

Complications and Treatment Errors in Periodontal and Implant Therapy

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ABSTRACT

During the last 50 years the assortment of periodontal and implant-related treatments has been continuously improved. Once the decision-making process has been established and the treatment procedure applied, it can be expected the partial or complete resolution of the problem (e.g., periodontal probing depth reduction, clinical attachment level gain, gingival recession reduction, dental hypersensitivity decrease, etc) and a diagnosis change with no or minimal occurrence of adverse events (i.e., complications, harms, technical errors or adverse / side effects). The clear identification of the potential types of adverse effects, complications or, even, errors is important for contemporary decision-making process as they may be related to different local, systemic and technical aspects. This chapter focused on four core components: 1) in providing periodontal definitions for errors, complications, harms and side effects; 2) defining the types of risk and the clinical impact of adverse effects, errors and complications in periodontal and peri-implant therapies; 3) evaluating the influence of accidental errors versus the lack of a proper treatment planning; and 4) reporting on the importance of establishing the 'net benefit ratio' between the clinical improvements promoted by the therapy and the occurrence of potential adverse events.

1 | INTRODUCTION

During the last 50 years the assortment of periodontal and implant-related treatments has been continuously improved. The idea of applying a well-known / established procedure, developing a new type of therapy, or even modifying a pre-existing one, is initially based on a clinical scenario: the condition a patient has and how the clinician can handle the problem. Typically, the development of new or alternative treatment approaches or techniques are the primary targets of therapy when definitive information is scarce.¹

The current standard of periodontal and implant treatment aims to promote patient's overall health that is governed by: "selection of the best treatment options available for each patient individually, based on the expected results, potential complications/adverse effects, acceptances of the treatment plan by the patient and costs."² Once the decision-making process has been established and the treatment procedure applied, it can be expected the partial or complete resolution of the problem (e.g., periodontal probing depth reduction, clinical attachment level gain, gingival recession reduction, dental hypersensitivity decrease, etc) and a diagnosis change with no or minimal occurrence of adverse events (i.e., complications, harms, technical errors or adverse / side effects). The current version of the *American Academy of Periodontology* Glossary of Periodontal terms³ does not encompass 'clinical definitions' on these important circumstances, but taking into consideration The Merriam-Webster⁴ dictionary, these may define as:

- Error: "an act involving an unintentional deviation from truth or accuracy"⁴ ... "an act that through ignorance, deficiency, or accident departs from or fails to achieve what should be done"⁴. Thus, in periodontal and implant therapy it might be defined as 'an action or practice originated of an unintended deviation of the preestablished objectives and precision of a treatment procedure, caused by an accident, imprudence, or the lack of knowledge technical skills'.
- Complications: "a difficult factor or issue often appearing unexpectedly and changing existing plans, methods, or attitudes"⁴ ... "a secondary disease or condition developing in

the course of a primary disease or condition"⁴. In Periodontology and Implant Dentistry they might be defined as 'those unexpected interurrences occurring during or after the execution of a treatment procedure that have potential of modifying or jeopardizing the wound healing process and the anticipated effect of treatment'.

- Harm: "physical or mental damage"⁴. A periodontal definition may be the 'mechanical, chemical or thermal injuries or damages inflicted to the periodontal tissues.'
- Side (adverse) effect: "a secondary and usually adverse ["acting against or in a contrary direction"⁴ ... "causing harm"] effect (as of a drug)"⁴ Similarly, periodontal side effects may be defined as 'those unexpected effects and events occurring following the delivery of a procedure or therapy'. Side effects may not necessarily be considered as adverse events, as these may not lead to a detrimental effect on the foreseen treatment results. Thus, adverse effects definition should account for both 'unexpected and undesirable detrimental effects...'

Errors and complications are not only part of professional experience, but of the iatrogenic one as well.⁵ It has been described that the occurrence of unexpected adverse events can typically generate an initial surprise or negation reaction,⁵ but an extensive disclosure of these issues is important for researchers, clinicians and patients in order to anticipate clear answers to the following questions: *What are the potential adverse events expected with the proposed therapy? Why do they occur? Are they important (and to which extent)? And how can they be prevented?* Treatment complications can happen during and following non-surgical and surgical treatment procedures, and these may lead to several emotional conditions (i.e., guilt feelings, reduced job satisfaction, shame, traumatic stress, anxiety, depression and insecurity) that can impair a clinician's ability to perform his/her job.⁵

