Decontamination of hard tissue professional mechanical tooth cleaning: general principles

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Professional Mechanical Tooth Cleaning (PMTC) is the cornerstone of active preventive office/consulting room treatments. Mechanical removal of dental plaque is vital for the prevention of carious and periodontal disease. Patients often see only the cosmetic improvement but dentists are primarily seeking a biological and bacteriological impact on all “at risk”. PMTC aims to: Remove soft coatings on dental tissue, restorations, dental and implanted prostheses; Restore polish on surfaces, using suitable mechanical treatment; Create a surface that discourages subsequent bacterial recolonisation, and facilitates the flow of saliva over the tooth surfaces; Further the process by using chemical treatment to improve decontamination and remineralisation. Modifying the flora through mechanical disturbance, and the surfaces by polishing, PMTC fosters ion exchange on the tooth surface and creates a new bacterial balance. The frequency of application, the only variable, depends upon carious (or periodontal) risk. To be effective, PMTC should preferably be conducted on patients who have already shown good home plaque control, because this is the guarantee of long-lasting results.

Introduction

Mechanical removal of dental plaque is vital in the prevention of carious and periodontal disease. Professional Mechanical Tooth Cleaning (PMTC) in the surgery modifies the state of dental surfaces and the bacterial environment. It alters the biological equilibrium between saliva, flora and teeth, achieved by patients who brush their teeth twice daily and corrects what was not accomplished by brushing at home.

Administrating PMTC regularly thrice within two weeks decreases bacterial levels by 72% (bacteria causing caries and periodontal disease).

The results of an experiment run over 30 years in Sweden are impressive. A PMTC-based treatment for 550 adult patients, used 1 to 6 times a year (depending on individual carious and periodontal risk), stopped or considerably limited the incidence of carious and periodontal diseases over this long period. Of the 173 teeth lost in 30 years, only 9 were lost for periodontal reasons and 12 for caries. Most losses were due to fractures or endodontic lesions [1].

This article does not deal with plaque control education, even though it is both a prerequisite and a vital addition to surface treatments administered in the surgery. The chemical treatments that can be associated with clinical PMTC sessions will also be dealt with in another article.

PMTC: Mechanical, bacteriological and cosmetic reasons

Patients often see only the cosmetic improvement: stains disappear, the teeth appear polished and the enamel looks transparent. However, dentists are first and foremost seeking a biological and bacteriological impact, so PMTC must be carried out as a priority on all “at risk” surfaces [2].

Aims of PMTC:

- Removal of soft coatings: food debris, materia alba, acquired exogenic film, chromogenic substances and, obviously, bacterial biofilm (on dental tissue, restorations and dental and implanted prostheses);
- Restoration of the polish on surfaces through suitable mechanical treatment (using interdental brushes, rotary polishing cups and increasingly fine-grained polishing pastes);
- Creation of a surface that discourages subsequent bacterial recolonisation, and facilitates the flow of saliva over the tooth surfaces [3];
- Furthering the process by using chemical treatments to improve decontamination and remineralisation.
By modifying the flora through mechanical disturbance, and the surfaces by polishing, PMTC fosters ion exchange on the tooth surface and creates a new bacterial balance. It would appear to have an impact up to 3 mm under the gums.

Nevertheless, although PMTC seems easy to perform, there can be certain negative effects that need to be prevented. For example; PMTC removes a fluoride-rich part of the enamel surface (3 - 4 µm removed by polishing for 30 sec). Although polishing pastes contain fluoride, this is not enough to restructure the teeth, so it is advisable to apply a fluoride varnish or gel topically at the end of the session, on the sites at risk. Moreover, surfaces of different types of fillings; such as glass ionomers, composites and especially, implants, are likely to be damaged by poor use of instruments. In these specific cases, precautions must be taken. (They will be dealt with in another article).

Table 1. Benefits-risks of PMTC

<table>
<thead>
<tr>
<th>Positive aspects of PMTC</th>
<th>Negative aspects of PMTC</th>
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<tr>
<td>Decrease in the density of microorganisms.</td>
<td>Damage of tooth structure; surface changes, if instruments are used wrongly.</td>
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<tr>
<td>Favourable changes in microbial flora.</td>
<td>Creation of irregularities in restoration materials and implants.</td>
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<tr>
<td>Decrease in incidence of carious and periodontal disease in patients receiving the treatment regularly.</td>
<td>Modification of the fluoride-rich layer.</td>
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<tr>
<td>Decrease in plaque accumulation.</td>
<td>Frequent visits needed but may not be covered by health insurance.</td>
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<td>Removal of stains.</td>
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PMTC: when to use it

PMTC must include overall treatment to prevent the onset of new caries and/or periodontal disease and stabilise any early initial lesions. During the initial stage of risk management, Axelsson recommends doing three PMTC sessions over ten days for improved initiation of changes to bacterial flora and surfaces [1]. After that the notion of residual risk guides the frequency of PMTC (ranging from once a year for low-risk patients to every three months or more at the start of treatment for high-risk patients).

PMTC: A 10-point guide, and errors to avoid

1. PMTC should be started only in patients who have begun effective plaque control (particularly in-between the teeth). The combination of energetic PMTC action and the repetition of appropriate daily treatment will make post-PMTC results last longer. (Figures 1 - 4)

Figure 1. SITUATION AT T0: It is better to do PMTC on patients who have already mastered effective plaque control. More instructions were given to improve the patient’s technique further.

Figure 2. SITUATION AT T0+2 MONTHS: Instructions were followed and plaque control was further improved, as shown by the disappearance of part of the coloured and even calcified coatings. The 1st PMTC could now be done under optimal conditions to obtain a lasting result.

