Knowledge level regarding the prescription of antibiotics within the dentistry field

Nivel de conocimiento sobre prescripción de antibióticos, en el campo odontológico

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Abstract

Antibiotic drugs represent a great tool in various dental treatments. However, their inappropriate use has been shown to negatively impact patients' health and the resistance of microorganisms, which can trigger future health crises. **Objective:** To determine dental students' knowledge level regarding the prescription of antibiotics during the 2021-2022 period. **Materials and Methods:** This research was observational, descriptive, and current cross-sectional. The questionnaire consisted of 14 items. Scores from 0 to 5 were stated as a low level of knowledge, 6 to 10 as a medium, and 11 to 14 as high. **Results:** There was an association between the variables of academic semester level and the level of knowledge. In terms of gender, there was no association. **Conclusion:** Despite having an acceptable level of knowledge, there is evidence of the need to reinforce and refine it in students regarding the management of antibiotic medications.

Key Words: Drug Prescriptions, Anti-Bacterial Agents, Students, Dental Staff, Knowledge

Resumen

Los fármacos antibióticos representan una gran herramienta en diversos tratamientos dentales, sin embargo, el uso inadecuado de los mismos ha mostrado tener impactos negativos tanto en la salud de los pacientes, como en la resistencia de microorganismos, lo que pudiese desencadenar en crisis sanitarias a futuro. **Objetivo:** Determinar el nivel de conocimiento de los estudiantes de odontología, respecto a la prescripción de antibióticos, en el periodo 2021-2022. **Materiales y Métodos:** Esta investigación fue de tipo observacional, descriptivo y transversal actual, la encuesta constó de 14 ítems, donde se consideró los puntajes de 0 a 5 como nivel de conocimiento bajo, 6 a 10 como medio y 11 a 14 como alto. **Resultados:** Hubo asociación entre las variables ciclo de estudio y nivel de conocimiento, en cuanto a la variable sexo no hubo asociación estadística. **Conclusión:** A pesar de tener un nivel aceptable de conocimiento, se evidenció la necesidad de reforzar y profundizar el mismo en los estudiantes, en cuanto refiere al manejo de fármacos antibióticos.

Palabras Clave: Prescripciones de medicamentos, antibacterianos, estudiantes, personal de odontología, conocimiento.

Introduction

Since the discovery of antibiotics until modern times, their use has been evolving and perfecting. However, health professionals often misuse or use them inefficiently, excessively, or unnecessarily, which triggers problems in the patient's organism[1-7]. This misuse causes a reduction in the effectiveness of pharmacotherapy, an increase in unnecessary risks for the patient, cost increases, difficulty in supply, more significant logistical challenges within public health, and the reduction of antibiotic options for the patient in the later stages of his life. Indeed, antibiotic inappropriate prescription would not provide sufficient benefit yet, it runs the risk of causing side effects ranging from gastrointestinal disturbances to fatal anaphylactic shock and emergence of resistant bacteria, and yields greater health. In addition, it is estimated that it

could have socioeconomic implications in the future, causing an antibiotic crisis that could affect the world economy and especially the growth of developing countries[1,8-16].

The use of antibiotic substances dates back to 1550 BC. However, it was not until 1928, and thanks to the discovery of penicillin by Alexander Fleming, that more in-depth studies began to be carried out. Later, Norman Heatley and his colleagues in Oxford purified this substance, laying the foundations for modern antibiotic therapy. Then, beginning in 1940, with the work of Selman Waksman, which is considered the golden age of antibiotics, allowing the development of various antibiotics based on substances produced by families of microorganisms such as Streptomyces, Amycolatopsis, Bacillus, among others, which produced antibiotic substances as chemical weapons against other organisms. When isolated allowed the development of drugs such as tetracyclines, macrolides, lincosamides, and other smaller families of antibiotics, being later created as antibiotic drugs of synthetic origin such as Quinolones and Sulfonamides[3,17-21].

Antibiotics have different mechanisms of action on microorganisms, including inhibition of the cell wall synthesis, alteration of cell membrane function, inhibition of protein synthesis, inhibition of nucleic acids formation, and prevention of the folic acid synthesis, causing cell death of the microorganism. They have minimal impact on the host, thus preventing the uncontrolled spread of infection in the body or acting as a prophylactic to prevent complications[1,17,22-24].

