

## Letter to the Editor

## Static Computer-Aided Implant Surgery: An Ally Against Bacterial Antimicrobial Resistance?

Oral antibiotics are some of the most used drugs in dentistry. Since the beginning of implant dentistry, preventive antibiotic therapy<sup>1</sup> (PAT) has been incorporated into dental implant procedures due to the presence of approximately 500 to 700 bacteria species in the oral cavity<sup>2</sup> and the consequent risk of contamination and infection of the surgical site.

The use of these medications in the mentioned procedures is questioned due to its associated side effects and potential complications (ie, toxicity in target organs) leading to a lack of agreement regarding the advantages and disadvantages of the prescription of PAT in dental implant procedures.<sup>3</sup> Besides what has been mentioned, the development of bacterial antimicrobial resistance (AMR) against most types of known antibiotics is a significant worldwide problem. AMR is related to increased hospital stays, treatment costs, and patient mortality and has become a major public health issue.<sup>4</sup> It is estimated that in the next few years, 390,000 people will die due to AMR in Europe,<sup>5</sup> and in the United States, there are more than 23,000 annual deaths associated with AMR.<sup>6</sup> Therefore, it is of utmost importance to review the prescription protocols of these medications, because if behavioral features of the problem does not change, dental procedures will contribute to it.<sup>4</sup>

Thus, many studies have been published trying to rationalise the prescription of PAT in implant dentistry.<sup>7</sup> Currently, the recommended trend is to prescribe 2 to 3 g of amoxicillin 1 hour before the procedure in ordinary dental implants, that is, those procedures with anatomic constraints,<sup>8</sup> in guided bone regeneration with the placement of dental implants in 1 or 2 stages,<sup>9</sup> and in second-stage or peri-implant plastic surgery procedures lasting more than 2 hours and/or where soft tissue grafts are used extensively.<sup>9</sup> Meanwhile, for other dental implant procedures, such as immediate implants, sinus lift procedures, and multiple implant placements, PAT is indicated during the preoperative phase and antibiotic therapy is given during the postoperative phase.<sup>7,10,11</sup>

In this regard, the above-mentioned surgical procedures are related to larger mucoperiosteal flaps, which are commonly associated with longer surgical time and major surgical trauma that increases the risk of contamination and surgical wound infection; both are related to early implant failure.<sup>12</sup> In fact, the placement of multiple implants has a higher prevalence of failure compared to single-unit implants (3.12<sup>13</sup> to 4.00<sup>14</sup> times), for this reason, it seems normal for clinicians to use higher doses of PAT in these procedures.

In this way, the use of virtual planning technologies in implant dentistry allows the combination of radiographic, prosthetic, surgical, and laboratory aspects, allowing complete virtual treatment planning and computer-aided clinical

execution. The incorporation of the mentioned technologies is expanding the possibilities to perform innovative treatment modalities, making the processes more accurate, faster, less invasive, and less expensive.<sup>15</sup>

Static computer-aided implant surgery (S-CAIS) offers the possibility of inserting multiple implants in an optimal tridimensional position with a lower surgical time compared to a conventional procedure. When the clinical situation allows S-CAIS to be performed under a flapless approach, the postoperative infection rate as well as the patient's inflammatory response are also decreased. Moreover, the computer-assisted procedure permits placing implants in limited anatomic regions, avoiding ridge augmentation procedures in many cases.<sup>16,17</sup>

As mentioned above, digital planning and S-CAIS seem to contribute to performing less invasive interventions, helping clinicians to modify the usage of PAT and therefore favor the prevention of increasing AMR.

Nevertheless, it is necessary to perform studies to analyse the prevalence of secondary infections in digitally assisted fully guided implant placement vs conventional implant placement regarding the PAT protocol used.

### Declaration of Competing Interest

None disclosed.

### REFERENCES

1. Salgado-Peralvo AO, Kewalramani N, Garcia-Sanchez A, Peña-Cardelles JF. "Antibiotic prophylaxis" and "preventive antibiotic therapy": two sides of the same coin. *J Stomatol Oral Maxillofac Surg* 2021;20 S2468-7855(21)00278-0. doi: [10.1016/j.jormas.2021.12.010](https://doi.org/10.1016/j.jormas.2021.12.010).
2. Salgado-Peralvo AO, Kewalramani N, Peña-Cardelles JF, et al. Preventive antibiotic prescribing habits among professionals dedicated to oral implantology: an observational study. *Antibiotics* 2021;10:301. doi: [10.3390/antibiotics10030301](https://doi.org/10.3390/antibiotics10030301).
3. Salgado-Peralvo AO, Sanz-Esporrín J, Mateos-Moreno MV, Haidar-Wehbe A, Blanco-Carrión A, Velasco-Ortega E. Antibiotic prophylaxis in oral implantology. A critical review of the literature. *Rev Esp Cir Oral Maxillofac* 2019;41:80–90. doi: [10.20986/recom.2019.1011/2018](https://doi.org/10.20986/recom.2019.1011/2018).
4. Organización Mundial de la Salud. Resistencia a los antibióticos. 2017.
5. O'Neill J. *Tackling drug-resistant infections globally: final report and recommendations. Review on Antimicrobial Resistance*. London: Wellcome Trust; 2016.
6. Dadgostar P. Antimicrobial resistance: implications and costs. *Infect Drug Resist* 2019;12:3903–10. doi: [10.2147/IDR.S234610](https://doi.org/10.2147/IDR.S234610).

