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Comparison of Postoperative Healing in Bilateral Maxillary Sinus Lift Surgery: Chlorexidine Gel 0.12% X Bluem Gel

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Abstract

There are several postoperative protocols that can be carried out after oral surgery, all of them aim to maintain local hygiene and the patient's general well-being, so that healing can happen normally. Despite the prescription of products based on Chlorhexidine (CHX) being the most indicated by dentists, some patients have sensitivity and/or resistance due to its excessive use, for which it is necessary to test other alternative formulations. The present article is a split-mouth and compared study, comparing through a photographic protocol, the clinical evolution with the analysis of photographic pixels, generated by the ImageJ® software, of the post-surgical healing of a bilateral maxillary sinus lift surgery, in a same patient who used 0.12% CHX Gel on the left side, and BlueM Gel on the right side, for 5 consecutive days. Clinically, it was noted that healing took place more quickly on the right side, with tissue contraction in the posterior area, more tissue in pink (less inflamed), and a large concentration of immature vessels (neo-vessels) in the center of the lesion, which indicates the beginning of tissue granulation formation. When interpreting the program data, although the right side, on the fifth day, still has more red dots (9.2%) compared to the other side (8.2%), this side has more pink dots (28.4%) when compared to the left (26.4%), thus corroborating the clinical findings. Therefore, the product can be an alternative for patients who are not sensitive to any of its components felt in the formula, seeking healing interference.

Keywords: Healing, Chlorhexidine, Oxygen, Dental Implant

Introduction

Well-performed surgical dental procedures include three different phases that need to be respected and developed with the best possible aptitude by the professional who performs them, being the pre, trans and post-operative periods [1].

Within post-operative care, it is possible to mention the importance of cleaning the wound, placing protective bandages if necessary, administering medications and daily clinical control of the patient and his respective surgical wound [1].

There are several post-operative protocols that can be carried out after oral surgery, all of which aim to maintain local hygiene and the patient's general well-being, so that healing occurs normally [1].

Antiseptics are products the most commonly used as aids for cleaning the oral cavity, including the mouth, teeth and gums. These come in the form of sprays, tablets, gels or lotions that contain antiseptic compounds such as Chlorhexidine, salicylic acid, hydrogen peroxide, triclosan, sodium fluoride, thymol, eucalyptol, among others in their formulation [2].

Although the prescription of Chlorhexidine-based products are the most recommended by dentists, a new Dutch product based on active oxygen presents itself as an alternative for patients who are sensitive to Chlorhexidine or who are resistant to it due to its excessive use [2].

The present article is a split-mouth study that compared, through a photographic protocol, the clinical evolution of postoperative healing following bilateral maxillary sinus lifting surgery, using

0.12% Chlorhexidine Gel on one side. and on the other BlueM Gel, for 5 consecutive days.

Methodology

The study is a research with daily photographic monitoring, of just one patient and had its opinion substantiated by the Research Ethics Committee (CEP) of the Universidade do Oeste de Santa Catarina (UNOESC), approved under number 5,667,040 (CAAE 61233822.8.0000.5367).

Male patient, 55 years old, systemically healthy, not using controlled medication, sought a dental clinic for fixed prosthetic rehabilitation through the installation of osseointegrated implants. After anamnesis, clinical and radiographic evaluation of the case, it was considered surgically lifting the maxillary sinuses (right and left) using the lateral window technique, given an initial insufficient amount of local bone for implant placement.

At the end of the surgical procedure, the healing of the injured tissues was monitored in a clinical environment, where antiseptic gels were applied to the wounds. The maxilla was divided in half with the help of a pencil, using the patient's midline as a reference. On the right side, BlueM Gel was applied, and on the left side, Chlorhexidine Gel (CHX) 0.12%.

The applications carried out for 5 consecutive days and were made once a day every 24 hours, for a period of 15 minutes, simultaneously. After this period, the gels were removed and the patient's oral cavity was washed with distilled water.

