying causes of disease or oral health inequalities (8).
Historically, Italian oral health services have been organized separately from general health services, as often happens worldwide (11). In Italy, there is a limited supply of dental services at the public level, with limited resources allocated to reimbursable services (12). Dental services covered by the National Health Service (SSN) are limited to oral health protection programs for children aged 0-14 and specific vulnerable population groups, as established by Legislative Decree 502/1992 and subsequent amend-

ments and integrations, and by the DPCM of January 12, 2017 (13). For the rest of the population, preventive, routine, or essential oral healthcare is generally not covered (14, 15), thus generating inequalities in access and use of care. Social inequalities influence access to care, with clear differences related to income, education, and place of residence (16, 17). About 19 billion and 123 thousand euros are spent annually on the treatment of oral diseases, of which 95% is represented by out-of-pocket payments by citizens (7).

Relationship between Aging, Oral Health, Systemic Health, and Quality of Life

Oral health is an essential factor for the elderly, and the need for oral care is increasing in aging societies (18). In the last fifty years, socioeconomic development in many countries has been accompanied by a strong reduction in fertility and a drastic increase in life expectancy (19, 20). This phenomenon, known as demographic transition (21), is the basis for rapid demographic changes worldwide, characterized by an increase in the percentage of elderly people in the general population over a relatively short period (20). The report published by the United Nations in 2020 states that the population aged 65 or older is 703 million, and this number is expected to double in 30 years, while the number of people aged 80 and over is 143 million and is expected to triple by 2050 (22). In this demographic context, an increase in the prevalence and incidence of chronic diseases is more likely, which rise with age (23, 24). The presence of chronicity and multimorbidity has a negative impact on levels of autonomy in essential daily activities and on quality of life, especially among the very elderly (25). Aging is the physiological change that occurs in the body over time (26). However, poor oral health is not an inevitable part of aging, as good oral care throughout life can result in the maintenance of a functional dentition even in advanced age (27, 28). The most prevalent oral health problems in the elderly population are tooth loss, caries, periodontal disease, xerostomia, and precancerous and cancerous oral lesions (21, 27). Oral health is a determining factor for maintaining quality of life, health, and general well-being (29), but is often neglected in integrated approaches to general health (30). The presence of oral problems such as missing teeth, caries, tooth mobility, prosthesis-related problems, oral lesions, and xerostomia can cause pain and discomfort. Furthermore, they can compromise chewing, communication, swallowing, smiling, socialization, and have a negative impact on quality of life (31). There is a growing body of evidence in the literature demonstrating various associations, some of which are bidirectional, between the oral cavity and systemic diseases prevalent in the elderly population, such as diabetes, cardiovascular diseases, dementia, and respiratory diseases (31). Tooth loss and periodontitis represent a disability among the elderly, resulting in reduced chewing, inadequate nutritional choices, difficulties in speaking, and psychological problems (32), weight loss, poor communication, and low levels of well-being and self-esteem (33). Poor oral health has been shown to be associated with a diet poor in quantity and quality of food for older individuals. The number of teeth is significantly associated with the number of foods that elderly people are able to eat. This is because tooth loss could influence the choice of foods with a softer consistency, resulting in a loss of pleasure in eating (34), leading to malnutrition and consequently frailty (27). The lack of nutrients exacerbates chronic disease in the elderly, predisposing them to sarcopenia and frailty. The term "anorexia of aging" has been introduced to refer to this phenomenon, which makes the elderly more vulnerable to distress factors and more prone to negative health outcomes, such as poor quality of life and reduced survival (35). The elderly population is at risk of developing not only dental diseases but also oral lesions. Therefore, regular dental visits and preventive oral care are of fundamental importance for successful aging, reducing oral inflammation and maintaining general and oral health (36). Good oral hygiene is essential for controlling total oral bacterial load, maintaining or restoring oral symbiotic balance, and preventing the spread of oral bacteria to other sites in the body (4, 37). Demographic changes in high-income countries have important implications for healthcare services. The number of people with morbidity and dependency is increasing and will continue to grow, as will the number of residents in nursing homes. In the Lombardy region, there are a total of 707 nursing homes, offering a total of 64,165 available beds. For residents in nursing homes, the prevalence of oral health problems such as caries, periodontal disease, and edentulism remains high, and poor oral hygiene is one of the main concerns in long-term care facilities (38). These oral problems can be further aggravated by cognitive and motor disorders and by a decline in general health. Moreover, when a patient's general health worsens, dental hygiene and health are often neglected (39). All residents in long-term care facilities should be regularly evaluated and monitored by qualified personnel. However, evidence shows high levels of oral diseases but poor access to dentists in these populations (40). Current preventive practices and service provision in nursing homes are often inadequate. The current approach to oral health management in elderly care is passive, as the initial stages of oral diseases are often neglected and only considered after the patient reports pain (41). In Italy, there are no specific dental services for the elderly (42). Therefore, it is necessary to provide oral health care for vulnerable elderly people, including residents in nursing homes. Integrating oral care with general care could improve the quality of daily life for the elderly and reduce healthcare costs (18). Thus, the aim of this study was to conduct a knowledge survey on the prevention of oral health among elderly residents in nursing homes to understand the role of the dental hygienist in this context.

MATERIALS AND METHODS

A questionnaire was developed using Google Forms, consisting of 30 closed-ended questions divided into two sections. The first section aimed to understand demographics, oral health conditions, main preventive activities related to oral health, and which professional performs them. The second section aimed to evaluate

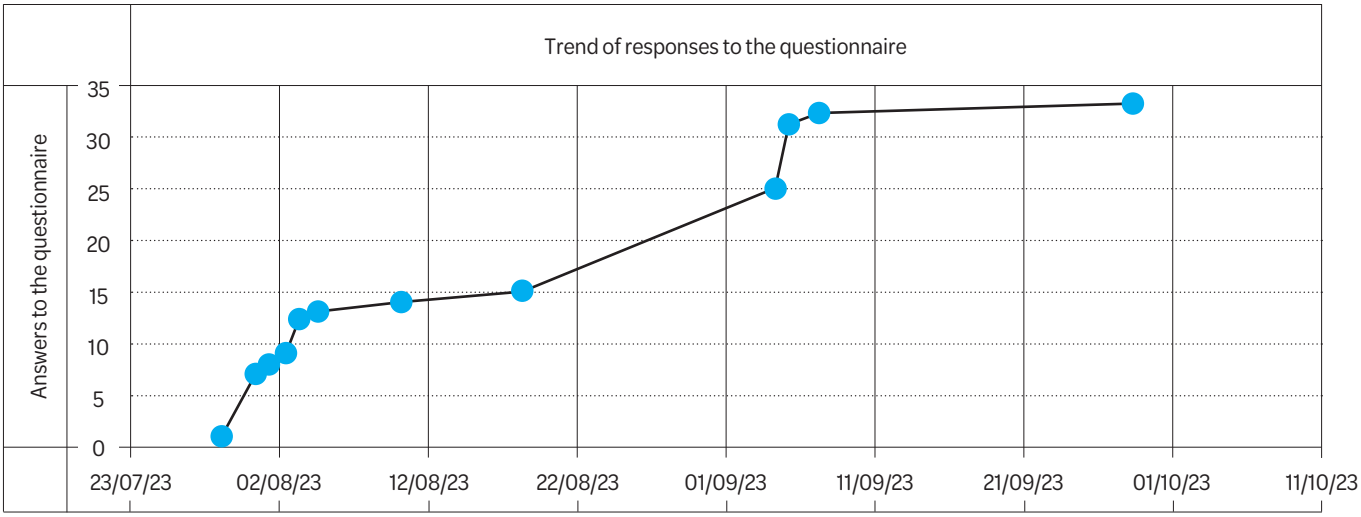

Fig. 1 Trend in responses to the questionnaire in the period from 07/29/23 to 09/28/23.

the training received by nursing home staff, particularly nurses and healthcare operators, in oral health. The selection of facilities was based on the list of nursing homes registered in Lombardy, available on the regional website, which reported 706 facilities. Subsequently, the facilities were divided according to the number of patients, classifying them into three samples:

- Small facilities: up to 50 patients (N=129).
- Medium facilities: between 50 and 100 patients (N=349).
- Large facilities: over 100 patients (N=228).

For each category, the facilities were ordered in tables and assigned an identifying number. Then, 100 identifying numbers were randomly selected for each category, obtaining three samples (n=100):

- Sample 1 (small facilities).
- Sample 2 (medium facilities).
- Sample 3 (large facilities).

Sampling was performed using the Python programming language. The code was set to provide a dataset composed of 100 random numbers between the extremes 1 and the total number of facilities in a given category. After identifying the facilities, the questionnaire was sent via email. Responses to the questionnaire were accepted in the period between July 29 and September 28, 2023 (62 days). The questionnaire was administered to the healthcare directors of the selected nursing homes. Facilities that responded to the questionnaire within the established time limits were 33. Finally, the collected data were analyzed using Microsoft Excel.

RESULTS

Response Trends

The questionnaire was administered between July 29 and September 28, 2023, during which 33 responses were obtained, with the distribution described in the graph below (Fig. 1). The responses were distributed among the samples as follows:

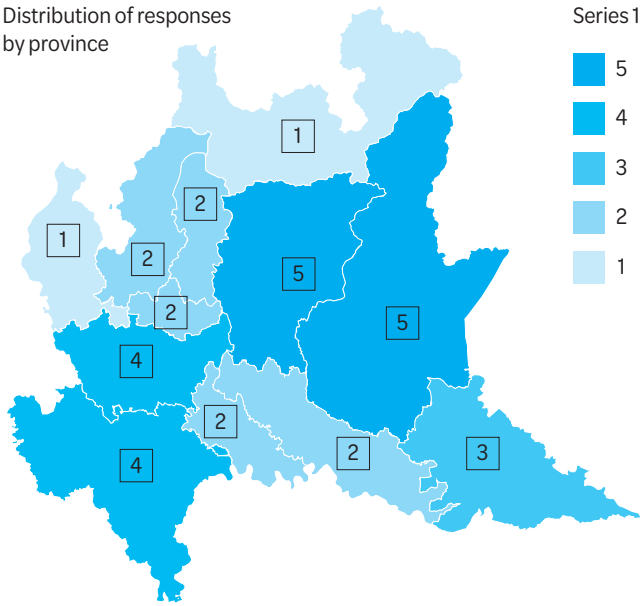

Fig. 2 Distribution of questionnaire responses by province in Lombardy.

- Sample 1: 9 responses (27%).
- Sample 2: 12 responses (40%).
- Sample 3: 11 responses (33%).

Additionally, the distribution of responses across the Lombardy region was observed. The highest response rate was in the provinces of Bergamo and Brescia, Milan and Pavia, and finally Mantua (Fig. 2).

Demographic Data

Regarding the age range of patients hosted by the facilities, it was found that globally the majority are over 80 years old, i.e., 97%. The remaining 3% are between 76 and 80 years old (Tab. 1). Regarding the level of self-sufficiency, based on the classification adopted by individual nursing homes to define patients, the following was observed (Tab. 2):

- 91% reported that the percentage of self-sufficient

Age	Sample			
	<50	50 and 100	>100	Total
65-70 years old	0 (0)	0 (0)	0 (0)	0 (0)
71-75 years old	0 (0)	0 (0)	0 (0)	0 (0)
76-80 years old	0 (0)	0 (0)	1 (3)	1 (3)
Over 80 years old	9 (27.3)	13 (39.4)	10 (30.3)	32 (97)
Total	9 (27.3)	13 (39.4)	11 (33.3)	33 (100)

Tab. 1 Absolute and relative frequency of the variable "self-sufficiency" of patients residing in RSA.

Self-sufficiency	Sample			
	<50	50 and 100	>100	Total
<25%	8 (24.2)	12 (36.4)	10 (30.3)	30 (90.9)
25-50%	1 (3)	1 (3)	0 (0)	2 (6.1)
50-75%	0 (0)	0 (0)	0 (0)	0 (0)
>75%	0 (0)	0 (0)	1 (3)	1 (3)
I don't know	0 (0)	0 (0)	0 (0)	0 (0)
Total	9 (27.3)	13 (39.4)	11 (33.3)	33 (100)

Tab. 2 Absolute, relative and cumulative frequency of oral health problems in patients residing in nursing homes at the time of the survey.

subjects is less than 25%.
- 6% reported that the percentage of self-sufficient subjects is between 25% and 50%.
- 3% reported that the percentage of self-sufficient subjects is over 75%.

Oral Health Conditions

Regarding oral health conditions, the following was observed (Fig. 3):
- 9% reported that less than 25% of patients have oral problems.
- 33% reported that between 25% and 50% of patients have oral problems.
- 37% reported that between 50% and 75% of patients have oral problems.
- 18% reported that more than 75% of patients have oral problems.
- 3% reported not knowing the percentage of patients with oral problems.

Regarding the most frequent types of oral problems in nursing home residents, the following emerged globally (Tab. 3):
- Problems with prostheses (21.3%).
- Difficulties in chewing (17.6%).
- Difficulties in oral hygiene (15.4%).
- Tooth loss (15.4%).

Oral Hygiene Procedures in Nursing Homes

Regarding the presence of protocols or specific treatment plans for managing oral or dental problems in patients, it emerged that in 58% of the interviewed facilities, there are no specific protocols or treatment plans, while 42% reported that protocols are present (Fig. 4).
Regarding the operator responsible for performing oral hygiene in non-self-sufficient patients, it was found that:
- In 91% of cases, it is the healthcare operator.
- In 9% of cases, it is the nurse.

In self-sufficient patients, the operator responsible for checking or supervising oral hygiene procedures is:
- The healthcare operator in 64% of cases.
- The nurse in 33% of cases.
- Collaboration among all healthcare operators and the doctor in 3% of cases.