The clear identification of the potential types of adverse effects, complications or, even, errors is important for contemporary decision-making process as they may be related to different local, systemic and technical aspects. Furthermore, these issues shall influence the predictability of treatment (or in other words, the results of therapy anticipated by both the

clinician and the patient). As a result, the fundamentals of reporting and understanding the clinical evidence regarding adverse effects, errors and complications are mandatory, and cannot be neglected. Since 1993, when the first volume of *Periodontology 2000* was published, this is the first issue exclusively devoted to treatment errors and complications in both periodontal and implant dentistry. A clear assessment of all the potential conditions influencing on the treatment outcomes is mandatory, and they should not only be based on what a technique or procedure can do to improve the patient's well-being or aesthetics. Thus, why is it important to focus on these treatment interurrences? Because current standards of periodontology and implantology should also involve the assessment of both clinical and patient-reported disadvantages and any other potential detrimental responses associated to therapy.

The series of review articles included in this volume of *Periodontology 2000* are focusing on five important big scenarios where complications and treatment errors may be originated: 1) periodontal or peri-implant soft tissue therapies (i.e., non-surgical periodontal treatment, periodontal plastic surgery, palatal soft tissue harvesting, and peri-implant soft tissue management); 2) periodontal or peri-implant hard tissue therapies (i.e., periodontal regenerative surgery, implant positioning, alveolar ridge preservation, peri-implant hard tissue management, sinus lift procedures, and peri-implantitis); 3) interdisciplinary approaches affecting the periodontium (i.e., orthodontics, prosthetic and restorative dentistry); 4) patients' systemic conditions (i.e., age-related factors and periodontal and implant therapy in medically compromised patients); and 5) the availability and interpretation of the evidence (i.e., lack of information about adverse events and poor understanding/interpretation of published research).

2 | DEFINING THE TYPES OF RISK AND THE CLINICAL IMPACT OF ADVERSE EFFECTS, ERRORS AND COMPLICATIONS

Different types of risk factors, adverse effects and complications can alter the course of the wound healing process of both non-surgical and surgical periodontal treatment as well as implant-related therapies. These complications and/or adverse effects can be initially categorized based on the timing they occur, as early (≤ 14 days) and late (> 14 days) adverse events. A comprehensive investigation of these risk factors, adverse effects and complications are important for proper decision-making not only for patients but also for treatment clinicians. Typically, the most common risk factors, adverse effects and complications could be categorized as:

- Local and systemic related-risk factors: traumatic habits (i.e., toothbrushing), poor plaque control, smoking, uncontrolled diabetes, antibiotic prophylaxis neglect... and many others;
- Technical related-risk factors: Improper selection of treatment tools and materials (e.g., instruments, surgical blades, and suture materials);
- Operator related-complications: improper flap management / handling (e.g., wrong incision and flap designs), poor flap elevation, position, and suture. Others include but are not limited to: excessive trauma, wrong management of tools / instruments, improper treatment choice, inadequate training for performing treatment procedures;
- Wound healing adverse events: The occurrence of adverse events during wound healing can be grouped into:
 - Adverse effects: pain, tenderness, swelling and bruises / ecchymosis.
 - Complications: bleeding, suture / wound dehiscence, involuntary exposure of a surgical site or grafts / biomaterials, infections and tissue necrosis.

Moreover, the overall clinical impact of the extension of their undesirable influence in the wound healing process, as well as the detrimental impact on the final treatment outcome cannot be fully anticipated, but they may be classified as of:

- Without potential harm: These are within the factors that may not influence or cause a detrimental impact on the outcome of interest following complete wound healing of the treated site (i.e., treatment predictability), but they are related to changes in the patient-reported outcomes during the early phase of healing (i.e. < 21 days post treatment) and can lead to potential discomforts. Pain, bleeding, swelling and bruise are the most common types of intercurrents.
- With potential harm (deleterious effect): Their occurrence may reduce (or even completely preclude) the achievement of potential gains anticipated by the periodontal or implant therapy upon complete wound healing of the area (i.e., 4 to 6 months post treatment). Mechanical trauma, suture / wound dehiscence, inadequate flap adaptation (i.e., wrong positioning and excess of tension), graft displacement, membrane / barrier exposure and infection may be considered harmful intercurrents.

Additionally, other types of “positive side effects” were also described in the literature, such as the occurrence of creeping attachment⁶⁻⁸ (i.e., coronal migration / displacement of the gingival margin) and bone exostosis^{9,10} (i.e., peripheral localized benign bone overgrowth), but their development have been reported to occur following complete wound healing (> 6 months) of sites submitted to soft tissue augmentation procedures (i.e., keratinized tissue augmentation and root coverage) through free gingival grafts or connective tissue grafts.⁶⁻¹⁰ However, it is not clear the reasons, the extension of hard and soft tissue improvements, the exact period(s) of development, and what exact circumstances may origin them.