All photographs were taken by the same dental surgeon (CD), with the same Canon® DS1262291 camera, with FF22, ISO AUTO, 1/125, MANUAL MODE, CANON MACRO LENS EF 100mm 1:2.8 USM, ULTRASONIC, and the same YONGNUO DIGITAL® Macro Ring Lite YN14EX flash in 1/16, directly, without the use of intra-oral mirrors, just lip retractors, so that the patient was lying in the dental chair at an angle of approximately 30 degrees in relative to the floor, and the DC standing, positioned on the right side and in front of the patient.

The images obtained were analyzed by ImageJ® Software, which counted red and pink pixels on the different healing days (day 1 to day 5), on both sides individually, followed by a comparison. The pink pixels represent better healed tissue, and the red pixels represent inflammation. The data quantified by the program were compared with the clinical evolution of the patient's healing.

Results

Clinical Evolution

Initially, a very similar pattern of postoperative inflammation was observed on both surgical sides, analyzing the incision line made on the crest of the alveolar ridge, which provided access for the lifting.

On both sides, the presence of local edema, generalized inflammation with several red dots, inflammatory exudate and bacterial plaque on the synthetic suture thread (Absorbable Vicryl from Ethicon) was noted on both sides (figure 1).

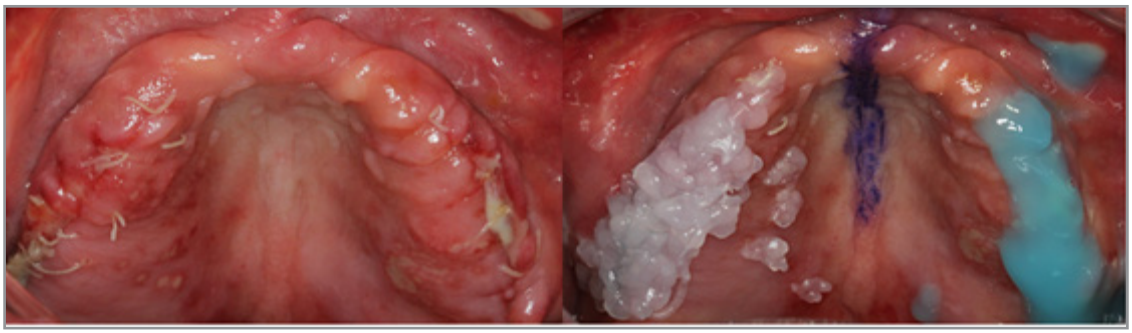


Figure 1: DAY 1- Clinical Analysis, and application of the products Gel BlueM (right/white), and CHX 0.12% (left/blue).

On the second day, an area still swollen on both sides can be seen, with a greater amount of bacterial plaque when compared to the first day, however a more pinkish color than reddish in the anterior area on the right side can be noticed (Figure 2) .

Figure 2: DAY 2- Clinical Analysis, and application of the products Gel BlueM (right/white), and CHX 0.12% (left/blue).

On the third day, in addition to an improvement in the color of the injured tissue, the tissue contraction began in the posterior area on the right side, resulting from the reduction in edema, while on the left side there was a subtle improvement (figure 3).