Regarding the main aids or devices used to perform oral hygiene procedures in non-self-sufficient patients, it was found globally that in 33.3% of cases, it is performed

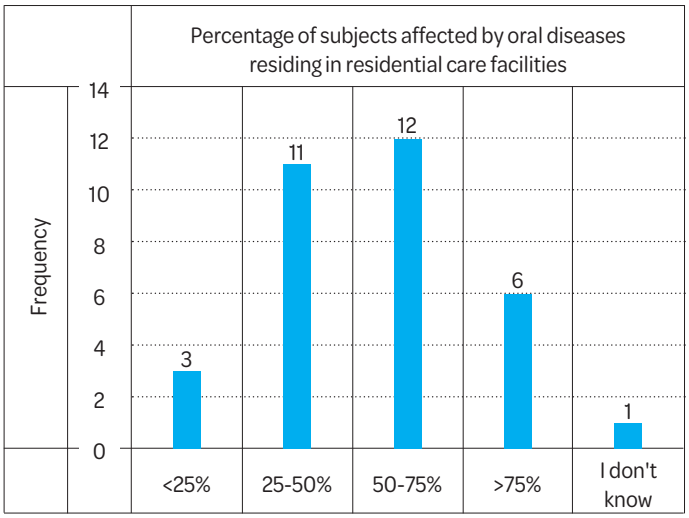

Fig. 3 Frequency of the percentage of subjects affected by oral diseases residing in nursing homes at the time of the survey 09/28/23.

Oral health problem	Frequency		
	absolute	relative	cumulative
Tooth decay	4	2.9%	2.9%
Oral candidiasis	6	4.4%	7.3%
Dry mouth (xerostomia)	11	8.1%	15.4%
Gingivitis or periodontitis	20	14.7%	30.1%
Tooth loss	21	15.5%	45.6%
Hygiene difficulties	21	15.5%	61.1%
Chewing difficulties	24	17.6%	78.7%
Denture problems	29	21.3%	100%
Total	136	100	-

Tab. 3 Absolute, relative and cumulative frequency of oral health problems in patients residing in nursing homes at the time of the survey.

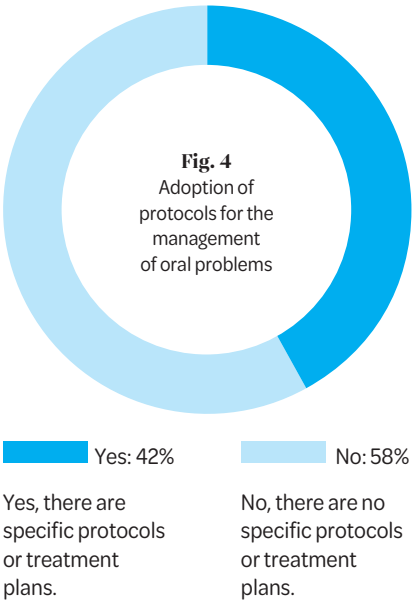

Fig. 4 Adoption of protocols for the management of oral problems

	Samples			
Prevalence of oral problems	< 50	50 and 100	> 100	Total
<25%	1 (3.1)	2 (6.25)	0 (0)	3 (9.4)
25-50%	7 (21.9)	3 (9.4)	4 (12.5)	14 (43.8)
50-75%	0 (0)	5 (15.6)	4 (12.5)	9 (28.1)
>75%	1 (3.1)	2 (6.25)	2 (6.25)	5 (15.6)
I don't know	0 (0)	1 (3.1)	0 (0)	1 (3.1)
Total	9 (28.1)	13 (40.6)	10 (31.2)	32 (100)
Type of oral problems	< 50	50 and 100	> 100	Total
Tooth decay	1 (3.1)	2 (6.25)	0 (0)	3 (9.4)
Oral candidiasis	7 (21.9)	3 (9.4)	4 (12.5)	14 (43.8)
Dry mouth (xerostomia)	0 (0)	5 (15.6)	4 (12.5)	9 (28.1)
Gingivitis or periodontitis	1 (3.1)	2 (6.25)	2 (6.25)	5 (15.6)
Tooth loss	0 (0)	1 (3.1)	0 (0)	1 (3.1)
Hygiene difficulties	9 (28.1)	13 (40.6)	10 (31.2)	32 (100)
Chewing difficulties	0 (0)	1 (3.1)	0 (0)	1 (3.1)
Denture problems	9 (28.1)	13 (40.6)	10 (31.2)	32 (100)
Total	36 (26.5)	54 (39.7)	46 (33.8)	136 (100)

Tab. 4 Absolute, relative and cumulative frequency of oral health problems in patients residing in nursing homes at the time of the survey.

through direct assistance by a healthcare operator with the aid of disposable toothbrushes or sponges (Tab. 5).
Regarding the frequency of oral hygiene procedures, it was found that:

- 94% of facilities perform them daily.
- 3% reported not knowing the frequency with which procedures are performed.
- 3% reported that oral hygiene procedures are performed less frequently.

Additionally, regarding the evaluation of patients' oral hygiene level, the following was observed:

- In 53% of cases, the method used is direct visual observation of the patient's mouth and teeth.
- In 43% of cases, the method used is the evaluation of the degree of cleanliness of the teeth during oral hygiene procedures.
- In 4% of cases, no evaluation is performed.

Oral Prevention in Nursing Homes

Regarding the execution of periodic evaluations to assess patients' oral health needs, it emerged that:

- In 21% of cases, a periodic evaluation is performed.
- In 55% of cases, an evaluation is performed only in specific cases.
- In 24% of cases, no periodic evaluation is performed.

Regarding the promotion of preventive practices for oral health, it was observed that:

- In 52% of cases, no preventive practice is promoted.
- In 45% of cases, preventive practices are promoted.
- In 3% of cases, it was reported that it is not known whether preventive practices are promoted or not.

Regarding the frequency of dental check-ups for nursing home residents, the following was observed in the table (Tab. 7).

	Frequency		
Oral hygiene aids/devices for RSA	absolute	relative	cumulative
Use of auxiliary tools	6	8%	8%
Use of specific oral hygiene solutions or products	20	26.7%	34.7%
Use of disposable toothbrushes or oral hygiene sponges	24	32%	66.7%
Direct assistance from a healthcare professional	25	33.3%	100%
Total	75	100%	-

Tab. 5 Absolute, relative and percentage frequency of oral hygiene devices and aids adopted in residential care homes.

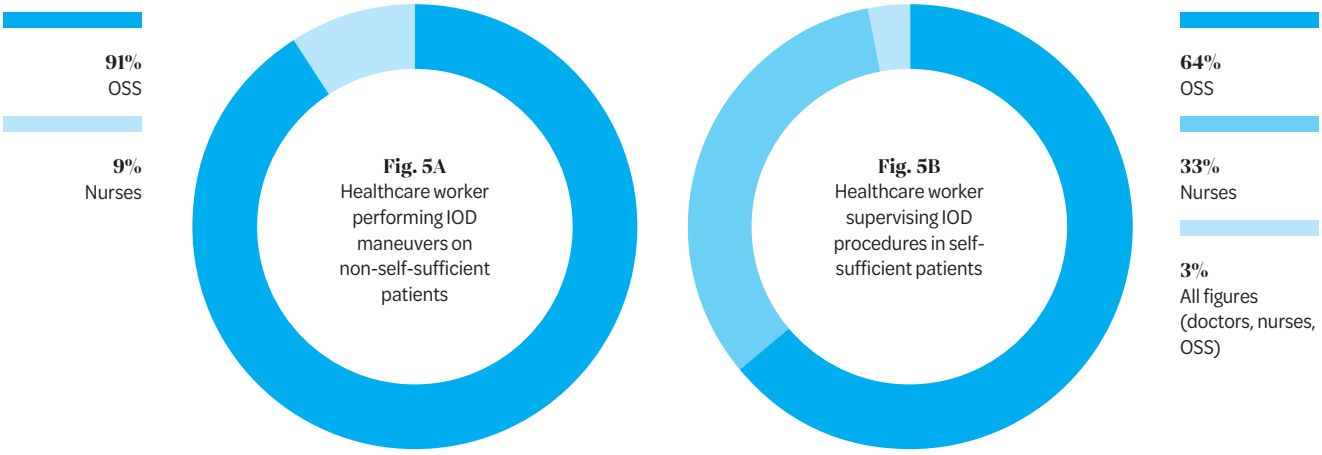

Fig. 5 Graphs showing the operator performing/supervising IOD procedures in non-self-sufficient and self-sufficient patients, respectively.

	Samples			
Presence of protocols	< 50	50 and 100	> 100	Total
No	3 (9.1)	9 (27.3)	7 (21.2)	19 (57.6)
Yes	6 (18.2)	4 (12.1)	4 (12.1)	14 (42.4)
Total	9 (27.3)	13 (39.4)	11 (33.3)	33 (100)
Non-self-sufficient workers				
Healthcare assistants	9 (27.3)	12 (36.4)	9 (27.3)	30 (90.9)
Nurses	0 (0)	1 (3)	2 (6.1)	3 (9.1)
Total	9 (27.3)	13 (39.4)	11 (33.4)	33 (100)
Self-sufficient workers				
Healthcare assistants	4 (12.1)	9 (27.3)	8 (24.3)	21 (63.7)
Nurses	4 (12.1)	4 (12.1)	3 (9.1)	11 (33.3)
Healthcare assistants, nurses, and doctors	1 (3)	0 (0)	0 (0)	1 (3)
Total	9 (27.3)	13 (39.4)	11 (33.3)	33 (100)
Oral hygiene devices/aids				
Direct assistance from a healthcare worker	8 (10.7)	9 (12)	8 (10.7)	25 (33.3)
Use of auxiliary instruments	2 (2.7)	2 (2.7)	2 (2.7)	6 (8.1)
Use of disposable toothbrushes or sponges for oral hygiene	6 (8)	11 (14.7)	7 (9.3)	24 (32)
Use of specific oral hygiene solutions or products	6 (8)	6 (8)	8 (10.7)	20 (26.7)
Total	22 (29.4)	28 (37.4)	25 (33.3)	75 (100)
Frequency of patient oral hygiene				
Daily	8 (24.2)	12 (36.4)	11 (33.3)	31 (94)
Every two days	0 (0)	0 (0)	0 (0)	0 (0)
Every three days	0 (0)	0 (0)	0 (0)	0 (0)
Less frequently	1 (3)	0 (0)	0 (0)	1 (3)
I don't know	0 (0)	1 (3)	0 (0)	1 (3)
Total	9 (27.3)	13 (39.4)	11 (33.3)	33 (100)
Oral hygiene assessment methods				
Direct visual observation of the patient's mouth and teeth	7 (14.9)	9 (19.1)	9 (19.1)	25 (53.1)
Assessment of the degree of cleanliness of teeth and gums during oral hygiene procedures	5 (10.6)	7 (14.9)	8 (17)	20 (42.5)
Use of specific indices to assess the degree of oral hygiene	0 (0)	0 (0)	0 (0)	0 (0)
Not assessed	0 (0)	1 (2.1)	1 (2.1)	2 (4.2)
Total	12 (25.5)	17 (36.1)	18 (38.2)	47 (100)

Tab. 6 Absolute and relative frequencies of variables related to the execution of oral hygiene maneuvers divided by samples.

Frequency of dental check-ups in nursing homes	Frequency		
	absolute	relative	cumulative
Never	2	6.1	6.1
Every 3-6 months	3 9.1	15.2	7,3%
I don't know	5	15.2	30.4
Once a year	5	15.2	45.6
Rarely	18	54.5	100
Total	75	100	-

Tab. 7 Absolute, relative and cumulative frequency of dental check-ups for RSA patients.

Furthermore, from the questionnaire responses, it emerged that the main activities for the promotion and prevention of oral health (if present), detailed in the graph (Fig. 6), are predominantly represented by education on correct daily oral hygiene behaviors (38.4%). In particular, regarding patient education on daily oral hygiene procedures, it was found that 67% do not provide any education to patients. Instead, 30% report providing specific training. Finally, 3% report not knowing whether education is provided or not.
Moreover, it was observed that in 30% of cases where specific education is provided, the methodologies reported in the table (Tab. 8) are used, occurring in 58.8% of cases through individual training sessions.

Collaboration with Dental Hygienists and/or Dentists

Regarding collaboration with external dental hygienists and/or dentists for the management of oral health problems, it was found that:

- 33% collaborate occasionally with these professionals.
- 15% collaborate regularly with these professionals.
- 12% do not collaborate with any of these professionals.

Regarding the presence of dental hygienists and/or dentists within the nursing home, it emerged that:

- In 21% of facilities, a dentist is present.
- In 18% of facilities, there is active collaboration with external operators.
- In 61% of facilities, there is neither a dental hygienist nor a dentist.
- In no facility is a dental hygienist present.

Recording of Oral Health Data

Regarding the recording of oral health and oral hygiene data by staff working in the nursing home, it was found that:

Frequency of dental check-ups in nursing homes	Frequency		
	absolute	relative	cumulative
Audiovisual materials (videos, presentations)	1	2.9	2.9
No response	2	5.9	8.8
Written materials (brochures, pamphlets, flyers)	5	14.7	23.5
Educational sessions are not held	6	17.7	41.5
Individual training sessions	20	58.8	100
Total	75	100	-

Tab. 8 Absolute, relative and cumulative frequency of methodologies used for oral hygiene education activities for patients residing in nursing homes.