The proper pharmacological management always seek to safeguard the risk-benefit ratio in favor of the care and protection of the patient's health[1-3]. Therefore, the professional must know in depth the drugs they handle, including pharmacological properties, indications, contraindications, precautions, adverse reactions, warnings, restrictions, pharmacological interactions, pharmacokinetics, pharmacodynamics, toxicology, dosage, routes of administration, and different presentations according to the local availability[4-5,9].

The inadequate use of antibiotic therapy has severe consequences for the patient and public health worldwide. [16-17,25] Among the problems related to the inadequate administration of antibiotics, which specifically affect the patient, are the lack of care regarding dosage and interaction with other drugs, which could cause problems of varying severity in the physiology of the internal structures of the body, especially in the gastrointestinal system, kidneys, and liver. These may cause irreversible damage and effects such as allergic reactions. In other cases, it may interfere with the functioning of other drugs, causing the annulment, potentiation, or reduction of their pharmacological effects. All these factors could put the patient's life at risk and, in the worst case, cause their death[5,15,19-20,26].

In world public health, the most significant concern is the adaptation of microorganisms to drugs through various mechanisms, causing the so-called antibiotic resistance. Such mechanisms are the destruction of the antimicrobial agent by enzymes, reduction of the permeability of the cell membrane, capacity to identify and expel the antibiotic from its interior, modification of the target point to avoid the entry of the antibiotic, and changes in its metabolism to evade the drug. Moreover, after having survived contact with the antibiotic, microorganisms can use one or several of these mechanisms and transmit them to subsequent generations when reproducing, allowing their evolution. Eventually, they become Super Bacteria, with greater capacity for contagion, survival, reproduction, and resistance to most currently available drugs[16,27-30]. This is further aggravated by the frequency with which the general population self-medicates[31-32,] which in the future could cause an enormous increase in the mortality rate due to infections of bacterial origin[1].

Resistance to antibiotics is a process that has adaptively occurred throughout history by microorganisms and their interaction with the environment. However, the massive use of antibiotics in the modern era has led to accelerating these adaptations, which results in a catastrophic scenario concerning the preservation of human health. Some main factors affecting this problem are overpopulation in specific geographical centers, increased global migration, greater use of antibiotics in clinics and animal production, excessive prescription of certain pharmacological groups, poor sanitation, invasive fauna, and deficient sewage disposal systems[15-17,20,26].

Since antibiotic therapy is one of the main pillars of modern medicine, antimicrobial resistance poses a serious global threat of growing concern for human, animal, and environmental health. This concern is due to the emergence, spread, and persistence of multidrug-resistant bacteria or superbugs. The superbugs exist in the triangle of animal, human and environmental niches, so the inadequate prescription by health professionals, coupled with self-medication, inappropriate use at the veterinary level, and the release of them into the environment by feces and urine in water systems, facilitate the emergence of multidrug-resistant bacterial infections in the community. Furthermore, releasing them into the environment through feces and urine in water systems facilitates the appearance of multiresistant bacterial infections in the community, becoming a problem we must face as professionals and as a society. Otherwise, we risk losing or reducing the effectiveness to a great extent of one of the tools that have been crucial in medicine to extend both human life expectancy and the quality of life in modern society[2,29,31-34].

For this reason, the purpose of this research is to identify the knowledge level of professionals in training in dentistry concerning the prescription of antibiotics, which will serve the respondents themselves to identify the shortcomings concerning the subject and thus reinforce them and will also be helpful for the dental community, allowing them to recapitulate various essential topics on antibiotic therapy. Thus, this study aims to determine dental students' knowledge of prescribing antibiotics in 2021-2022 to highlight possible shortcomings and thus refine their knowledge, allowing them to perform better in the professional field.

Materials and Methods

The present study is an observational, descriptive, and cross-sectional study, and a survey previously validated by experts was used as an instrument.

Among the inclusion criteria, the participants had to be students of Dentistry and belong to the following academic cycles: sixth, seventh, eighth, ninth, tenth cycle or have recently graduated.