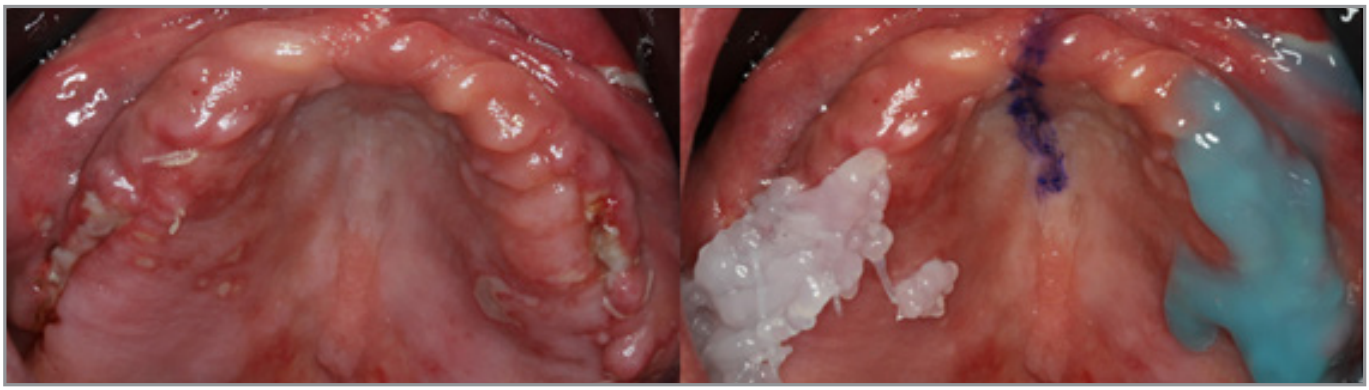


Figure 3: DAY 3- Clinical Analysis, and application of the products Gel BlueM (right/white), and CHX 0.12% (left/blue).

On the fourth day, healing is similar on the right and left side, with the reduction of most of the red inflammation points (figure 4), at this point the suture threads are being absorbed by the body itself or loosening, consequently reducing the amount of plaque local bacterial seen clinically.

Figure 4: DAY 4- Clinical Analysis, and application of the products Gel BlueM (right/white), and CHX 0.12% (left/blue).

On the fifth day, it appears that healing is happening more quickly on the right side, where tissue contraction is seen in the posterior area, more tissue with a pink color (less inflamed), and a large concentration of immature vessels (neo-vessels) in the center of the lesion, which indicates the beginning of granulation tissue formation. On the left side, there is an improvement compared to the fourth day, however the tissue appears to be healing slower (figure 5), as neo-vessels are not yet visible superficially in the center of the tissue, unlike on the other side (figure 6) .

Figure 5: DAY 5- Clinical Analysis, and application of the products Gel BlueM (right/white), and CHX 0.12% (left/blue).

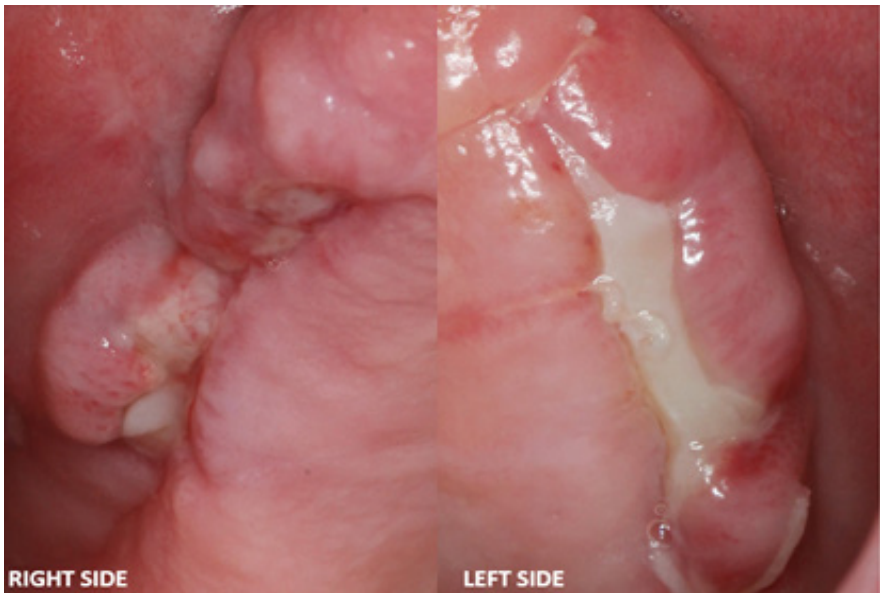


Figure 6: Magnification of images and clinical comparison between right and left side on the 5th day. The presence of superficial neo-vessels in the center of the healing lesion on the right side can be analyzed.

Color Intensity

To check the color intensity, a pixel analysis was carried out in each image. Table 1 presents the data values obtained with the analysis and it is concluded that initially the right side had more red dots (30.1%), suggestive of inflammation, than the left side (28.8%). Furthermore, the tissue had fewer pink spots (14.4%), suggestive of healthy tissue when compared to the left side (16.5%). However, at the end of the research, although the right side still had more red dots (9.2%), compared to the other side (8.2%), this side still had more pink dots (28.4%) when compared to the left (26.4%).