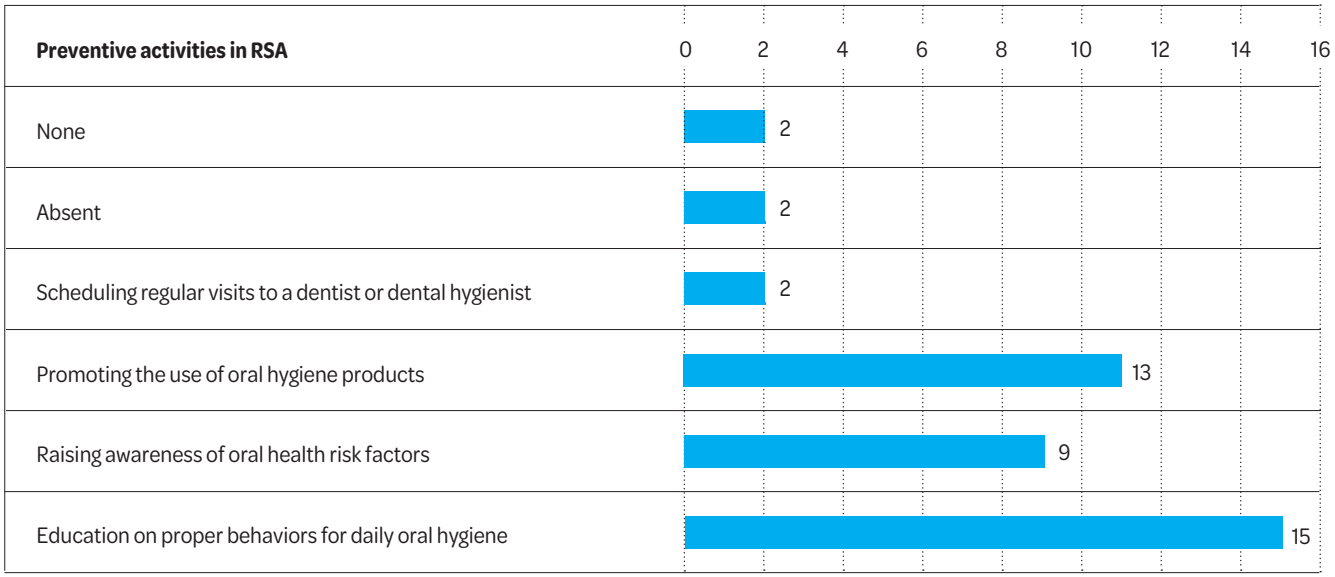

Fig. 6 Preventive activities adopted by RSAs.

	Samples			
Assessment of oral health needs	< 50	Tra 50 e 100	> 100	Total
Yes, a periodic assessment is performed	4 (12.1)	0 (0)	3 (9.1)	7 (21.2)
Yes, it is performed only in specific cases	3 (9.1)	8 (24.2)	7 (21.2)	18 (54.5)
No, a periodic assessment is not performed	2 (6.1)	6 (18.2)	1 (3)	7 (21.2)
I don't know	0 (0)	0 (0)	0 (0)	0 (0)
Total	9 (27.3)	13 (42.4)	11 (33.3)	33 (100)
Frequency of dental checkups				
Never	1 (3)	1 (3)	0 (0)	2 (6.1)
I don't know	1 (3)	3 (9.1)	1 (3)	5 (15.1)
Every 3-6 months	0 (0)	2 (6.1)	1 (3)	3 (9.1)
Rarely	6 (18.2)	7 (21.2)	5 (15.2)	18 (54.6)
Once a year	1 (3)	0 (0)	4 (12.1)	5 (15.1)
Total	9 (27.3)	13 (39.4)	11 (33.4)	33 (100)
Promotion of preventive practices				
Yes, preventive practices are promoted	5 (15.2)	4 (12.1)	6 (18.2)	15 (45.5)
No, preventive practices are not promoted	4 (12.1)	8 (24.2)	5 (15.2)	17 (51.5)
I don't know	0 (0)	1 (3)	0 (0)	1 (3)
Total	9 (27.3)	13 (39.4)	11 (33.3)	33 (100)
Preventive activities				
Education on proper daily oral hygiene behaviors	6 (14.3)	5 (11.9)	4 (9.5)	15 (35.7)
Awareness of oral health risk factors	1 (2.4)	4 (9.5)	4 (9.5)	9 (21.4)
Promotion of the use of oral hygiene products	3 (7.1)	6 (14.3)	4 (9.5)	13 (30.9)
Scheduling regular visits to a dentist or dental hygienist	0 (0)	0 (0)	2 (4.8)	2 (4.8)
None	0 (0)	2 (4.8)	0 (0)	2 (4.8)
No response	1 (2.4)	0 (0)	0 (0)	1 (2.4)
Total	11 (26.2)	17 (40.5)	14 (33.3)	42 (100)
Patient oral hygiene education activities				
Yes, specific training is provided	5 (15.1)	0 (0)	5 (15.1)	10 (30.3)
No, specific training is not provided	4 (12.1)	12 (36.3)	6 (18.1)	22 (66.7)
I don't know	0 (0)	1 (3)	0 (0)	1 (3)
Total	9 (27.3)	13 (39.4)	11 (33.3)	33 (100)
Patient oral hygiene education activities				
Individual training sessions	7 (20)	6 (17.1)	8 (22.9)	21 (60)
Written materials (brochures, brochures, flyers)	1 (2.9)	2 (5.7)	2 (5.7)	5 (14.3)
Audiovisual materials (videos, presentations)	1 (2.9)	0 (0)	0 (0)	1 (2.9)
Educational sessions are not held	0 (0)	5 (14.3)	1 (2.9)	6 (17.1)
No response	2 (5.7)	0 (0)	0 (0)	2 (5.7)
Total	11 (31.4)	13 (37.1)	11 (31.4)	35 (100)

Tab. 9 Absolute frequencies of variables relating to oral prevention in nursing homes divided by sample.

- In 18% of cases, data are systematically recorded.
- In 55% of cases, data are recorded only in specific cases.
- In 27% of cases, data are not recorded.

In particular, among those who record data, in 78.8% of cases, data are entered into the patient's general medical record.

The frequency of recording oral hygiene and oral health data is:

- Daily in 24% of cases.
- Monthly in 3% of cases.
- Only during specific visits or evaluations in 55% of cases.
- Not performed in 15% of cases.

Additionally, 3% reported not knowing whether data are recorded or not.

	Samples			
Collaboration with external professionals	< 50	Tra 50 e 100	> 100	Total
Yes, regularly	0 (0)	2 (6.1)	9 (27.3)	11 (33.3)
Yes, occasionally	8 (24.2)	10 (30.3)	0 (0)	18 (54.6)
No, there is no external collaboration	1 (3)	1 (3)	2 (6.1)	4 (12.1)
I don't know	0 (0)	0 (0)	0 (0)	0 (0)
Total	9 (27.2)	13 (39.4)	11 (33.3)	33 (100)
Presence of internal professionals				
Yes, there is a dentist	0 (0)	2 (6.1)	5 (15.2)	7 (21.1)
Yes, there is a dental hygienist	0 (0)	0 (0)	0 (0)	0 (0)
No, there is an external dentist or dental hygienist	3 (9.1)	1 (3)	2 (6.1)	6 (18.2)
No, there is neither an internal dentist nor dental hygienist	6 (18.2)	10 (30.3)	4 (12.2)	20 (60.6)
Total	9 (27.3)	13 (39.4)	11 (33.3)	33 (100)

Tab. 10 Absolute frequencies of variables relating to the collaboration of nursing homes with a dental hygienist and/or a dentist.

	Samples			
Recording	< 50	Tra 50 e 100	> 100	Total
Yes, they are recorded systematically	1 (3)	6 (18.2)	4 (12.2)	11 (33.3)
Yes, they are recorded only in some specific cases	7 (21.2)	1 (3)	5 (15.2)	13 (39.4)
No, they are not recorded	1 (3)	6 (18.2)	2 (6.1)	9 (27.3)
I don't know	0 (0)	0 (0)	0 (0)	0 (0)
Total	9 (27.3)	13 (39.4)	11 (33.3)	33 (100)
Place of recording				
In the patient's general health record	8 (24.2)	9 (27.3)	9 (27.3)	26 (78.8)
In a specific oral hygiene record	0 (0)	1 (3)	0 (0)	1 (3)
In both records, both in the general health record and in a specific record	0 (0)	0 (0)	1 (3)	1 (3)
They are not recorded	1 (3)	3 (9.1)	1 (3)	5 (15.2)
Total	9 (27.3)	13 (39.4)	11 (33.3)	33 (100)
Recording frequency				
Daily	1 (3)	3 (9.1)	2 (6.1)	6 (6.1)
Weekly	0 (0)	0 (0)	0 (0)	0 (0)
Monthly	0 (0)	0 (0)	0 (0)	0 (0)
Only during specific visits or assessments	4 (12.1)	7 (21.2)	7 (21.2)	18 (54.5)
I don't know	1 (3)	0 (0)	0 (0)	1 (3)
They are not recorded	1 (3)	3 (9.1)	1 (3)	5 (15.2)
Total	9 (27.3)	13 (39.4)	11 (33.3)	33 (100)
Type of data recorded				
Assessment of the oral hygiene index	1 (2.7)	1 (2.7)	3 (8.1)	5 (13.5)
Specific conditions of the teeth, gums, or dentures	7 (18.9)	7 (18.9)	9 (24.3)	23 (62.2)
Specific oral hygiene habits reported by the patient	3 (8.1)	3 (8.1)	2 (5.4)	8 (21.6)
Not recorded	0 (0)	0 (0)	0 (0)	0 (0)
Performance of oral hygiene procedures	0 (0)	1 (2.7)	0 (0)	1 (2.7)
Total	11 (29.7)	12 (32.4)	14 (37.8)	37 (100)

Tab. 11 Absolute frequency of variables related to the recording of oral health data in nursing homes.

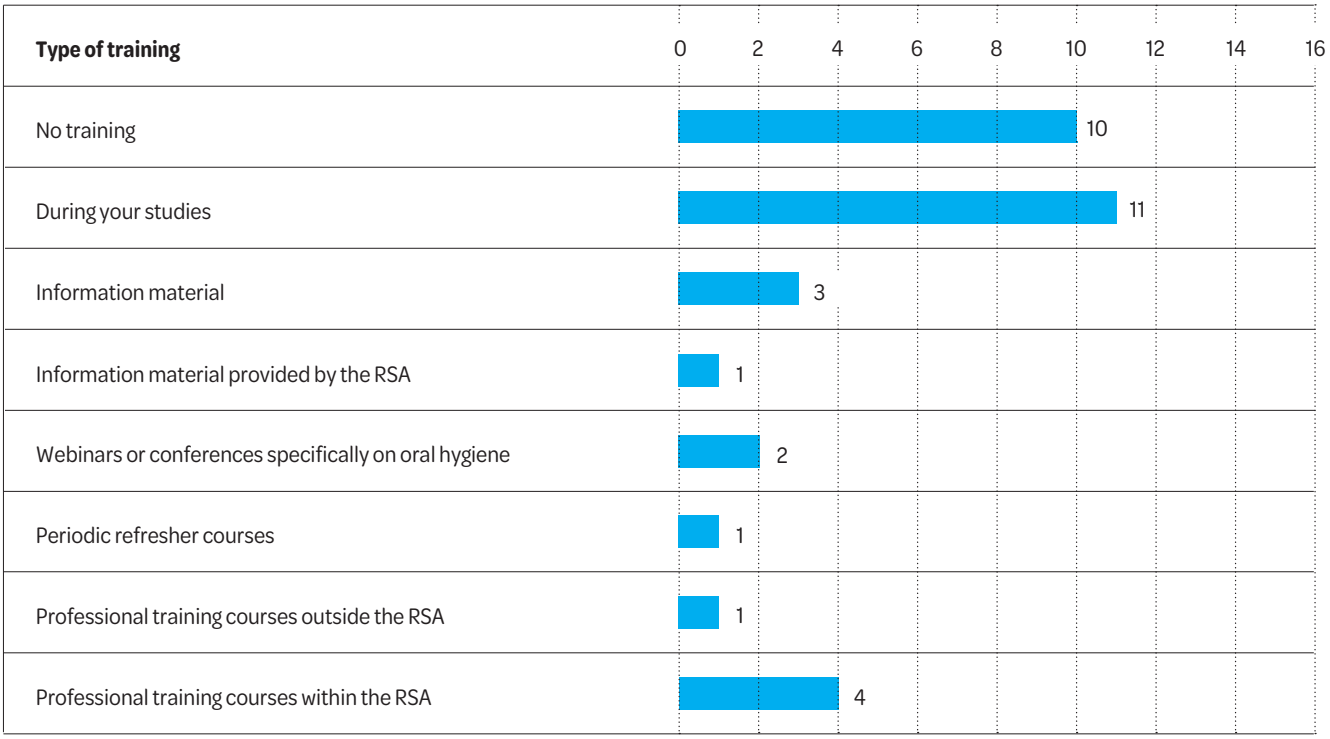

Fig 7 Absolute frequencies relating to the type of training received.

Training on Oral Hygiene for Staff

Regarding training on oral hygiene, the following emerged (Fig. 7):

- 55% have received training on oral hygiene.
- 45% have not received training on oral hygiene.
- In most cases, training was received during studies.

Regarding the time elapsed since the last training in oral health, it was observed that in most cases, no specific training was received and the time elapsed is more than 5 years (Fig. 8).

Regarding the evaluation of competencies related to the execution of oral hygiene procedures, it was found that (Fig. 9):

- Overall, in 12% of cases, a regular or occasional assessment of competences related to oral hygiene procedures was received.
- In 76% of cases, no assessment was ever received.