Regarding exclusion criteria, those who did not accept to be part of the research or had any condition that threatened their autonomy, those who filled out surveys incompletely or erroneously, and students in cycles lower than those mentioned above. Finally, a non-probabilistic convenience sample of 200 students was obtained.

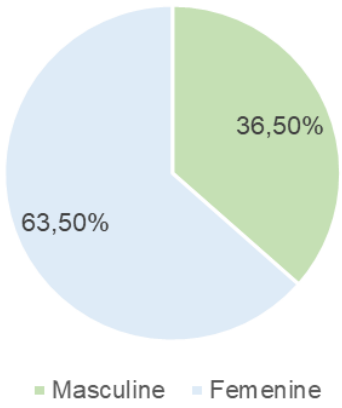
It was used an electronic survey elaborated in an open access software (Google forms). The survey consisted of 14 items that evaluated knowledge about posology, prophylactic prevention, dry socket management, pregnancy, and alternatives in case of allergies. Scores from 0 to 5 were considered a low level of knowledge, 6 to 10 medium, and 11 to 14 high.

The data collected were evaluated and validated before being processed and analyzed for the elaboration of the results.

Results

It was observed in Graph 1 that most of the sample was female, so the results of this study cannot be generalized, nor can they represent the entire population of the institution.

Graph 1: Distribution of participants



The statistical analysis demonstrated a statistical association (p= 0.004) between the study cycle and the level of knowledge, showing an increase in the medium and high-level parameters while the low-level parameter decreased. These results could be attributed to the experience and knowledge that the students acquire during their studies. However, it is evident that a considerable number of them still need to refine their understanding of pharmacotherapy to practice the dental profession adequately.

The statistical analysis indicated (p=0.33) that there is no statistically significant association between the level of knowledge and the sex of the student, but rather as shown in Table 1, it tends to be more related to the knowledge and experience that increases in the course of the development of the career.

Table 1: Knowledge level of dental students according to study cycle.

Knowledge Level	Gender		Seventh		Eight		Ninth		Tenth		Graduated		Total	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Low	17	41,46	10	58,82	12	24,49	7	26,92	8	16,67	0	0	54	27
Medium	21	51,22	7	41,18	35	71,43	15	57,69	34	70,83	10	52,63	122	61
High	3	7,32	0	0	2	4,08	4	15,38	6	12,5	9	47,37	24	12
Total	41	20,5	17	8,5	49	24,5	26	13	48	24	19	9,5	200	100

X^2=45,67 p=0,004

Table 2: Knowledge level of dental students according to gender.

Knowledge Level	Male		Female		Total	
	n	%	n	%	n	%
Low	22	30,14	32	25,2	54	27
Medium	43	58,9	79	62,2	122	61
High	8	10,96	16	12,6	24	12
Total	73	36,5	127	63,5	200	100

X^2=0,58 p=0,33

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Discussion

In their study, Cantero et al.[5], carried out in Paraguay, in 2019, on antibiotic management in allergic and pregnant patients, the level of knowledge of dental students showed that the highest representation was in the medium level of expertise with 60%. Colque.[7], in his study in Peru, in 2017, on the level of knowledge of dental students regarding antibiotic prescription, indicated that most of them had an average level of expertise represented by 50%. Santana et al.[8], in a study carried out in Ecuador, in 2020, on the level of knowledge in antibiotic therapy in university students, indicated that the highest percentage was also in the medium level of knowledge, being a similar result to this study where most students also had a medium level of knowledge. Which could indicate that even though various instruments were used since there is no standard form of evaluation for the level of knowledge on the management of antibiotic therapy, certain deficiencies are evident in the knowledge of the students in each of the studies, indicating that it is necessary to reinforce their knowledge in the field.

Colque[7] indicates that the highest percentage was found in students of the eighth cycle with 63.33%, which agrees with this study where the highest rate was also found in the average level of knowledge of students of the eighth cycle with 71.43%, 43%. These results could be attributed to the level of experience and knowledge, since in both studies, as they approach career completion, there is a decrease in the percentages of low level and an increase in both the medium and high level.

Colque[7], also mentions that concerning gender, no relevant discrepancies demonstrate an association with this variable. Furthermore, the values obtained between the two sexes were quite similar; Zevallos et al.[9], in a study carried out in Peru in 2021, found no association between sex and the level of knowledge, coinciding in turn with the findings of this study, which could indicate that sex is not a variable to be taken into account for the evaluation of the level of knowledge in the pharmacological field in students in the health area.