Table 1: Comparison of red and pink pixels separated according to right and left sides.

Day	Side	Red	Pink
1	Right	30,0561	14,4251
	Left	28,8036	16,5444
2	Right	20,9978	20,0318
	Left	18,1685	18,12401
3	Right	23,4846	28,3479
	Left	21,2489	21,2286
4	Right	10,5021	19,1125
	Left	9,3728	20,9928
5	Right	9,2299	28,3782
	Left	8,2668	26,4461
Average	Right	18,8540	22,0600
	Left	17,1720	20,6660
p[1] Value	Right	0,010*	0,453
	Left		

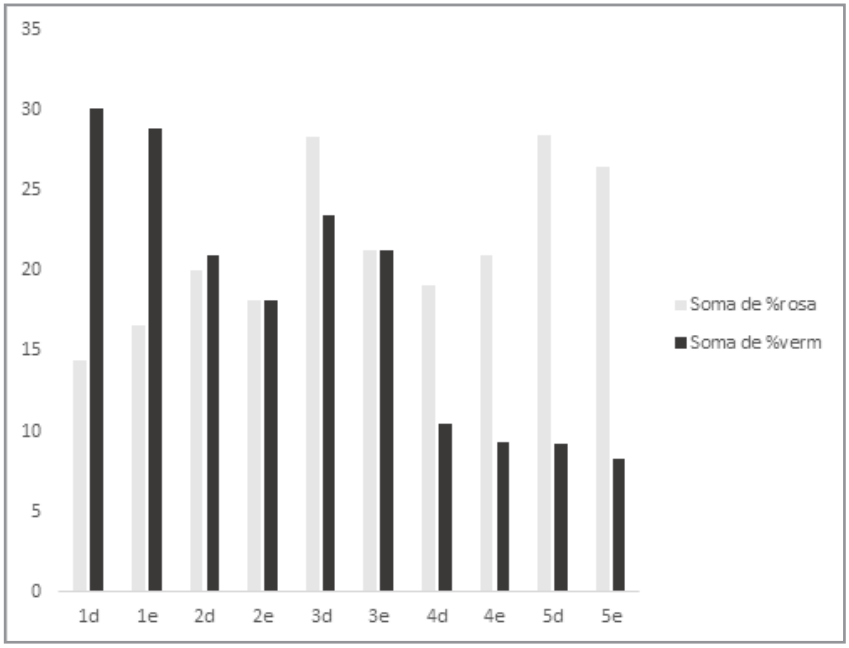
[1] = Paired Samples T-Test. * = statistically significant.

Furthermore, Graph 1 shows the progression of healing over the 5 days and the number of pixels analyzed day by day. When comparing only the initial and final number of pixels (DAY 5-DAY 1), on the right side the increase in those colored in pink was 14%, on the left side the value was 9.9%, resulting in 4.1% of difference between them.

Regarding the red ones, the difference was smaller, both sides considerably reduced the number of pixels counted (DAY 1-DAY 5), however the right side showed a reduction calculated at 20.9% and the left 20.5%, resulting in a difference of 0.4%.

It is also evident that until the second day the red pixels predominated, only from the third day that the pink ones became the

majority. Although on the fourth day a greater number of pink were recorded on the left side, on the last day (fifth), there was a reversal of dominance, with the right side showing a higher percentage, therefore demonstrating more efficient healing.



Graph 1: Number of pink and red pixels per day in each photograph.

Discussion

Based on the data above and taking into account the tissue healing process, which is complex, dynamic, and involves three phases (containing stages) with various types of cells, we sought to relate the results with the composition of each product and the phases of healing [3].

Called the inflammatory phase, the first phase of the healing process begins immediately after the injury, lasting 1 to 5 days. In this, hemostasis occurs, followed by the release of chemical substances, such as cytokines and growth factors that attract inflammatory cells to the injured area, this explains the local edema and generalized inflammation seen clinically, also the greater amount of red pixels counted on the first and second day of research [4-6].