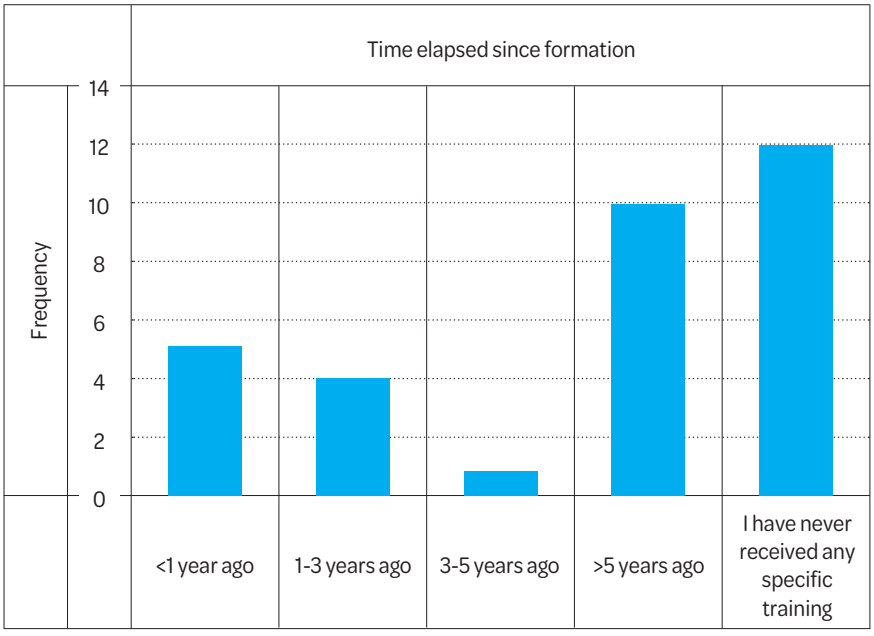

Fig 8 Graph showing the time elapsed since the last training in oral health.

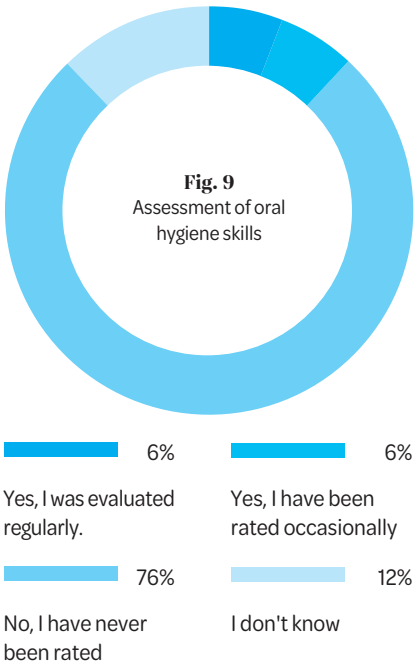

Fig. 9 Assessment of oral hygiene skills

	Samples			
Oral hygiene training	< 50	Tra 50 e 100	> 100	Total
Yes, I have received specific training	5 (15.2)	5 (15.2)	8 (24.2)	18 (54.5)
No, I have never received specific training	4 (12.1)	8 (24.2)	3 (9.1)	15 (45.5)
I'm not sure	0 (0)	0 (0)	0 (0)	0 (0)
Total	9 (27.3)	13 (39.4)	11 (33.3)	33 (100)
Type of training				
Professional training courses within the nursing home	2 (6.1)	1 (3)	1 (3)	4 (12.1)
Professional training courses outside the nursing home	0 (0)	0 (0)	1 (3)	1 (3)
Periodic refresher courses	0 (0)	1 (3)	0 (0)	1 (3)
Webinars or specific conferences on oral hygiene	2 (6.1)	0 (0)	0 (0)	2 (6.1)
Informational material provided by the nursing home	0 (0)	0 (0)	1 (3)	1 (3)
Informational material	0 (0)	1 (3)	2 (6.1)	3 (9.1)
During studies	2 (6.1)	5 (15.2)	4 (12.1)	11 (33.3)
No training	3 (9.1)	5 (15.2)	2 (6.1)	10 (30.3)
Total	9 (27.3)	13 (39.4)	11 (33.3)	33 (100)
Time since last training				
Less than 1 year ago	1 (4)	3 (12)	2 (8)	6 (24)
1 to 3 years ago	0 (0)	0 (0)	0 (0)	0 (0)
3 to 5 years ago	0 (0)	0 (0)	0 (0)	0 (0)
More than 5 years ago	4 (16)	7 (28)	7 (28)	18 (72)
I have never received specific training	1 (4)	0 (0)	0 (0)	1 (4)
Total	6 (24)	10 (40)	9 (36)	25 (100)
Skills assessment				
Yes, I have been regularly assessed	2 (6.1)	0 (0)	0 (0)	2 (6.1)
Yes, I have been occasionally assessed	0 (0)	0 (0)	2 (6.1)	2 (6.1)
No, I have never been assessed	7 (21.2)	11 (33.3)	7 (21.2)	25 (75.8)
I don't know	0 (0)	2 (6.1)	2 (6.1)	4 (12.1)
Total	*9 (27.3)*	*13 (39.4)*	*11 (33.3)*	*33 (100)*

Fig 12 Absolute frequencies of variables relating to oral hygiene training received.

Finally, the absolute frequencies divided by sample for variables relating to the training of healthcare workers on oral hygiene are shown in Table 12.

DISCUSSION

Oral health is an important component of health, well-being, and quality of life. Good oral care is fundamental for maintaining oral health and forms the basis for preventing oral diseases among elderly residents in long-term care facilities (43).
However, this study showed that oral health within nursing homes remains a present but largely ignored issue, as evidenced by the low questionnaire response rate (11%). In fact, 37% of surveyed facilities reported that between 50% and 75% of elderly residents in nursing homes have oral problems, most frequently issues with prostheses (21.3%), difficulties in chewing (17.6%), problems with oral hygiene (15.4%), and tooth loss (15.4%).
The systematic review by Pino et al. (2003) reported that maintaining good oral health among elderly residents in long-term care is a crucial aspect for improving psychosocial well-being, which confirms the neglect of this area. It also reported that, generally, nursing home staff do not recognize the seriousness of poor oral health (44). Concerning the prevalence of oral diseases, literature reports that these are common in the elderly and include tooth loss, poor oral hygiene, dental caries, periodontal disease, absence of prosthetic rehabilitation or defective prosthetic devices, hyposalivation, and oral lesions

associated with prosthesis use or pre-cancerous or cancerous states (45), confirming the results of this study. The consensus report of group 4 of the EFP/ORCA joint workshop stated that epidemiological trends of caries and periodontal disease in this population group cannot be described due to the scarcity of data, but it was possible to demonstrate that non-self-sufficient elderly and those with cognitive decline have worse oral health than independent elderly without cognitive decline (46).

Furthermore, several studies have shown that neglect of oral health, resulting in poor oral hygiene, can trigger both local and systemic infections and inflammations. Oral infections were shown to be correlated with atherosclerosis, diabetes, and aspiration pneumonia (47, 48). In particular, Sjøgren et al. indicated that improved oral hygiene could have prevented about 10% of deaths due to pneumonia in nursing homes (49). Finally, compromised chewing function resulting from poor oral health has been associated with changes in eating habits, malnutrition, and cognitive decline (48).

This study further found that in 58% of the participating facilities there are no specific protocols or treatment plans for the oral hygiene of patients, who in most cases are non-self-sufficient. The person responsible for performing oral hygiene maneuvers for these patients is the healthcare assistant (91%) through direct assistance (53%) with disposable toothbrushes or sponges. For self-sufficient patients, supervision of oral hygiene is provided by nurses in 33% and by healthcare assistants in 64%. With regard to oral hygiene training, 55% of interviewees had received specific training, in most cases during their studies, while the remaining 45% had not received any training. The time since the last training was predominantly more than 5 years, and 76% had never had their competencies assessed.

Oral hygiene is an integral part of daily care in long-term care facilities. Nurses and care workers are responsible for oral hygiene in these facilities. Although various oral hygiene protocols may be established, these are often neither sufficiently frequent nor in-depth, leaving residents' oral hygiene suboptimal. Furthermore, the low priority, lack of knowledge and skills in oral health are factors that prevent workers from carrying out oral hygiene maneuvers (50). Another study reported that the most frequently reported barriers by workers are lack of knowledge and competences, resistant behaviors especially among dementia patients, lack of suitable oral hygiene routines, absence of systems for documenting oral health problems, high workload, and lack of a control system (47). The literature shows that educational programs not only increase knowledge but also improve attitudes among care workers regarding oral hygiene (50). A study by Garry et al. showed that increasing the level of knowledge and skills related to oral hygiene is an effective strategy for improving patients' oral health (51).

With respect to the adoption of preventive behaviors regarding oral health among nursing homes, this study showed that it is rather poor. In 52% of cases, no preventive practices are promoted. Regarding the execution of periodic assessments to evaluate the oral health status of patients, in 55% of cases this only occurs in specific cases, which suggests a therapeutic rather than preventive approach to oral health. Supporting this, the data showed that dental check-ups are rarely scheduled in 54.5% of cases, oral health data are recorded only in specific instances in 55% of cases, and 67% of facilities do not provide patients with any oral education.

A recent systematic review showed that although oral diseases are among the most common chronic conditions and represent a significant public health problem due to their prevalence and the high cost of treatment, there is a general but mistaken belief that oral hygiene and dental care are not important (52). Furthermore, it has been reported that removal of dental plaque at least twice a day (morning and evening) is fundamental in maintaining oral health, especially in dependent elderly people. However, despite the crucial role that hospital and other long-term care facility staff could play in maintaining and improving oral health in this patient category, they are often unaware of specific oral care and hygiene protocols, except in some cases (such as mechanical ventilation) (52, 53).

It is also reported that oral problems in the elderly are largely underdiagnosed due to barriers or preconceptions about oral health. As people age, they tend to forego routine dental care, while the number of consultations with non-dental healthcare providers increases, but few of these are well trained to assess oral problems, advise on or perform appropriate oral care, or identify problems that should be referred to a dental professional (45). Indeed, regarding collaboration with such professionals, this study found that 55% of the surveyed facilities occasionally collaborate with them. Within the nursing home, it was found that in 61% of cases there is neither a dentist nor a dental hygienist; a dentist was present in 21% of facilities, and in no case was there a dental hygienist. These data confirm a generally passive approach to oral health.

However, most chronic oral diseases, like caries, periodontal disease, and many oral lesions, can be prevented and successfully treated if diagnosed early (45), and oral pathologies and conditions associated with aging require greater preventive, periodontal, and restorative dental care (54). Dental hygienists are qualified oral health professionals, specifically trained to develop personalized oral care plans and prevention programs to reduce oral diseases in the community (55).

The study by Vigild et al. (1998) showed that an oral health care program for residents of nursing homes or long-term care facilities, which provided oral examinations, dental treatments, oral prophylaxis, and instructions both to nursing staff and residents, reduced the number of carious lesions, the need for periodontal treatments, the prevalence of prosthesis-related stomatitis, and improved prosthesis hygiene (56). Consistently, the study by Yoneyama et al. (2002) demonstrated that brushing teeth by nurses and caregivers, combined with professional oral care by dentists and dental hygienists, was associated with reduced pneumonia, fewer fever days, reduced pneumonia mortality, and improved daily living activities and cognitive functions among institutionalized elderly people (57).

The vulnerability to diseases among the elderly can be influenced by various factors, such as comorbidities, frailty, medication use, reduced salivary secretion, widespread use of fixed and removable dentures, and changes in vision, tactile sensitivity, cognitive and motor functions, including the ability to perform effective oral hygiene. Thus, a personalized oral healthcare plan is particularly important for vulnerable elderly people (46).

Nonetheless, a World Health Organization survey on the oral health of elderly patients revealed that programs targeting this population segment are rather rare, noting that the approach tends to be therapeutic rather than ideally preventive (52, 58), confirming the findings of this study. For these reasons, hospitalization or long-term residency in care facilities represents an excellent opportunity to provide dental care that might otherwise not be available (52).

The standard of oral healthcare in nursing homes or facilities is rarely comparable to that of the general population. Dental hygienists, as providers of preventive oral care, have a great opportunity to fill this gap and raise the standard of care (59, 60). In this way, vulnerable elderly residents in these facilities need not resign themselves to losing their teeth or having a lower quality of life due to lack of access to care (59).

CONCLUSIONS

Taking into account the results of the present study and those already present in the literature, it is possible to deduce that the role of the dental hygienist could be crucial for promoting and maintaining the oral health of elderly residents in nursing homes. In addition, the involvement of this professional could play a key role in training staff on oral hygiene, helping to shift from a therapeutic towards a more prevention-centered approach and improving the residents' quality of life.

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Comparison of two professional tooth whitening methods: preliminary results

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ABSTRACT

Introduction: Tooth whitening, with a growing commodity market, is a non-invasive procedure to improve smile aesthetics. The objective of this study was to evaluate the effectiveness of two professional treatments: a 6% hydrogen peroxide treatment (in-office) and a 16% carbamide peroxide treatment (professional home-use).
Material and Methods: Thirty subjects with good oral health were selected and analyzed - before and after the use of both treatments - using spectrophotometric technique. The Shapiro-Wilk test was used to verify the normality of variables. Student's t-test was instead used to investigate any significant differences between variables ($p<0.05$).
Results: Both techniques analyzed in this study were statistically significant in producing a positive ΔE (CIE Lab), with improved tooth color; specifically, a ΔE of 1.70 for the in-office method and 3.21 for the home-use method. Both treatments increased tooth brightness and reduced red and yellow tones, resulting in tooth color modification.
Conclusion: The professional home-use method, due to treatment continuity, proved to be more effective; however, the "in-office" method, both for the results obtained and the time and application method, is an extremely interesting professional whitening technique to propose to patients after being duly informed of the achievable results.