Ramachandran et al.[15], in a study about the implications of overprescribing antibiotics conducted in India in 2019, indicated that most participants prescribed antibiotics without careful thought, indiscriminately, and inappropriately. Furthermore, Teoh et al.[26], in their research on antibiotic resistance in general dental practice, in Australia 2018, indicated an increase in antibiotic prescriptions. However, often in an uncontrolled manner or without proper diagnostic justification, indicating both authors mentioned in this study that the dental community has considerable responsibility for the problem of antibiotic resistance, so it is necessary for professionals to increase their knowledge in the pharmacological field, which could help to reduce the possible impact of the antibiotic crisis.

Conclusion

Correctly handling drugs is fundamental in any health profession, and the objective should always be for the patient's benefit. Therefore, although most of the participants in the study obtained acceptable scores, in a minimum percentage, the need to provide feedback on the subject treated is observed. In this way, the dentist's contribution will total the multidisciplinary team they belong to.

Limitations of the study

Due to the disparity of the sample and the lack of standardized instruments for evaluating these criteria, there may be discrepancies with results obtained in other studies.

Authors' contributions

Christian Andrés Orellana Alpala: Coordination, execution, and writing of the research article.

Katherine de los Ángeles Cuenca León. Revision of the writing and Methodological Design. Validation of the final work.

Daniela Calle, Edisson Pacheco, Eleonor Vélez. Design and execution of fieldwork, validation of the work.

References

1. Hernández R, Pozos A, Chavarría D. Conocimiento de protocolos de terapia antibiótica por estudiantes de Odontología de universidades costarricenses. Odovtos [Internet]. 2018 [Cited 2021 Nov 25]; 20(3):93-104. Available at: https://www.scielo.sa.cr/pdf/odovtos/v20n3/2215-3411-odovtos-20-03-93.pdf

2. Pacheco E, Cuenca K, Paladines S. Automedicación en estudiantes de Odontología de la Universidad Católica de Cuenca, Ecuador. Salud [Internet]. 2018 [Cited 2021 Nov 25]; 2(2):1-6. Available at: https://killkana.ucacue.edu.ec/index.php/killcana_salud/article/view/245/443

3. Idrovo P, Gutiérrez K, Castillo G, Ordoñez A. Antibióticos indicados en odontología. Oactiva [Internet]. 2019 [Cited 2021 Nov 25]; 4(Esp):63-68. Available at: https://oactiva.ucacue.edu.ec/index.php/oactiva/article/view/409/554

4. Romero D, Díaz C. "Nivel de conocimiento sobre antibióticos y su aplicación en los alumnos de la clínica odontológica del VIII y X semestre de la facultad de odontología de la Universidad Católica de Santa María 2017". U.C.S.M.F.O. [Internet]. 2018 [Cited 2021 Nov 25]; 1:1-123. Available at: http://tesis.ucsm.edu.pe/repositorio/bitstream/handle/UCSM/7839/64.2802.O.pdf?sequence=1&isAllowed=y

5. Cantero R, Villasanti U. Conocimientos sobre prescripción de antibióticos en pacientes alérgicos y embarazadas de los estudiantes del 4to y 5to año de la facultad de odontología de la Universidad Nacional de Caaguazú en el año 2019. U.N.C.F.O. [Internet]. 2020 [Cited 2021 Nov 25]; 1:1-71. Available at: https://odontounca.edu.py/wp-content/uploads/2021/06/CANTERO-RODRIGO.pdf

6. Mandal N, Rauniyar G, Rai D, Panday D, Kushwaha R, Agrawal S, Regmee P. Self-medication Practice of Antibiotics among Medical and Dental Undergraduate Students in a Medical College in Eastern Nepal: A Descriptive Cross-sectional Study. JNMA J Nepal Med Assoc. [Internet]. 2020 [Cited 2021 Nov 25]; 58(225):328-332. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7654467/pdf/JNMA-58-225-328.pdf