The second phase, called proliferative, lasts from 3 to 21 days after the beginning of the lesion, includes re-epithelialization, matrix synthesis and neovascularization of the area. The stages of neo-angiogenesis, epithelialization, fibroplasia and formation of granulation tissue (composed of neo-vessels, evolution of neo-angiogenesis) follow, the initial milestone in scar formation. Fibroblasts and endothelial cells are the predominant and most important cells in this phase [4-6].

In the present study, the clinical findings and quantitative data extracted from the images corroborate the literature, since clinically an improvement in the tissue condition is observed, with healing progress and a higher count and pink pixels from the third day onwards.

The third phase, or remodeling phase, begins about 21 days after initiation and can last several months or years. During this period, the granulation tissue reorganizes and matures, making the scar tissue stronger and more resistant. The density and organization of collagen are altered and the number of cells decreases, resulting in wound contraction and scar formation, however this phase has not been analyzed [4-6].

On both surgical sides, none of the products used accelerated the healing process to the point where we could see distinct phases, both sides remained in the second phase. However, on the right side where BlueM Gel was used, more pink pixels were counted, suggesting faster healing.

Even though BlueM Gel was used on the right side on which was the most traumatized side during the maxillary sinus lifting surgery, with the presence of a septum, which makes the technique difficult, and explains the greater quantity of initial red pixels, this side presented a greater decrease in these comparing day 1 and day 5.

It can also be inferred that the right side presented more red dots at the final moment, because diferently the left side, the more accelerated healing generated superficial neo-vessels in the center of the injured tissue, counted by the software as points of inflammation, however the appearance of the tissue is not similar to initial inflammation, but rather to the beginning of granulation tissue formation.

This is because BlueM Gel contains a combination of ingredients such as water, alcohol, glycerin, silica, sodium saccharin, sodium perborate, citric acid, sodium gluconate, PEG-32, cellulose gum, xanthan gum and lactoferrin, which accelerate healing according to some studies [7-11]. The sodium perborate present in the formula, in contact with the injured tissue, releases active oxygen in small portions, aiding healing through its topical action [12].

Oxygen therapy has been used for years in wound treatment, as it boosts cellular activitie [13]. In the mouth, it causes fibroblasts to produce more collagen and stimulates the proliferation of keratinocytes [14]. Active oxygen also accelerates the healing process because it increases the recruitment of leukocytes, the revascularization of injured tissue through neo-angiogenesis and helps in the formation of matrix extracelular [15, 16].

The oxygen released slowly and gradually by both the rinses and the gel leads to a reduction in the bacterial load adhered to lesions colonized by anaerobic bactéria [17, 18].

Lactoferrin is also part of the product's composition which is a protein present in breast milk that has antimicrobial and anti-inflammatory properties, which stimulates the activity of neutrophils (the body's defense cells, which help fight infections). Glycoprotein can bind to iron ions, which are necessary for the growth and proliferation of bacteria and fungi, depriving them of this essential nutrient and preventing their growth [11].

Used on the left side, Chlorhexidine is an antimicrobial agent effective against a wide variety of microorganisms, including bacteria, fungi and viruses. Its action occurs through binding to the lipids of the cell membranes of these microorganisms, causing damage and consequent death [19, 20].

At a concentration of 0.12% it is safe and effective for use in the mouth, as long as it is used correctly [21]. In the present study, it proved to be effective by reducing the number of red pixels, increasing the number of pink pixels and improving the clinical conditions on the patient's left side.

Used to treat and prevent wound infections as an antiseptic, it is considered the gold standard by numerous scientific studies [22-24]. However, its indiscriminate use by patients has led to a condition in which bacteria develop the ability to survive or grow in the presence of this antimicrobial agent [25, 26].

Therefore, it is important to study other alternative formulations to Chlorhexidine, aiming at new treatment possibilities for already resistant patients and reducing side effects caused by inappropriate use, such as stains on teeth, skin irritation and allergic reactions, which can include numerous symptoms that ranging from local irritation to cases of anaphylaxis [27].