7. Salgado-Peralvo AO, Velasco-Ortega E, Peña-Cardelles JF, et al. [Clinical practice guideline for the prescription of preventive antibiotics in oral implantology](#). Madrid: Spanish Society of Implants; 2021.
8. Romandini M, de Tullio I, Congedi F, et al. Antibiotic prophylaxis at dental implant placement: which is the best protocol? A systematic review and network meta-analysis. *J Clin Periodontol* 2019;46:382–95. doi: [10.1111/jcpe.13080](#).
9. Salgado-Peralvo AO, Mateos-Moreno MV, Velasco-Ortega E, Peña-Cardelles JF, Kewalramani N. Preventive antibiotic therapy in bone augmentation procedures in oral implantology: a systematic review. *J Stomatol Oral Maxillofac Surg* 2022;123:74–80. doi: [10.1016/j.jormas.2021.01.011](#).
10. Salgado-Peralvo AO, Uribarri A, Peña-Cardelles JF, Kewalramani N, Garnier-Rodríguez JL, Velasco-Ortega E. Does the prosthetic phase of dental implants justify the prescription of preventive antibiotics in healthy patients? A systematic review. *J Oral Implantol* 2022 Online ahead of print. doi: [10.1563/aaid-joi-D-21-00213](#).
11. Salgado-Peralvo AO, Peña-Cardelles JF, Kewalramani N, et al. Preventive antibiotic therapy in the placement of immediate implants: a systematic review. *Antibiotics* 2022;11:5. doi: [10.3390/antibiotics11010005](#).
12. Kim AS, Abdelhay N, Levin L, Walters JD, Gibson MP. Antibiotic prophylaxis for implant placement: a systematic review of effects on reduction of implant failure. *Br Dent J* 2020;228(12):943–51. doi: [10.1038/s41415-020-1649-9](#).
13. French D, Larjava H, Ofec R. Retrospective cohort study of 4591 Straumann implants in private practice setting, with up to 10-year follow-up. Part 1: multivariate survival analysis. *Clin Oral Implants Res* 2015;26:1345–54. doi: [10.1111/clr.12463](#).
14. Figueiredo R, Camps-Font O, Valmaseda-Castellón E, Gay-Escoda C. Risk factors for postoperative infections after dental implant placement: a case-control study. *J Oral Maxillofac Surg* 2015;73:2312–8. doi: [10.1016/j.joms.2015.07.025](#).
15. Lanis A, Llorens P, Álvarez del Canto O. Selecting the appropriate digital planning pathway for computer-guided implant surgery. *IJ Comp Dent* 2017;20(1):75–85.
16. Moraschini V, Velloso G, Luz D, Porto-Barboza E. Implant survival rates, marginal bone level changes, and complications in full-mouth rehabilitation with flapless computer-guided surgery: a systematic review and meta-analysis. *Int J Oral Maxillofac Surg* 2015;44:892–901. doi: [10.1016/j.ijom.2015.02.013](#).
17. Laleman I, Bernard L, Vercruyssen M, Jacobs R, Bornstein M, Quirynen M. Guided implant surgery in the edentulous maxilla: a systematic review. *Int J Oral Maxillofac Implants* 2017;31:s103–17. doi: [10.11607/jomi.16suppl.g3](#).

Juan-Francisco Peña-Cardelles\*

Ignacio Pedrinaci

Elli Kotina

Alejandro Lanis

Department of Restorative Dentistry and Biomaterials Sciences,  
Harvard School of Dental Medicine, Boston, Massachusetts, USA

Angel-Orión Salgado-Peralvo

Department of Dental Clinical Specialties, Universidad Complutense  
de Madrid, Spain

\*Corresponding author. Harvard School of Dental Medicine, 188  
Longwood Avenue, Boston MA 02115.

E-mail address: [Juan\\_PenaCardelles@hsdm.harvard.edu](mailto:Juan_PenaCardelles@hsdm.harvard.edu)

(J.-F. Peña-Cardelles).

0020-6539/© 2022 The Authors. Published by Elsevier Inc. on  
behalf of FDI World Dental Federation. This is an open access  
article under the CC BY-NC-ND license  
(<http://creativecommons.org/licenses/by-nc-nd/4.0/>)  
<https://doi.org/10.1016/j.identj.2022.12.004>