7. Colque N. “Nivel de conocimientos sobre la prescripción de antibióticos en los estudiantes de la clínica odontológica de la UNA-Puno, 2017”. U.N.A.F.O. [Internet]. 2020 [Cited 2021 Nov 25]; 1:1-69. Available at: http://repositorio.unap.edu.pe/bitstream/handle/UNAP/7368/Colque_Yanapa_Noem%c3%ad.pdf?sequence=1&isAllowed=y

8. Santana N, Rodríguez A, Thomas M. “Nivel de conocimientos acerca de los antibióticos más utilizados en odontología, en los estudiantes de la clínica de grado de UNIBE, periodo 2020. U.I.F.O. [Internet]. 2020 [Cited 2021 Nov 25]; 1:1-99. Available at: https://repositorio.unibe.edu.do/jspui/bitstream/123456789/280/1/160658_TF.pdf

9. Zevallos A, Cornejo J. Relación entre el nivel de conocimiento y actitud sobre la prescripción antibiótica en estudiantes de estomatología de la Universidad Privada de Huancayo Franklin Roosevelt. U.R.F.O. [Internet]. 2021 [Cited 2021 Nov 25]; 1:1-42. Available at: https://repositorio.uroosevelt.edu.pe/bitstream/handle/ROOSEVELT/386/TESIS%20MARTIN%20-%20ANA%20ELBIA.pdf?sequence=1&isAllowed=y

10. Jairoun A, Hassan N, Ali A, Jairoun O, Shahwan M. Knowledge, attitude and practice of antibiotic use among university students: a cross-sectional study in UAE. BMC Public Health [Internet]. 2019 [Cited 2021 Nov 25]; 19(1):1-8. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6501289/pdf/12889_2019_Article_6878.pdf

11. Doshi A, Asawa K, Bhat N, Tak M, Dutta P, Bansal T, Gupta R. Knowledge and practices of Indian dental students regarding the prescription of antibiotics and analgesics. Clujul Med [Internet]. 2017 [Cited 2021 Nov 25]; 90(4):431-437. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5683835/pdf/cm-90-431.pdf

12. AboAlSamh A, Alhussain A, Alanazi N, Alahmari R, Shaheen N, Adlan A. Dental Students’ Knowledge and Attitudes towards Antibiotic Prescribing Guidelines in Riyadh, Saudi Arabia. Pharmacy (Basel) [Internet]. 2018 [Cited 2021 Nov 25]; 6(2):1-8. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6025366/pdf/pharmacy-06-00042.pdf

13. Peña G, Rodríguez A, Anselmi A, Barrera B, Maira S, González A, Reyes M. “Patrón de prescripción de antibióticos en la Facultad de Odontología UNCuyo, en el tratamiento de infecciones de origen endodóntico: “. Revista de la Facultad de Odontología [Internet]. 2018 [Cited 2021 Nov 25]; 12(2):23-28. Available at: https://bdigital.uncu.edu.ar/objetos_digitales/13357/peagracielarfo-1222018.pdf

14. Ahmadi H, Ebrahimi A, Ahmadi F. Antibiotic Therapy in Dentistry. Int J Dent [Internet]. 2021 [Cited 2021 Nov 25]; 2021:1-10. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7861949/pdf/IJD2021-6667624.pdf

15. Ramachandran P, Rachuri N, Martha S, Shakthivel R, Gundala A, Battu T. Implications of Overprescription of Antibiotics: A Cross-Sectional Study. J Pharm Bioallied Sci. [Internet]. 2019 [Cited 2021 Nov 25]; 11(2):S434-S437. Available at: https://www.jpbsonline.org/temp/JPharmBioallSci116434-2021871_053658.pdf

16. Veses V, Del Mar S, González R, Cortell I, Sheth C. Raising awareness about microbial antibiotic resistance in undergraduate dental students: a research-based strategy for teaching non-laboratory elements of a microbiology curriculum. BMC Med Educ. [Internet]. 2020 [Cited 2021 Nov 25]; 20(1):1-9. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7014758/pdf/12909_2020_Article_1958.pdf

17. Hutchings M, Truman A, Wilkinson B. Antibiotics: past, present and future. Curr Opin Microbiol. [Internet]. 2019 [Cited 2021 Nov 25]; 51:72-80. Available at: https://reader.elsevier.com/reader/sd/pii/S1369527419300190?token=1EF29BCE80910FB9DAF0EEC-1C7B498E7CE1B5466E8F0D7CA9D3ACC3B8D7E9FF997EDB4A35529DEF966F3C53A268FEF2E&originRegion=us-east-1&originCreation=20211230021220