Considered effective for topical use for a short-term period (maximum of three weeks), prolonged use of Chlorhexidine can impair healing, because the product can interfere with the proliferation and migration of cells important to the healing process, such as epithelial cells. and fibroblasts [28].

Some studies also suggest that incorrect use of Chlorhexidine can decrease cell adhesion, which can affect the proper formation of granulation tissue and, therefore, wound healing [29].

Due to the patient's limitations in traveling to the dental clinic, the present study was restricted to just 5 consecutive days of daily application of the products (every 24 hours), so no problem with healing was observed due to excessive use of the gels.

Final Considerations

A more accelerated healing can be seen on the patient's right surgical side, where BlueM® Gel was used, evidenced by clinical analysis and ImageJ® software, which indicates an increase in the number of pink pixels when comparing day 1 with day 5. (difference of 4.1%), and also a greater drop in the count of red pixels (difference of 0.4%).

Therefore, the product can be an alternative in the postoperative period of oral surgeries, for patients who are not sensitive to any of the components described in the formula, especially for those allergic and/or resistant to Chlorhexidine.

As this is a study with a single patient, it is necessary to conduct research using the same materials and methods, aiming for a larger sample and consequently more reliable results.

References

1. HUPP James R, TUCKER Myron R, ELLIS Edward (2015) Contemporary Oral and Maxillofacial Surgery. Rio de Janeiro: Elsevier 6: 692.
2. Danilo Barral de Araujo, Elvira Maria Borges Gonçalves, Gabriela Botelho Martins, Max José Pimenta Lima, Maria Thereza Barral Araújo (2015) Oral health: the importance of mouthwashes with antiseptics. Journal of Medical and Biological Sciences 14: 88-93.
3. Clark RAF (2005) Wound repair. In: Kumar, Robbins, Cotran: Pathologic Basis of Disease, 7th ed., Ed. Saunders 112.
4. Geoffrey C Gurtner, Sabine Werner, Yann Barrandon, Michael T Longaker (2008) Wound repair and regeneration. Nature 453: 314-321.
5. Lawrence WT, Diegelmann RF (1994) Growth factors in wound healing. Clin Dermatol 12: 157-169.
6. Aldo Cunha Medeiros, Antônio Medeiros Dantas Filho (2016) Healing of surgical wounds. J Surg Cl Res 7: 87-102.
7. Bruna Marca Mattei, Soraia A W Imanishi, Grasieli de Oliveira Ramos, Paloma Santos de Campos, Suyany Gabriely Weiss, et al. (2021) Mouthwash with Active Oxygen (blue®m) Reduces Postoperative Inflammation and Pain. Case Rep Dent 2021: 5535807.
8. Leonardo Rosalen da Silva, Soraia Almeida Watanabe Imanishi, Léa Maria Franceschi Dallanora, Amanda Lopes, Jaques Luiz, et al. (2021) Pilot study of different approaches to pain management in patients with oral mucositis undergoing cancer treatment at a university hospital in Southern Brazil. Full Dent Sci 12: 109-114.
9. Schreml S, Szeimies RM, Prantl L, Karrer S, Landthaler M, et al. (2010) Oxygen in acute and chronic wound healing. Br J Dermatol 163: 257-268.
10. Makelva IM, Tambortseva NV (2014) Applying toothpaste and mouthwash BLUEM in complex oral care in patients with coronary heart disease. Stomatologlia(mosk) 93: 18-20.
11. Blijdorp P (2010) Effective solution to periodontitis and peri-implantitis. Bluem: Innovation in implant care 2010: 1-3.
12. David E Eisenbud (2012) Oxygen in Wound Healing: nutriet, antibioctic, signaling molecule and Therapeutic Agent. Clin Plastic Surg 39: 293-310.