Keywords Dentistry, Tooth Bleaching, Hydrogen Peroxide, Carbamide Peroxide, Spectrophotometry

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INTRODUCTION

The smile plays a fundamental role in social interactions. Since smiling involves revealing one's teeth, dental aesthetics and their good health status are essential for self-esteem and self-confidence(1,2). A smile should also communicate strength and confidence. Consequently, a "perfect" smile is sought not only by adolescents and young people, but also by leaders and people working in the public sector. The literature highlights how a light tooth color has greater social appeal compared to smiles showing teeth of a more natural color(3). In particular, it is reported that physical appearance plays a very important role in human social interactions. The face is usually considered the social calling card, and in some cases, an aesthetic defect can be a significant obstacle. Considering the face, the eyes and mouth are the most important elements. People's smiles are thought to be the main component determining the attractiveness of facial aesthetics. It is for this reason that in the dental field, whitening is increasingly requested, with a market growing by 15% every year. To this end, whitening is often proposed as a non-invasive and conservative aesthetic procedure to restore smile balance without damaging dental structure(4).
Tooth color is determined by intrinsic characteristics and is influenced by extrinsic elements, such as pigmentations that can form on the external surface. The intrinsic color of teeth is conditioned by how light is diffused and absorbed on the surface and within the tooth structure. The perception of tooth color is determined by enamel, which is a translucent material that diffuses light. In some cases, enamel is unable to sufficiently cover the underlying dentin; this can influence the overall perception of tooth color.
Whitening can be performed with various methods: the most commonly used are professional in-office whitening performed chairside, and home-use whitening performed at home by the patient using dedicated kits. There are also numerous options regarding product choice and application times, which is why it is necessary to choose the one most suitable for the individual and the dentist's clinical experience(5). Tooth whitening products help improve the aesthetics and whiteness of teeth by improving the intrinsic color of teeth and, in some cases, removing extrinsic stains.
Home-use whitening products treat teeth in a non-invasive but effective manner, thanks to the use of substances based on hydrogen peroxide (HP) and carbamide peroxide (CP).
Although product activation methodologies are not yet clear, defined, and unequivocal (6), the literature agrees that tooth whitening occurs mainly through the gradual dissolution of chromogenic pigments. In other words, oxygen radicals, produced by the decomposition of the aforementioned whitening substances, react with chromogenic pigments through an oxidation process that breaks down the chromogenic component (7).
Hydrogen peroxide is an unstable and highly soluble compound. This agent can be used at different concentrations: lower concentrations (6-20%) are used for home

whitening, while higher concentrations (20-40%) for professional whitening, which requires the use of a liquid dam to protect soft tissues from possible irritation (8,9).
Although the action of hydrogen peroxide and its effect on enamel and dentin are not yet fully understood (6), it appears that its activation triggers a series of oxidative processes that lead to the formation of water and free radicals, which break pigmented molecules creating the whitening effect. To reduce product concentration while maintaining equal treatment efficacy but with greater safety, a photo-catalyst, titanium dioxide (TiO_2), has been incorporated into the compound. This agent, activated by a light source of 450±10nm, enhances the action of hydrogen peroxide (7,10).
Depending on the concentration of the whitening agent and also the gel's action time, the use of such substances at high concentrations is harmful not only to gingival tissues but can also become harmful to the dental pulp, causing sensitivity (10). In this sense, a whitening agent with low hydrogen peroxide concentration represents an interesting alternative as it has a positive aesthetic impact (11) and also provides good clinical results, with fewer side effects compared to high-concentration products (12).
Carbamide peroxide is instead a more stable structural complex. The activation of carbamide peroxide depends on a reaction with water that determines the dissociation of this compound into hydrogen peroxide and urea, and subsequently into oxygen, water, and carbon dioxide, thus performing its whitening phase (4).
Carbamide peroxide-based gels can have different concentrations, the most common of which are 6% and 16%. These have the advantage of promoting a slow and gradual release of hydrogen peroxide, preventing its diffusion through enamel and dentin at high concentrations and allowing an active and prolonged whitening process. For this reason, this technique is considered safer for dental structure. This procedure, however, is also not without risks and could cause sensitivity, which proves to be transitory and ceases with discontinuation of treatment (13-15).
Regarding the use of whitening products, the use of products containing whitening agents with hydrogen peroxide concentrations below 0.1% as adjuvants to therapy is widely used.
The effectiveness of whitening toothpastes is still subject to debate. These products act both chemically, whitening enamel, and physically, removing surface stains by abrasion. In fact, in addition to standard ingredients such as fluoride, whitening toothpastes contain active whitening agents such as hydrogen peroxide, carbamide peroxide, or sodium citrate, and abrasive materials such as silica, calcium carbonate, or alumina. In addition to composition, one must also consider the size of abrasive particles present in whitening toothpastes (RDA). Whitening toothpastes have a higher relative dentin abrasion index compared to traditional toothpastes, which results in greater enamel abrasion, potentially causing irreversible damage (4,8).
However, recent studies have demonstrated that whitening toothpastes containing blue covarine show a whitening effect from first use, with statistically reduced tooth yellowing (16).
Therefore, although numerous techniques, products, and whitening agents exist to improve patient aesthetics, not all whitening treatments are suitable for all patients (17) and should only be used as part of a comprehensive treatment plan developed by a dentist after a thorough oral examination (18).
The objective of this study was to evaluate the effectiveness of two professional treatments: a 6% hydrogen peroxide treatment (in-office) and a 16% carbamide peroxide treatment (professional home-use).

MATERIALS AND METHODS

The study sample consists of 30 subjects, subjected to tooth whitening treatments for various types of discolorations.

The inclusion criteria were as follows:
- age between 18 and 50 years;
- Periodontal Screening Record (PSR) of 1 or 2;
- good oral health status: absence of untreated caries and restorations of frontal elements in both arches;
- absence of previous whitening treatments in the previous 24 months.

The exclusion criteria were as follows:
- presence of systemic diseases;
- patients undergoing pharmacological treatment;
- hypersensitivity to the active ingredient contained in the product;
- anomalies in dentin development or accentuated intrinsic discolorations such as amelogenesis imperfecta, fluorosis, or tetracycline;
- patients with fixed orthodontic appliances or night retainers;
- patients with prosthetic elements;
- smokers (>10 cigarettes/day).

Informed consent was obtained and signed by all participants, explaining all information about the product, procedures performed and possible complications, as well as instructions for product application.
Two whitening methods were proposed. Specifically, a 6% hydrogen peroxide in-office method (Genius pro 6%, White Beauty professional, Miromed, Mendrisio, Switzerland) and a professional home-use technique with 16% carbamide peroxide and individual trays (Whitening Gel 16%, Mendrisio, Switzerland) were proposed.
All patients underwent a professional hygiene session before undertaking the tooth whitening treatment.
The in-office method involved the application of 6% hydrogen peroxide immediately at the end of the professional oral hygiene session for 5 minutes twice. Thanks to its highly viscous consistency, the whitening gel can be distributed homogeneously over the entire tooth surface, thus reducing the risk of ingestion. Additionally, it contains water, which prevents dehydration of dental elements.
The professional home-use technique with 16% carbamide peroxide involved delivery of individual whiten-

ing trays without reservoir or self-modeling trays along with a syringe containing 3 ml of product, to be used for a minimum of 4 hours per day until product depletion, estimated as a suggestion at 1 week.
Each subject was assigned to a different procedure, freely choosing which to perform after in-depth discussion with the clinician about which method was most suitable. Tooth whitening in fact required a preliminary cognitive-behavioral phase in which the patient is instructed on all aspects and benefits of tooth whitening, in addition to expectations and timing, and on how to use the device, behaviors, and side effects.
This phase is of fundamental importance for managing the patient's clinical desires. Good initial communication completes therapeutic success and ensures good patient control where expectations are not completely met or side effects are poorly tolerated.
Color measurements were performed before the whitening treatment (t^0) and at the end of the treatment itself (t^1).
Color was measured on upper incisors (1.1, 1.2, 2.1, and 2.2) and upper canines (1.3 and 2.3). Color was measured with a spectrophotometer (SpectroShade micro, MHT, Italy). This instrument is based on LED technology and is capable of acquiring an image of a tooth, displaying it on the screen, and analyzing it by studying the main color of the tooth or its chromatic mapping in the three thirds of the tooth: incisal, middle, and cervical. Color measurement occurs through a light source that creates the entire spectrum of visible light. The image of the area thus illuminated is then reflected in a black and white CCD sensor positioned at the end of the optical system and capable of reading data in the visible spectrum between 400 and 700 nm. To reprocess the acquired chromatic data, the CIE L*, a*, b* system is used, where L* indicates color brightness from 1 (black) to 100 (white) and corresponds to value, a* indicates the amount of green and red on a scale from -a (green) to +a (red), b* marks the amount of blue and yellow on a scale from -b (blue) to +b (yellow) and corresponds to hue(19(. By applying the following formula, it is possible to calculate the color difference (ΔE) of two spectrophotometer readings: $\Delta E=(\Delta L^2+\Delta a^2+\Delta b^2)$ (1/2), where ΔL is the difference between two L values, Δa the difference between two a values, and Δb the difference between two b values. ΔE expresses the overall color difference between two samples, expressed as the distance between two points in color space, and therefore represents an objective evaluation.
Statistical analysis of results was performed using Jamovi software (version 1.6.14, Jamovi Project, Sydney, Australia). The Shapiro-Wilk test was used to verify the normality of variables. Student's t-test was instead used to investigate any significant differences between variables ($p<0.05$).

RESULTS

Whitening treatments were performed without adverse effects in all patients, excluding dentin hypersensitivity phenomena and some cases of dysgeusia, which resolved spontaneously. In none of the cases was it necessary to discontinue treatment due to the appearance of adverse effects. The entire analyzed sample responded that they were satisfied with the results obtained.

T0			T1		
L	a	b	L	a	b
72,08	3,09	15,97	72,97	14,50	1,70

Tab. 1 CIE L*, a*, b* data after in-office treatment.

T0			T1		
L	a	b	L	a	b
71,97	3,33	17,93	73,57	2,66	3,21

Tab. 2 CIE L*, a*, b* data after professional home-use treatment.

In office			Professional home		
ΔL	Δa	Δb	ΔL	Δa	Δb
+0,88	-0,36	-0,95	+1,61	-0,68	-2,31

Tab. 3 Differences in CIE L*, a*, b* data after in-office and professional home-use treatment.

Whitening mode	Δa
In office	1.70
Professional home	3.21

Tab. 4 ΔE after in-office and professional home-use treatment.

Tables 1 and 2 report the results of L*, a*, b* obtained from spectrophotometry before and after tooth whitening for the in-office method and home-use method, respectively. In particular, Table 3 illustrates the differences between the beginning and end of treatment.
The in-office method showed an increase in the L* parameter of +0.88, a reduction in the a* parameter of -0.36, and in the b* parameter of -0.95. Instead, home whitening shows a greater increase in brightness (+1.61) and a greater reduction in a* and b* parameters, -0.68 and -2.31 respectively.
The results show a homogeneous change in tooth color throughout the sample, with few outliers.
As also detected by our analysis, tooth whitening must lead to an increase in L* (increased brightness) and a decrease in b* (reduction of yellow) and a* (reduction of red) (7,11). All variables showed a statistically significant difference ($p<0.05$).
Table 4 instead shows data relating to the obtained ΔE representing measurements of color difference between t^0 (before whitening) and t^1 (after completion of whitening treatment).
A color variation ΔE is to be considered significantly perceptible from a clinical point of view for values greater than +2.17, as reported by other studies (20). In our sam-

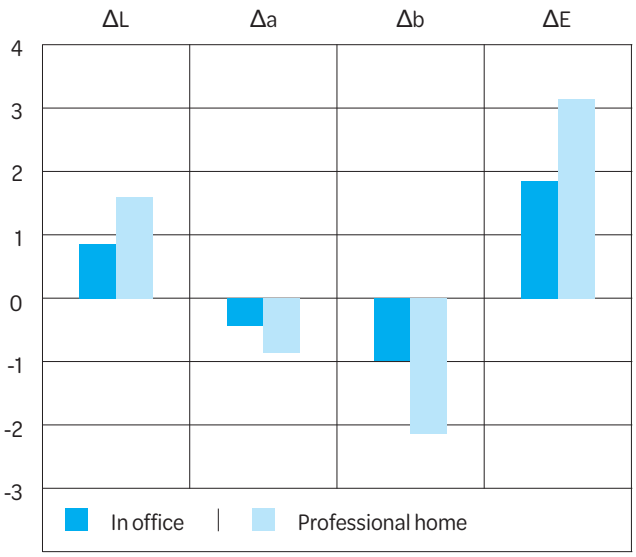

Fig. 1 Comparison graph between the results of the study's whitening methods.

ple, although only home whitening shows a ΔE greater than this limit (3,20), even subjects undergoing in-office whitening obtained a clear improvement in tooth color. The difference between the two modalities was statistically significant ($p<0.05$).
Both treatments were therefore effective in producing a whitening effect, with particular attention to professional home-use treatment. In the ratio of means of obtained differences, the in-office treatment determines a significant improvement in tooth brightness (L) (Fig. 1).

DISCUSSION

Both techniques analyzed in this study were significant in producing a positive ΔE, with a value for the in-office method of 1.70 and 3.21 for the home-use method.
In particular, a significant increase in L* (+0.88) and a reduction in a* (-0.36) and b* (-0.95) parameters were observed in our in-office whitening case series. Instead, for the home-use method, an increase in L* of +1.61 and a reduction in a* parameters of -0.68 and b* of -2.31 were observed. The results highlight that the home-use method proved to be more effective, but this consideration is the result of the fact that carbamide peroxide is present at higher concentration and actively released for a longer time. These premises make it obvious that this exerts a more important action compared to hydrogen peroxide (21).
The collected data highlight an increase in tooth brightness accompanied by a decrease in the amount of red and yellow. Although all three parameters play a fundamental role, the L value appears to be of significant importance for the objective variation of color. In fact, the color of an object is determined by the number of reflected wavelengths: the less an object reflects, the darker it will appear. Therefore, the action of whitening substances, which oxidize the chromogens present, acts precisely by eliminating residual opacity and giving brightness(22).
However, the objective whitening of the tooth is not the only parameter to consider in evaluating the effectiveness of such treatments. In fact, results relating to patient perception, such as satisfaction with dental aesthetics and impact on self-esteem and social behavior, are crucial factors to consider in determining treatment effectiveness(23,24).
It has been found that the degree of patient satisfaction is correlated more with spectrophotometer b* variations rather than L* or a*, therefore Δb, the reduction of yellow or change in hue, is of primary importance for evaluating the effectiveness of whitening products. Thus, while the L* parameter is to be considered the most important for objectively evaluating whitening, the b* parameter proves to be effective for subjective evaluation by the patient.
The results of this study must also be considered with what was observed by the study by Llena et al., which observed how treatment with 16% carbamide peroxide results in effective whitening that remains stable up to 42 months (25). Different application protocols have also demonstrated equal efficacy with application at 48 hours and 72 hours for 6 weeks (26).
Also regarding the 6% hydrogen peroxide method, the literature confirms its effectiveness, with a high safety profile for hypersensitivity and gingival inflammation (27).