Figure 3. CONTROL AT T0+3 MONTHS: Despite a difficult anatomical environment, the patient was capable of effectively maintaining the state of the hard tissue and the bacterial equilibrium created during the previous month. A new “finishing touches” PMTC was done on at-risk sites.

Figure 4. SITUATION AT T0+8 MONTHS: The patient came back five months later for another session. The situation seemed to be permanently stabilised: home care and PMTC had achieved their objectives.
2. Use of a disclosing product revealed residual soft coatings (Figure 5).

Figure 5. PMTC began by disclosing the plaque, starting with the highest risk areas, which are usually harder to reach.

3. It is preferable to begin with the high-risk sites that are difficult to reach. These are often interproximal, palatal and lingual. Axelsson recommends starting with interdental spaces, which are cleaned with Profin® tips (Figure 6 - 8) and finished with polishing cups and silicone mounted points [3]. Fine particle polishing pastes are used in finishing them.

4. Using contra-angle (PROFIN® type) hand pieces with rotary instruments should produce the smoothest possible surface.

Figure 6. An oscillating Profin® contra-angle hand piece is very useful for treating proximal surfaces: shown here with an ultra fine metal tip.

Figure 7. Plastic Profin tips are designed to polish proximal surfaces with a prophylactic paste.

Figure 8. Profin in action: treating the mesial surface of 26.

Polishing with decreasingly abrasive pastes. Note that when surfaces are very rough and/or coloured, low speed silicone polishers, with high spray to avoid heating, can be more effective than coarse particle pastes. (Figures 9 - 13).
5. Intermittent pressure at moderate speed should be used (the rotary instrument should not be left in place) and any heating avoided. The polishing cup must be held perpendicular to the surface axis and should enter the proximal and intra-sulcular spaces without creating concavities. It is the paste that does the work.

6. Air polishers can be used in PMTC. We will not go into the benefits and risks here, but it should be remembered that:
   a. Air polishers that use sodium bicarbonate powder are more “aggressive” than those that use glycine.
   b. They are useful in cases of coronal stains and in parts that are difficult for interdental brushes and polishing cups to access.

7. After cleaning the interproximal and posterior lingual surfaces, the treatment is applied to the areas that are hardest to reach. After rinsing, the surfaces are verified by energetic drying or by a second application of a plaque-disclosing product.
Once all the unwanted soft and hard matter has been removed, final comprehensive polishing can be done with a low-abrasion paste (cf. box below).

9. This is the ideal time to treat the dental surfaces chemically (Figure 16):
   - Remineralisation: fluoride varnishes applied with a paintbrush, CPP-ACP on areas at risk, applied with a finger or in a heat-formed mouthpiece, fluoride gels in a mouthpiece;
   - Decontamination: applying Chlorhexidine varnish with a paintbrush.

10. The patient receives special instructions for home plaque control, to maintain the results obtained during this session and especially, to improve the state of dental surfaces through the natural healing process of hard tissue and gums.

Figure 14. Graded particle size fluoride paste in tubes (Proxyt® Vivadent®).

Conclusion

PMTC should be administered for all patients. The frequency of application is the only variable, depending on carious (or periodontal) risk. To be effective, it should preferably be carried out on patients who have already shown good home plaque control, because this is the guarantee of lasting results. The protocol is relatively simple to apply, and its effectiveness when it is part of long-term carious and periodontal prophylaxis has been verified. Being very familiar with the techniques and special instruments used, in order to obtain the desired results, is important.

Figure 15. Some pastes are supplied in individual polishing cups. (Cleanic® "variable" particle size shown here).

Figure 16. Applying FluorProtector® varnish after PPCDS for a patient with multiple caries.

Figure 17. The paste is simply applied with a spatula or injected with a syringe.
How to choose and optimise the particle size of increasingly finer pastes?

Increasingly finer pastes contain a traditional abrasive, such as pumice or zirconium silicate, which retains constant abrasiveness during application. The paste thus needs changing to reduce abrasiveness and increase the polish. Dentists often consult the RDA (Relative Dentine Abrasivity) indicated on the packaging. Unfortunately though, there is no standard protocol for evaluating RDA, which is – as its name indicates – a relative value (measured against water for example, or a pumice suspension – the reference is not standardised either). There are some protocols for toothpaste and others for professional prophylactic pastes. RDA values are the result of measurements and calculations. There are two systems for expressing results! It is important to note that there is no real standardisation: a "medium" paste in one brand could be "fine" in another brand. Therefore, a dentist must remain vigilant and continue to use a familiar protocol and familiar products.

Many areas have already been "treated" sufficiently by patients through brushing (Figures 1 - 4) and need only "gentle" professional treatment to remove any biofilm. We need to spend more time on the contaminated, rough "at risk" areas that often need energetic treatment. When patients are capable of maintaining their levels of plaque control (Figures 1 - 4), we generally use the following sequence: "highly abrasive" paste (RDA: > 80) and then "medium abrasive" paste (RDA: 79 - 35) for the first session (Figure 2). Then, 15 to 30 days later, for a second finishing session, "medium abrasive", followed by "low abrasive" paste (RDA: 34 - 7) (Figures 3).

Using "variable" particle size pastes: what are the advantages?

Other pastes, described as "variable grain" (e.g. Cleanic® by KerrHawe, Figure. 15), become progressively less abrasive with use (due to breakdown and wear of the special Perlite-based abrasives). Not having to change pastes saves a significant amount of time, but means that one has to start on the hardest (enamel) and most stained parts and finish on the most fragile parts (cement-dentine). In order to make the best use of the product, one also needs to treat a small group of teeth at a time (e.g. 3), spending 10-15 seconds on each tooth. It is also important not to use a new dose of paste on teeth that have already been treated, because the new paste will be more abrasive than that remaining from the previous session.

References