3 | ACCIDENTAL ERRORS VERSUS THE LACK OF A PROPER TREATMENT PLANNING

The question whether an error occurred by an accident or not may be the starting point of more profound thoughts about the binomial formed by knowledge and skills. Over the course of a clinician's professional life it is expected a gradual improvement on both his's/her's technical knowledge and manual skill levels: the so-called "learning curve". On one hand, the balanced combination of these two factors will allow the clinician an "upgrade" to more complex techniques, as well as better safety and mechanical refinement. On the other hand, neither theoretical knowledge nor skills alone shall be used to define a treatment planning (i.e., improvement of theoretical knowledge does not necessarily mean improvement of skills or vice versa)

Consequently, and in order to prevent the occurrence of "accidental errors", clinicians must ask themselves the following questions: 1) *do I have technical knowledge enough to identify the main characteristics associated to the disease or condition of interest, such as its aetiology, anatomical features and its clinical behaviour over time?* 2) *what are the best treatment options available to solve the patient's clinical scenario?* and 3) *do I have sufficient clinical skills and training to manage the case properly?* These questions are very important and must be answered prior establishing any treatment plan. Why? Because professionals who are unaware of these perceptions (and own limitations) tend to be more fearless and to make more mistakes (the more knowledge a clinician acquires, the more fearful he/she will become about the potential risks associated with an inadequate decision-making).

For instance, theoretical knowledge alone may not allow the clinician to perform adequately a surgical procedure (e.g., performing incisions, harvesting a graft, or suturing a flap) whereas the most talented and skilled surgeon may not know when, where and why to perform (or not) a specific type of incision or suture. For sure, anatomic discrepancies or other local or systemic conditions may alter the behaviour of periodontal tissues, but these aforementioned basic examples (i.e., lack of theoretical knowledge, skills or both), most of the time, may be the source of most of "accidental errors". As a result, it is important to base every treatment plan on

the combination of the highest/best level of information available (so called evidence-based therapy), patient-reported outcomes (oral/medical history conditions and individual needs and preferences), and the clinician's knowledge and skills. With these, it is expected that both the 'brain' and the 'hands' should receive proper training to reduce the sources of errors and complications.

4 | NET BENEFIT RATIO BETWEEN CLINICAL IMPROVEMENT AND POTENTIAL ADVERSE EVENTS

In deciding which outcome measures should be used to base the periodontal and implant therapy decision-making process, the clinician will need to go a little deeper in the 'net benefit ratio' (i.e., the balance between clinical improvements promoted by the therapy and the occurrence of potential adverse events).¹¹⁻¹⁴ This issue is essential to restrict the application of therapies that, although effective in solving the patient's problems (those who stimulated them to seek periodontal/implant therapy) might lead to new complaints and functional or aesthetic restrictions. Therefore, the extension, direction and balancing level of confidence in the benefit estimate with potential for harm (i.e., benefits versus adverse events) deserves attention as follows:

- If the additional clinical benefits achieved with therapy may outweigh potential harms (adverse events), there is no doubt that the pre-established procedure might be applied to improve the patient's condition (i.e., change the original periodontal diagnosis).
- If the clinical benefits anticipated by a treatment procedure are considered modest, or even uncertain, but with potential harms, the clinician must think about the available alternative treatment options and mainly consider whether his/her knowledge and skills may be enough to support the proposed treatment plan. However, for situations where the benefits are balanced with potential harms, the same knowledge and skills may be used to question the use of a particular therapy.

- In cases where no clinical advantage has been identified by previous published evidence or potential harms may outweigh benefits, the use of this procedure should be discharged and alternative treatment options (e.g., gold standard procedures) must be implemented.

As part of professional experience, either for experienced and non-experienced clinicians, it's anticipated that everyone will have to deal with these adverse events. The issue is how to properly avoid them or even anticipate and take care of these problems when they occur. It seems also important to highlight that complications and adverse events may affect patient perception of the treatment and may have negative effects on future treatment. Therefore, the main message of this special issue of *Periodontology 2000*, is to call attention to the importance of preventing, reporting and adequate handling of these adverse events. In summary, the final proposed treatment plan should only be established after critically appraisal of benefits and risks ratio of the procedure, as well as assessing the extent of clinician's knowledge, training and clinical skills. Hopefully, the extension of potential adverse events associated with a therapy can be prevented and, thus proper treatment can be provided if these events happen.

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