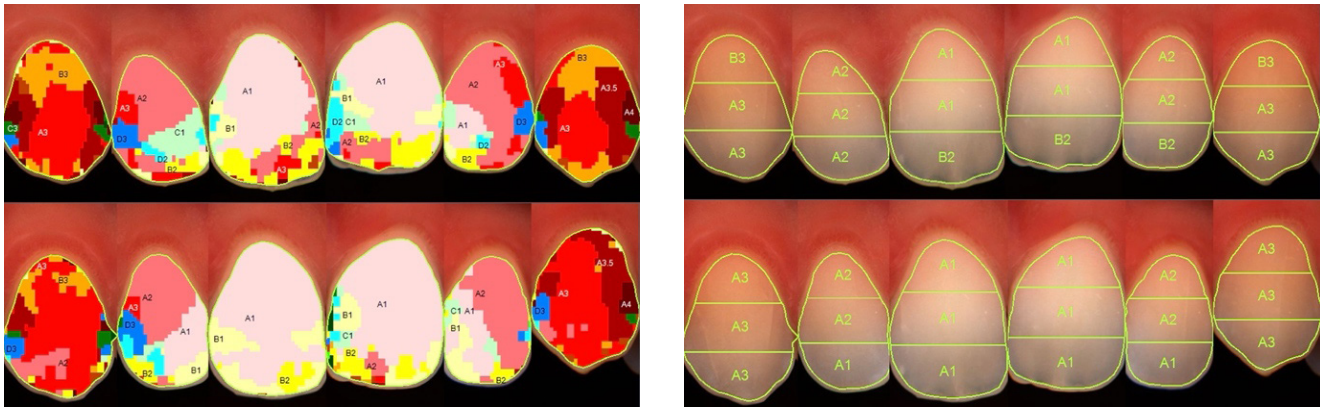

Fig. 2 Example of images of spectrophotometric results after in-office method with 6% hydrogen peroxide. For each image before tooth whitening (above) and after whitening (below).

There are many variables that can influence treatment outcome: age, sex, quality and quantity of dental tissues, diet, oral hygiene, and lifestyle (17). Therefore, to be able to perform such treatment there must be baseline hygiene conditions, and the choice of the best method must take into account the attitudes and personality of the patient at hand. The choice of the best treatment for our patient is the basis for its success.
In conclusion, our study highlighted the effectiveness of the whitening product, which led to an increase in the L* parameter and a decrease in a* and b* in both methods. Furthermore, all subjects enrolled in this study were satisfied with the result obtained (Fig. 2).

CONCLUSIONS

Although research demonstrates that both techniques generate a color modification, it is necessary, when proposing tooth whitening, to precisely define patient expectations in order to correlate them with the actual effectiveness of treatment. Patients often overestimate the effectiveness that whitening treatments could have, with the result that sometimes the achieved result is not subjectively gratifying and satisfactory for the patient. For these reasons, those who wish to whiten their teeth must be subject, before tooth whitening, to a long and thorough sharing of expectations and desires. Subsequently, patients must be informed about actual potential to limit and share the impossibility of unexpected results. This consideration is also necessary if we introduce the theme of limits and responsibility for guaranteeing means or results in aesthetic treatments.
The professional home-use method, due to treatment continuity, proved to be more effective; however, the "in-office" method, both for the results obtained and the time and application method, is an extremely interesting professional whitening technique to propose to patients after being duly informed of the achievable results.
Further investigations are necessary to define the potential of each whitening technique, potential that must be known because it is appropriate to the patient's subjective needs; not all patients desire the best and most effective whitening treatment, all desire the whitening treatment suitable and adequate to their own expectations and desires.

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Efficacy of periodontal risk communication on psychological outcomes and supragingival plaque control in anxious and/or depressed patients

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ABSTRACT

Introduction: To evaluate, in a cohort of anxious/depressed patients (group A/D) and control patients (group C) undergoing motivational interviewing (MI) following the first periodontal visit: 1) the psychological profile and supragingival plaque control prior to the MI session; 2) the efficacy of periodontal risk communication, performed with or without the support of a validated tool for assessing the patient's periodontal prognosis (PerioRisk; Trombelli et al. 2009), on psychological outcome measures and supragingival plaque control.
Materials and Methods: Fifteen patients with scores ≥11 on the Hospital Anxiety and Depression Scale (group A/D) and 15 patients matched for age, sex, and periodontal status (group C), all presenting for their first periodontal visit, contributed to this retrospective study. At the periodontal visit, a single MI session, implemented with or without communication of periodontal risk level determined by PerioRisk (RISK and CTR treatments respectively), was administered by a trained operator in about 8 minutes. The psychological profile of the patient was assessed immediately before and after CTR/RISK using the Positive Affect Negative Affect Scale (PANAS) and the Protection Motivation Theory (PMT) questionnaire. Plaque Index (PII) was reassessed in patients returning after 8–12 weeks.
Results: Before receiving CTR/RISK, patients in the A/D group exhibited lower positive emotion scores and higher negative emotion scores compared to patients in group C. Both RISK and CTR treatments positively affected various domains in the PANAS and PMT questionnaires. However, among patients who returned at 8–12 weeks (9 A/D and 13 C patients), only RISK treatment was associated with a small decrease in PII.
Conclusion: An 8-minute motivational interview (MI), implemented with or without the support of a validated tool for periodontal prognosis evaluation (PerioRisk), positively influences certain psychological variables and attitudes towards disease in anxious/depressed patients.

Keywords Anxiety, Depression, Risk assessment, Periodontitis

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INTRODUCTION

The main goal of primary and secondary prevention strategies in periodontology is the maintenance of periodontal health or stability. A key feature of both health and periodontal stability is the limited prevalence (<10%) of periodontal inflammation when assessed by bleeding on probing (BoP) (29, 9, 40, 53, 56). Biofilm control is currently the primary instrument to pursue this goal (7). It has been demonstrated that inadequate biofilm control combined with persistent exposure to other risk factors leads to treatment failure and disease recurrence (4, 57). Achieving and maintaining good oral hygiene over time is highly challenging (48) since it depends strongly on individual skills and dexterity, as well as motivation to maintain self-care (35) and on the individual's ability to seek adequate assistance (33, 53). Motivational interventions based on cognitive-behavioral theories can be more effective than unstructured interventions in changing oral hygiene habits and controlling risk factors related to periodontitis (1, 25), although their ability to produce additional clinical benefits in major preventive and therapeutic periodontal strategies is not uniformly recognized (8). These models, including cognitive-behavioral therapy, cognitive restructuring, verbal reinforcement, problem solving, and motivational interviewing (MI), share the premise that behavior is best understood by examining attitudes and beliefs (44, 45). Some randomized controlled studies have shown that in periodontitis patients, communication based on their individualized periodontal risk profile, processed through specific tools, can influence thoughts and emotions regarding periodontal disease itself (2), as well as psychological variables informing adherence to treatment. This translates into better patient performance in supragingival plaque control (3).

Anxiety and depression affect 322 million people worldwide (European Study on the Epidemiology of Mental Disorders (ESEMeD) – WHO) and are associated with poor quality of life (50), greater utilization of healthcare, and severe functional limitations (30). Anxiety and depression are known to complicate treatment of many diseases: depressed individuals often exhibit health risk behaviors such as smoking, alcohol consumption, and poor home oral hygiene (20, 18, 37, 59), and present overall poorer oral health (27). Although the role of stress and depression in modulating host response in periodontitis is well documented (5), these disorders are also strongly linked with weakened cognitive control (19, 31, 51), a set of processes crucial to motivated, goal-directed behavior that enables flexible adaptation of cognition and consequent actions to pursue a set goal (6, 17, 49). Anxiety and depression profoundly influence the way information is processed and how individuals think about themselves, others, and the surrounding world: anxious and depressed individuals take longer to manage negative information and experience difficulty suppressing irrelevant thoughts or constructing action pathways toward goals. This complicates emotion regulation and adaptation to fast-changing environments (10, 23), as well as the modification of ingrained habits. A study among young police recruits revealed that poor (OR 1.25) or nonexistent (OR 1.31) anxiety and stress coping were statistically significant predictors ($p < 0.05$) of ineffective home biofilm control (42), while anxious-depressive traits are significant risk indicators for clinical attachment loss in periodontitis (36).

This study, conducted on a cohort of anxious/depressed patients (group A/D) and matched controls for age, sex, and periodontal status (group C), was designed to comparatively evaluate in A/D and C patients:

1. psychological profile and supragingival plaque control level at the time of first periodontal visit;
2. efficacy of periodontal risk communication, performed with or without the support of a validated tool for periodontal prognosis evaluation (PerioRisk, 54), on psychological outcome measures and supragingival plaque control following motivational interviewing (MI).

MATERIALS AND METHODS

Experimental design, ethical aspects, and funding

This study consisted of a retrospective analysis of data derived from a single-blind randomized controlled trial (16) aimed to evaluate efficacy of periodontal risk communication (evaluated via PerioRisk) (54) on psychological profile and supragingival plaque control in patients who participated in MI during the first visit.

The experimental protocol was approved by the Ethics Committee of Area Vasta - Emilia Centro (CE-AVEC) protocol number 935/2021/Sper/AUSLFe, approval date 18/11/2021, and was registered on ClinicalTrials.gov (ID: NCT05078411). All patients provided written informed consent before participation and were given additional explanations as requested.

Study population

For this study, patients were retrospectively selected from the participants in Farina et al. (16). All participants were recruited at the Interdepartmental Research Centre for the Study of Periodontal and Peri-Implant Diseases, University of Ferrara, and the Complex Operational Unit of Dentistry of Ferrara Local Health Authority, in accordance with criteria detailed in Farina et al. (16). Briefly, patients were adults, fully or partially dentate, scheduled for a first periodontal visit. Exclusion criteria included inability to comprehend Italian, previous periodontal diagnosis, psychiatric comorbidities that could influence comprehension and questionnaire completion, HADS score ≥ 11 indicating clinical anxiety and/or depression (60), medications well documented to affect cognition necessary for questionnaire completion, alcohol or drug dependence, absence of a recent radiograph (OPT, max 24 months old) or contraindications to radiographic exam (e.g., pregnancy). Patients who did not adhere to protocol procedures, missed two consecutive appointments, failed to complete questionnaires, or withdrew from the study were excluded.

For this retrospective analysis, two groups were considered:

- anxious/depressed patients (group A/D), comprising all who had been previously excluded from Farina et al. (2024) due to HADS ≥ 11 but who still completed questionnaires and evaluations relevant to this study;
- control patients (group C), identified among Farina et al. (16) participants by matching for age, sex, and periodontal status to A/D patients.

Pre-experimental procedures

Operators participated in calibration sessions to guarantee homogeneous administration of the two interventions discussed here (see "Treatments" for details).

Experimental procedures

Outlined by observation times in Figure 1.

At screening visit (t0), selection criteria were verified.

Within three months after t0 (t1), anamnesis, smoker status, diabetic status, number of fully erupted permanent teeth, number of teeth lost to periodontitis or judged with poor prognosis due to severe periodontal support loss (46), and Plaque Index (PII) were recorded. The PII was calculated as the percentage of sites with supragingival plaque visible after plaque disclosing (16).

Periodontal diagnosis was made according to definitions of periodontal health, plaque-associated gingivitis, and periodontitis (9, 40, 53, 56), with staging, grading, extent, and stability determined in periodontitis cases (40, 53).

Periodontal risk level (numeric scale 1–5; 1 = low risk, 5 = high risk) was determined by PerioRisk (54).

A reevaluation visit was scheduled within 8–12 weeks after t1 (t2), when periodontal parameters including PII were reassessed.

Experimental treatments

Randomized assignment to test (RISK) or control (CTR) was computer-generated and conserved in sealed envelopes.

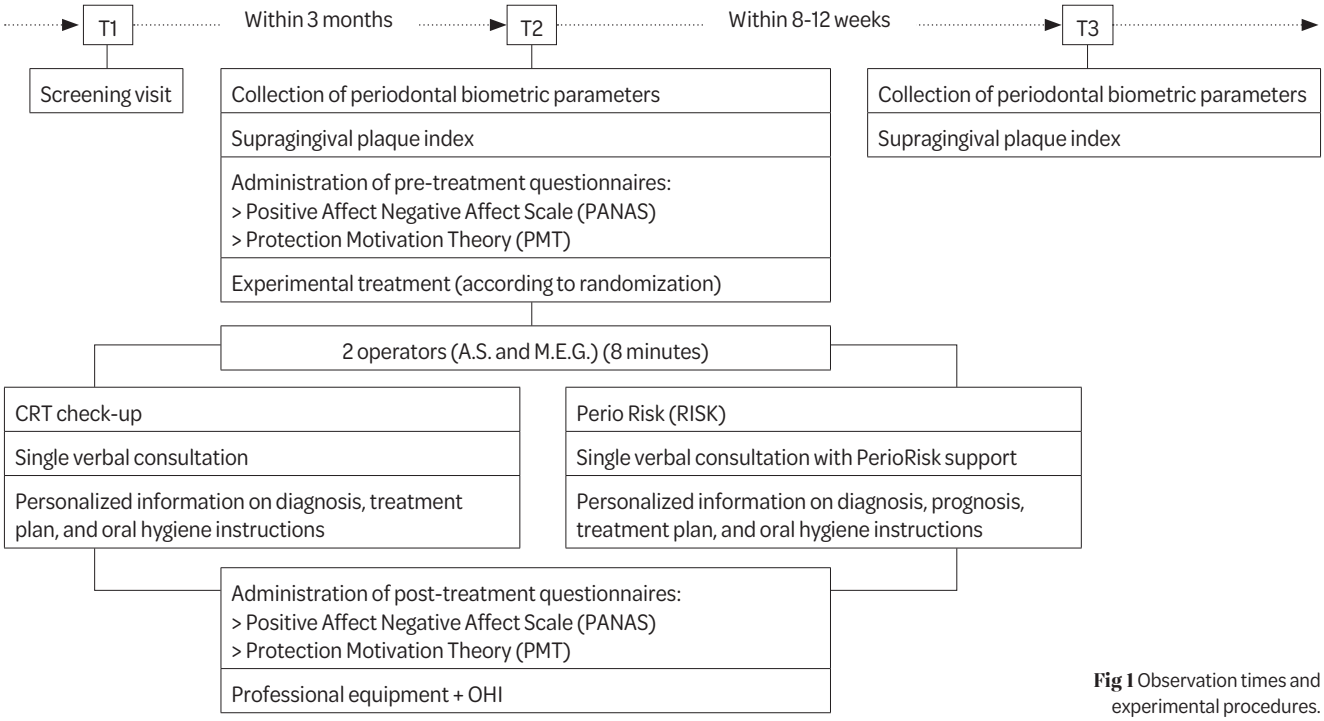

Fig 1 Observation times and experimental procedures.