13. Bruna Marca Mattei, Soraia A W Imanishi, Grasieli de Oliveira Ramos, Paloma Santos de Campos, Suyany Gabriely Weiss, et al. (2021) Mouthwash with Active Oxygen (blue®m) Reduces Postoperative Inflammation and Pain. Case Rep Dent 2021: 5535807.
14. Wei Cheong Ngeow, Chuey Chuan Tan, Yet Ching Goh, Tatiana Miranda, Chia Wei Cheah (2022) A Narrative Review on Means to Promote Oxygenation and Angiogenesis in Oral Wound Healing. Bioengineering 9: 636.
15. David R Knighton, Thomas K Hunt, Heinz Scheuenstuhl, Betty J Halliday, Zena Werb, et al. (1983) Oxygen tension regulates the expression of angiogenesis factor by macrophages. Science 221: 1283-1285.
16. Anisha Koul, Ritika Kabra, Rahul Chopra, Nikhil Sharma, Vidya Sekhar (2019) Comparative evaluation of oxygen releasing formula (Blue-M Gel®) and chlorhexidine gel as an adjunct with scaling and root planing in the management of patients with chronic periodontitis--A clinico-microbiological study. Journal of Dental Specialities 7: 111–117.
17. Emanuelle Juliana Cunha, Caroline Moreira Auersvald, Tatiana Miranda Deliberador, Carla Castiglia Gonzaga, Fernando Luis Esteban Florez, et al. (2019) Effects of Active Oxygen Toothpaste in Supragingival Biofilm Reduction: A Randomized Controlled Clinical Trial. Int J Dent 2019: 3938214.
18. Tatiana Miranda Deliberador, Suyany Gabriely Weiss, Felipe Rychuv, Gabriele Cordeiro, Michele Caroline Lima Ten Cate, et al. (2020) Comparative analysis in vitro of the application of blue oral gel versus chlorhexidine on Porphyromonas gingivalis: a pilot study. Adv Microbiol 10: 194-201.
19. Hugo WB, Longworth AR (1964) Some aspects of the mode of action of chlorhexidine action. Pharm Pharmacol 16: 655-662.
20. Gjermo, PA (1978) Chlorhexidine in dental practice. RGO 26: 22- 26.
21. Araujo MTB, Araujo RPC, Campos EJ (2001) In vitro and in vivo study of the bactericidal activity of 0.12% and 0.2% chlorhexidine and the pharmacological products Listerine and Duplax. Rev Odonto Ciênc 16: 187-200.
22. Harald Löe, Rindom Schiøtt C (1970) The effect of mouthrinse and topical applicacions of chlorhexidine on the development of plaque and gingivitis in man. J Periodotol Res 5: 79-83.
23. Rolla G, Melsen B (1975) On the mechanism of plaque inhibition by chlorhexidine. J Dent Res 54: 57-62.
24. Rindom Schiøtt C, Harald Löe (1972) The sensitivity of oral streptococci to chlorhexidine. J Periodont Res 7: 192-194.
25. Walmyr Ribeiro de Mello, Nara Evangelista, Juliana Marques, Roseane Vasconcelos Gouveia, Adriana Seber (2017) Protocolo de cuidados bucais para mucosite oral em TCTH utilizando produtos à base de dióxido de cloro estabilizado 0,02%. Braz J Transplant 20: 19-23.
26. Garvey LH, Roed-Petersen J, Husum B (2003) Is there a risk of sensitization and allergy to chlorhexidine in health care workers? Acta Anaesthesiol Scand 47: 720-724.
27. Matthew Toomey (2013) Preoperative Chlorhexidine Anaphylaxis in a Patient Scheduled for Coronary Artery Bypass Graft: A Case Report. AANA J 81: 209-214.
28. Kathrin Schedler, Ojan Assadian, Uta Brautferger, Gerald Müller, Torsten Koburger, et al. (2017) Proposed phase 2/ step 2 in-vitro test on basis of EN 14561 for standardised testing of the wound antiseptics pvp-iodine, chlorhexidine digluconate, polihexanide and octenidine dihydrochloride. BMC Infect Dis 17: 143.
29. Eric Röhner, Paula Hoff, Timo Gaber, Annemarie Lang, Pauline Vörös, et al. (2015) Cytokine expression in human osteoblasts after antiseptic treatment: a comparative study between polyhexanide and chlorhexidine. J Invest Surg 28: 1-7.