At baseline, after periodontal clinical assessment and questionnaire administration, patients were assigned to RISK or CTR treatment by clinicians administering the interventions only.
Both groups received a single structured MI intervention. Training sessions pre-study defined topics and average time (~8 minutes) per MI session, allowing additional time if participants requested clarification.
The intervention was delivered privately with only operator and patient present.
Both groups were informed of diagnosis, treatment plan, and oral hygiene instructions.
In CTR, the general concept of risk of periodontitis incidence/progression was explained, emphasizing relevance of risk factors (e.g., smoking, diabetes) and indicators (pockets, bleeding) from clinical data, without explicit mention of the PerioRisk-calculated risk level or any other tool.
This CTR strategy aligned with previous studies (2,3), where participants engaged in a 5–10-minute Q&A session without discussing disease risk.
RISK patients received their individual PerioRisk-generated risk level and profile information, with emphasis on treatment goals based on PerioRisk results during consultation. RISK patients were also given a PerioRisk brochure outlining individual risk, profile, and therapeutic recommendations to reduce risk.
Due to study nature/design, blinding of operators was not maintained.

Outcome measures: Psychological assessments

At t1, participants underwent psychological evaluation with Italian versions of the Positive Affect Negative Affect Scale (PANAS) (58), translated by Terracciano et al. (52) to evaluate emotional reaction during treatment, and Protection Motivation Theory questionnaire (PMT) (11) to assess beliefs on periodontal disease, with items from Asimakopoulou et al. (2).
PANAS is a 20-item Likert scale (5-point agreement: "not at all or very slightly," "little," "moderately," "quite a bit," "extremely") with excellent psychometric properties.
PMT is a 7-item Likert scale (10-point agreement from 1 "not at all" to 10 "extremely") exploring participant awareness of severity, susceptibility, treatment efficacy, self-efficacy, barriers, fears, and intention to adhere.
After CTR or RISK administration, patients repeated PANAS and PMT questionnaires.

Outcome measures: Plaque Index

Immediately before intervention and at reevaluation visit, PII was calculated as percentage of sites with visually detectable supragingival plaque after application of a disclosing agent (Mira-2-Ton®, Hager & Werken GmbH, Germany).

Statistical analysis

Data expressed as mean ± standard deviation.
This study was a retrospective sub-analysis of Farina et al. (16). The original study's sample size powered to test superiority of RISK vs. CTR; thus, this analysis was descriptive only.

RESULTS

Study population

Fifteen patients (age 55.7 ± 17.5 years; 1 male, 14 female) excluded from Farina et al. (16) for HADS ≥ 11 formed

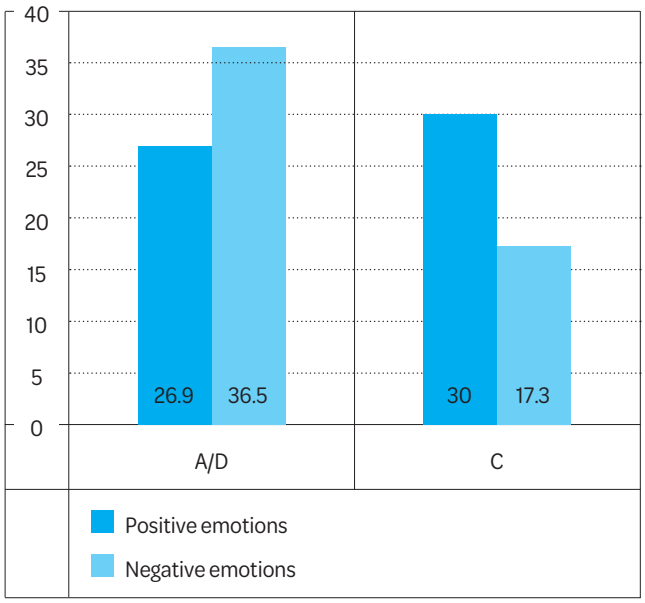

Fig 2 Pre-treatment scores on the PANAS questionnaire for positive and negative emotions.

group A/D. Of these, 13 scored ≥11 (range 11–16) for anxiety; 3 scored ≥11 (range 11–16) for depression.
Fifteen Farina participants (age 55.9 ± 14.5 years; 1 male, 14 female), matched for sex, age, and periodontal diagnosis to A/D patients, formed group C.
In both groups, 4 had gingivitis diagnosis; 3 had stage II, III, or IV grade B periodontitis; 8 had stage III or IV grade C periodontitis. Both groups had 6 smokers and 1 ex-smoker; 4 A/D had diabetes mellitus.
8 patients per group were assigned CTR; 7 per group were assigned RISK. 6 A/D patients assigned CTR and 2 C patients assigned RISK missed t2 and did not contribute PII data to this analysis.

Treatment administration time

For nearly all patients in both groups, treatment duration was between 8:00 and 9:30 minutes.

Baseline psychological (PANAS, PMT) and clinical (PII) profiles

At t1, before treatment, group A/D had lower PANAS positive emotion scores (26.9) than group C (30), and higher PANAS negative emotion scores (36.5 vs. 17.3) (Figure 2).
At t1, group A/D had lower PMT scores than group C across all domains: awareness (6.3 vs. 7.3), susceptibility (7.7 vs. 7.9), treatment efficacy (8.3 vs. 9.1), self-efficacy (7.9 vs. 9.5), fear/worry (6.8 vs. 8.2), intention to adhere (8.3 vs. 9.3). Group A/D perceived higher treatment costs/barriers (+1.9) than controls (Figure 3).
PII% was comparable (80.8%) between groups at t1 (Figure 4).

Response to CTR treatment in groups A/D and C

Following CTR, positive emotion increased by +0.5 in A/D and +0.9 in C (Figure 5).
Negative emotion decreased by −4.3 in A/D and −1.5 in C (Figure 5).
In A/D, CTR increased PMT scores for awareness (+2.62), susceptibility (+0.37), treatment efficacy (+1.5), self-efficacy (+0.12), fear/worry (+1.00), intention to adhere (+0.5), and perceived costs/barriers (+1.5) (Figure 6).
Similarly, CTR increased awareness (+1.75), susceptibility (+1.75), treatment efficacy (+0.38), self-efficacy (+0.5), intention (+0.37), costs/barriers (+2.75), and fear/worry (+0.5) in C (Figure 6).
CTR reduced PII by −11.2% in controls but produced no change in A/D patients (Figure 7).

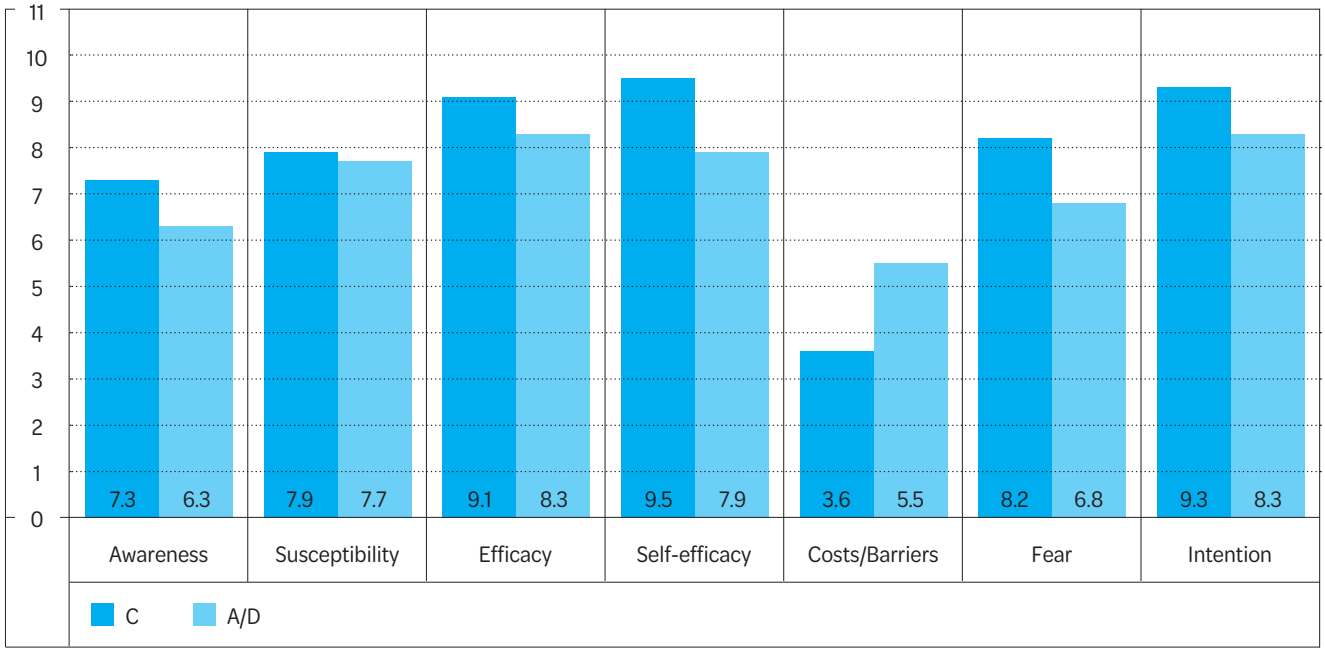

Fig 3 Pre-treatment PMT questionnaire scores for group C and group A/D.

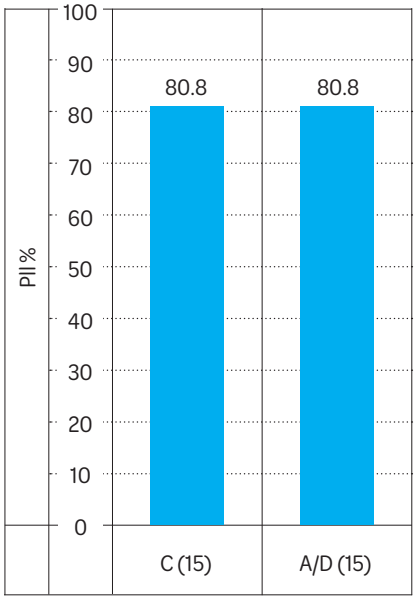

Fig 4 Pre-treatment plaque index groups C and A/D.

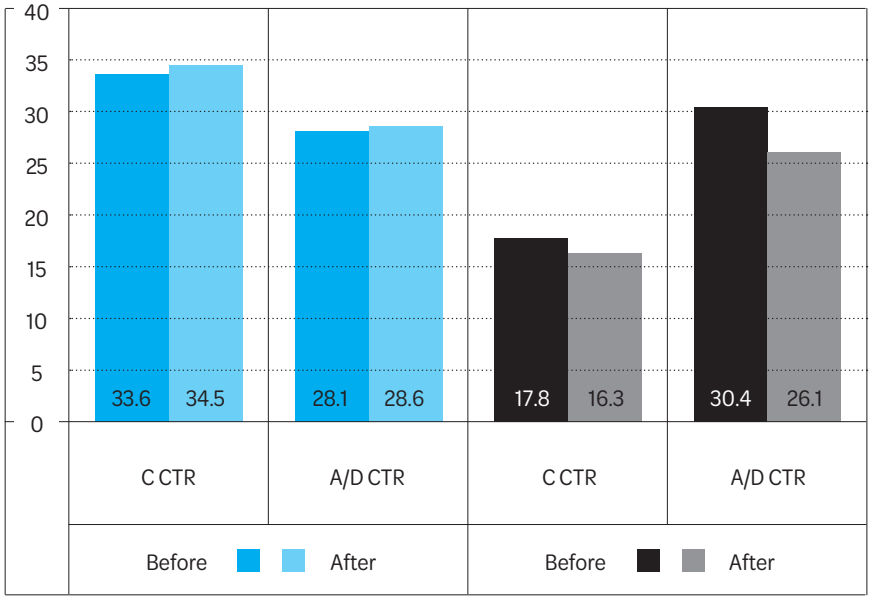

Fig 5 PANAS questionnaire scores for positive emotions pre- and post-treatment CTR; PANAS questionnaire scores for negative emotions pre- and post-treatment CTR.

Response to RISK treatment in groups A/D and C

Following RISK, both groups showed reductions in positive emotion (−0.5 A/D and −0.8 C) (Figure 8).
Negative emotion decreased by −6.5 in A/D but increased by +2.9 in controls (Figure 8).
In controls, RISK increased pre-post values in most PMT domains: awareness (+0.58), susceptibility (+1.28), treatment efficacy (+0.86), costs/barriers (+0.43), fear (+0.86), intention (+0.42). Self-efficacy did not change (Figure 9).
In A/D patients, most PMT domains started lower than controls except for costs/barriers (5.29 A/D vs. 4.71 controls), and had a mixed post-treatment pattern: awareness (+2.00), fear (+1.00), intention (+0.29) increased; susceptibility (−0.29), treatment efficacy (−1.14), and self-efficacy (−1) decreased; costs/barriers decreased from 5.29 to 4.43 (Figure 9).
RISK reduced PII by −4.1% in controls and −5.1% in A/D (Figure 10).

DISCUSSION

Successful primary and secondary periodontal prevention requires patient awareness of disease severity, treatment nature and aims, and willingness to adhere to home biofilm control, lifestyle changes, and professional interventions (43).
Anxiety and depression correlate with poor medical compliance; depressed patients are three times more likely to be non-adherent (OR 3.03, 95% CI) and show association

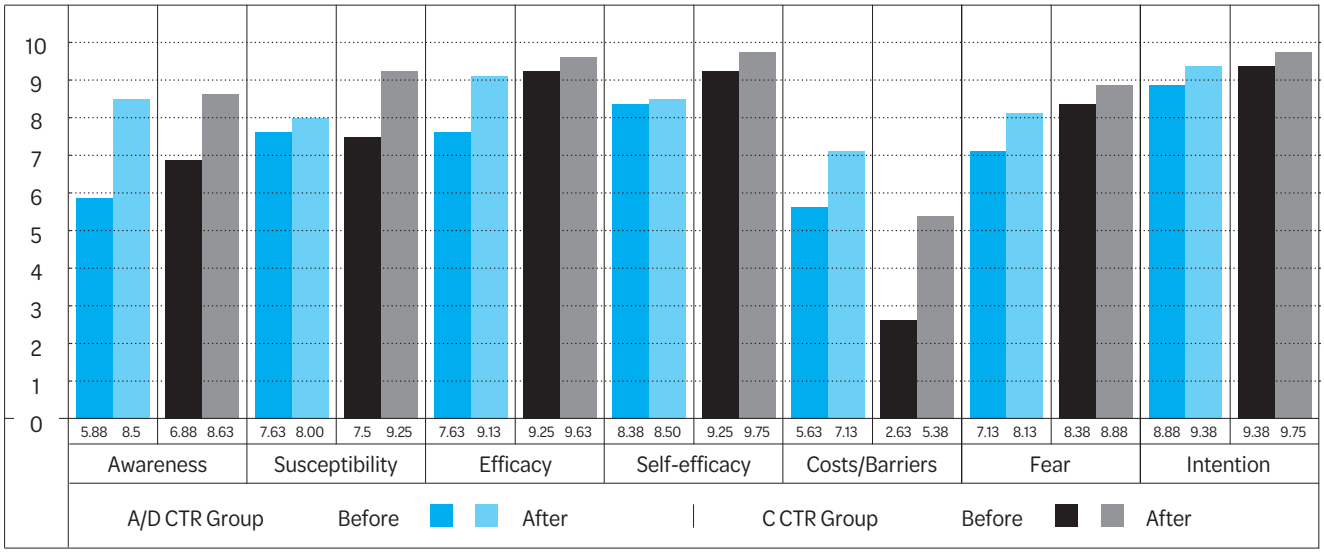

Fig 6 Pre- and post-treatment PMT questionnaire scores for CTR group A/D; Pre- and post-treatment PMT questionnaire scores for CTR group C.

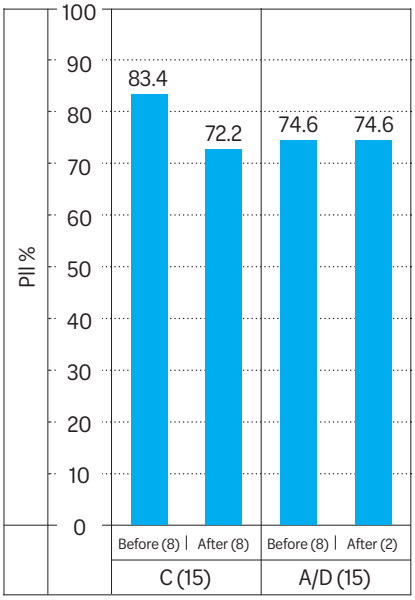

Fig 7 Post-treatment plaque index CTR groups C and A/D.

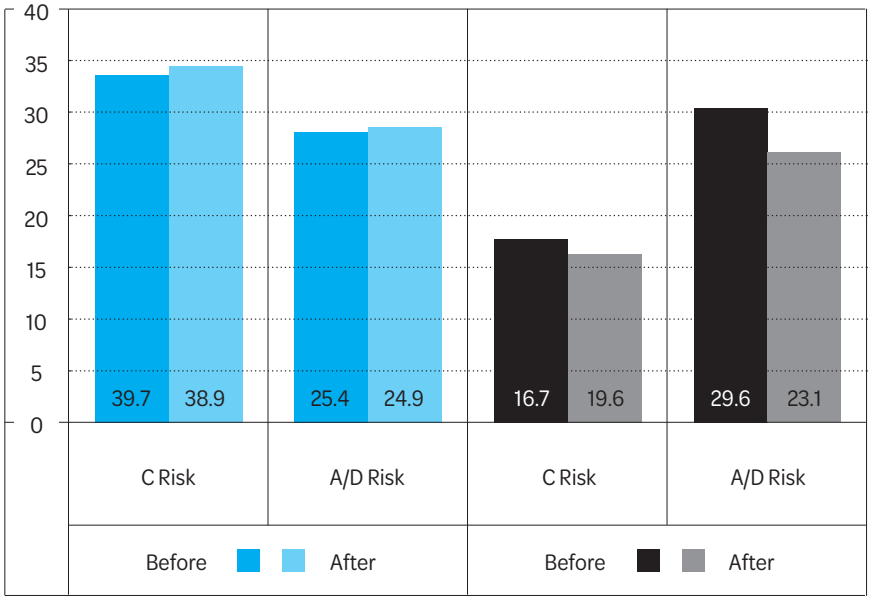

Fig 8 PANAS questionnaire scores for positive emotions pre- and post-treatment RISK; PANAS questionnaire scores for negative emotions pre- and post-treatment RISK.

between stress, anxious depressive disorders, periodontitis prevalence/severity, and sometimes worse treatment outcomes (14, 24, 26).

This well-documented biological association (5, 21) likely reflects anxiety/depression impairing pro-active behaviors critical for effective oral hygiene (42).

This work assessed the impact on psychological profile and supragingival plaque control of periodontal risk communication with or without PerioRisk support (54) in anxious/depressed patients (A/D) compared to matched controls (C).

Recent data show psychological interventions based on cognitive-behavioral theories in periodontitis patients without anxiety or depression do not demonstrate added clinical benefit over conventional motivation (8). Nonetheless, goal-setting and self-monitoring effectively promote behavioral change (35), presenting a challenge for anxious/depressed patients who take longer to digest health information and struggle to plan therapeutic goal-directed behavior (6, 17, 49).

Understanding benefits of behavioral change and disease severity awareness via periodontal risk communication (with Periodontal Risk Calculator) predicts behavioral change and improved plaque control in healthy periodontitis patients (2, 3). However, the efficacy of these methods in anxious/depressed patients has not yet been well elucidated.

In this study, patients with higher HADS (≥11) scores exhibited at baseline greater negative and fewer positive emotions (PANAS) than non-anxious/depressed controls (Figure 2), validating HADS psychometric performance. Baseline PMT scores were lower across all domains in A/D patients, consistent with their higher perceived barriers

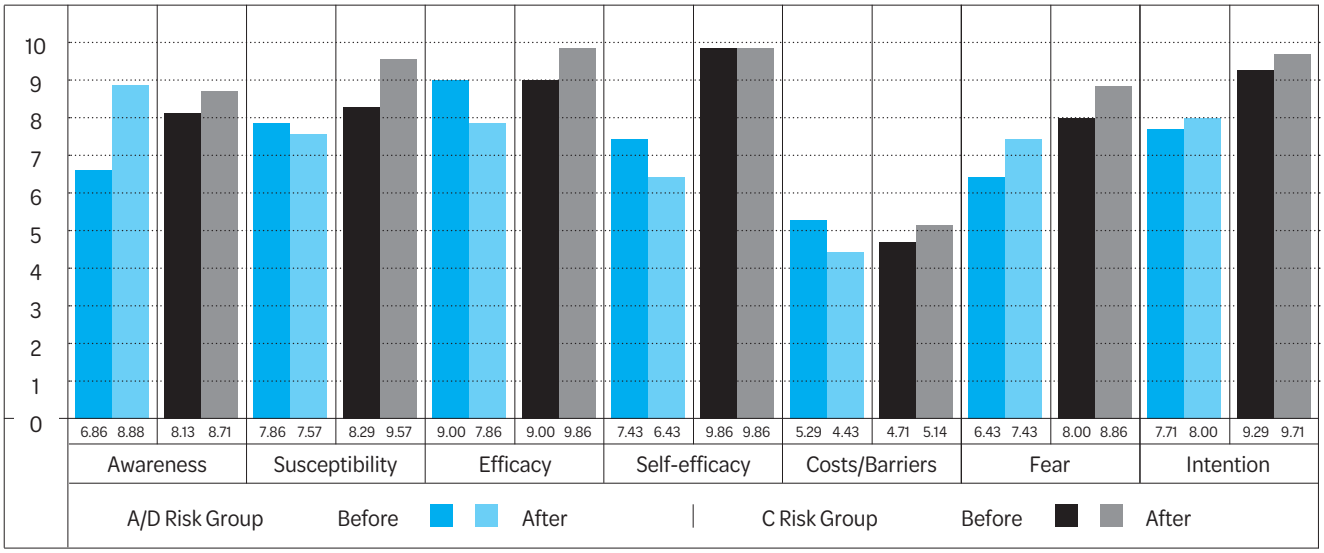

Fig 9 Pre- and post-treatment PMT questionnaire scores for RISK group A/D; Pre- and post-treatment PMT questionnaire scores for RISK group C.

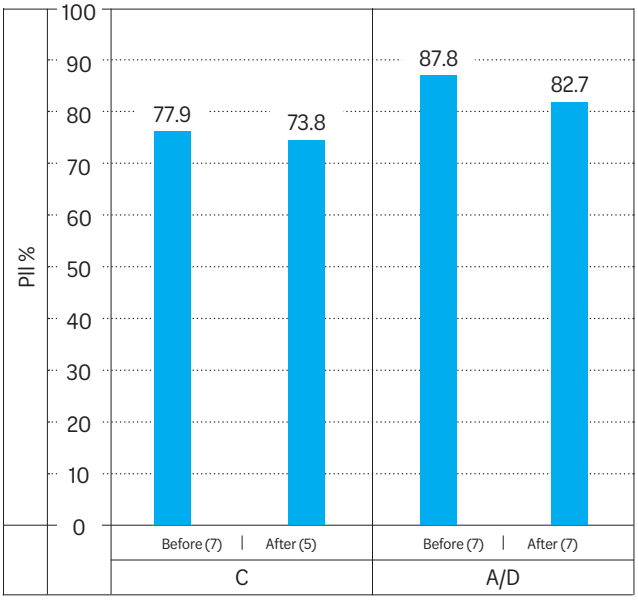

Fig 10 Post-treatment plaque index RISK groups C and A/D.

(Figure 3). Therefore, validated tools to easily detect anxious/depressed traits can assist clinicians in tailoring realistic periodontal therapy plans and are encouraged (22, 41).
Both CTR and RISK treatments minimally affected positive emotions in healthy controls but strongly reduced negative emotions in anxious/depressed patients (Figure 5).
CTR comprised a single structured MI lasting about 8 minutes, targeting diagnosis, treatment plan, and oral hygiene education. Similar MI in prior studies improved patient beliefs on seriousness and intention, indirectly improving plaque control at 8–12 weeks (2,3).
CTR increased PMT domains (awareness, intention, perceived treatment efficacy and self-efficacy) but also increased perceived costs/barriers, fear, and worry (Figure 6). A high dropout rate among A/D patients receiving CTR (n=6) may limit its efficacy in this population.
RISK integrated MI with PerioRisk risk level and profile, providing printed information on individual risk and therapeutic guidelines. Patients in control group receiving RISK showed small pre-post PMT improvements, whereas anxious/depressed patients exhibited mixed PMT responses: increased awareness, fear, and intention; decreased susceptibility, perceived efficacy, and self-efficacy; decreased cost/barrier perception (Figure 9).
Reduced barrier perception indicates treatment success. Anxiety disorders paired with depression vary widely from panic attacks to obsessive-compulsive behavior, which might paradoxically improve periodontal treatment adherence (32). RISK might support motivation in certain anxious/depressed patients; further studies are needed.
Clinically, both groups had high baseline PII levels (Figure 4). Neither treatment reduced biofilm sufficiently for periodontal stability in either group. Small A/D sample completing CTR might explain no PII change at t2 (Figure 7).
RISK-treated A/D patients (one dropout) exhibited modest PII decrease (–5.1%, Figure 10) similar to controls. A two-year study on compliance showed depressed patients learned and applied new oral hygiene more slowly but could follow professional advice equally, suggesting anxious/depressed patients may need more frequent motivational reinforcement and recall visits to build therapeutic alliance (22). Repeated MI sessions with periodontal risk evaluation tools might provide useful clinical support for anxious/depressed patients.

CONCLUSIONS

An 8-minute motivational interview (MI), with or without PerioRisk support, positively influences psychological variables and attitudes towards disease in anxious/depressed patients. Given limitations including retrospective design, small sample size, and lack of inferential statistics, PerioRisk may be a useful adjunct to enhance MI effects on psychological profile and supragingival biofilm control in this population, warranting further investigation.

Acknowledgments

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