18. Colmenares M, Hoffmann I, Guerrero E, Pérez H. Uso racional de AINEs y antimicrobianos en odontopediatría. Salus [Internet]. 2015 [Cited 2021 Nov 25]; 19(3):31-40. Available at: http://ve.scielo.org/pdf/s/v19n3/art07.pdf

19. Dayer M, Thornhill M. Is antibiotic prophylaxis to prevent infective endocarditis worthwhile. J Infect Chemother [Internet]. 2018 [Cited 2021 Nov 25]; 24(1):18-24. Available at: https://eprints.whiterose.ac.uk/123995/1/JIC-D-17-00361R1.pdf

20. Aidasani B, Solanki M, Khetarpal S, Ravi S. Antibiotics: their use and misuse in pediatric dentistry. A systematic review. Eur J Paediatr Dent. [Internet]. 2019 [Cited 2021 Nov 25]; 20 (2): 133-138. Available at: https://www.ejpd.eu/pdf/EJPD_2019_20_2_10.pdf

21. Spivak E. Antibiotic Use in Dentistry-What We Know and Do Not Know. JAMA Netw Open [Internet]. 2019 [Cited 2021 Nov 25]; 2(5):1-3. Available at: https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2734793

22. Robles P, Javierre A, Moreno N, Mas A, Frutos E, Morató M. Manejo de las infecciones odontogénicas en las consultas de atención primaria: ¿antibiótico? [Management of odontogenic infections in Primary Care: Antibiotic?]. Aten Primaria [Internet]. 2017 [Cited 2021 Nov 25]; 49(10):611-618. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6876037/pdf/main.pdf

23. Lockhart P, Tampi M, Abt E, Aminoshariae A, Durkin M, Fouad A, Gopal P, Hatten B, Kennedy E, Lang M, Patton L, Paumier T, Suda K, Pilcher L, Urquhart O, O’Brien K, Carrasco A. Evidence-based clinical practice guideline on antibiotic use for the urgent management of pulpal- and periapical-related dental pain and intraoral swelling: A report from the American Dental Association. J Am Dent Assoc [Internet]. 2019 [Cited 2021 Nov 25]; 150 (11): 906-921. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8270006/pdf/nihms-1701240.pdf

24. Maslamani M, Sedeqi F. Antibiotic and Analgesic Prescription Patterns among Dentists or Management of Dental Pain and Infection during Endodontic Treatment. Med Princ Pract [Internet]. 2018 [Cited 2021 Nov 25]; 27(1):66-72. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5968269/pdf/mpp-0027-0066.pdf

25. Tampi M, Pilcher L, Urquhart O, Kennedy E, O’Brien K, Lockhart P, Abt E, Aminoshariae A, Durkin M, Fouad A, Gopal P, Hatten B, Lang M, Patton L, Paumier T, Suda K, Cho H, Carrasco A. Antibiotics for the urgent management of symptomatic irreversible pulpitis, symptomatic apical periodontitis, and localized acute apical abscess: Systematic review and meta-analysis-a report of the American Dental Association. J Am Dent Assoc [Internet]. 2019 [Cited 2021 Nov 25]; 150(12):e179-e216. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8098651/pdf/nihms-1676921.pdf

26. Teoh L, Stewart K, Marino R, McCullough M. Antibiotic resistance and relevance to general dental practice in Australia. Aust Dent J. [Internet]. 2018 [Cited 2021 Nov 25]; 63(4):414-421. Available at: https://onlinelibrary.wiley.com/doi/10.1111/adj.12643

27. Giunta C, Soto M, Acevedo A. Medical-dental considerations in the care of children with facial cellulitis of odontogenic origin. A disease of interest for pediatricians and pediatric dentists. Arch Argent Pediatr [Internet]. 2018 [Cited 2021 Nov 25]; 116(4):e548-e553. Available at: https://www.sap.org.ar/docs/publicaciones/archivosarg/2018/v116n4a17e.pdf

28. Durkin M, Hsueh K, Sallah Y, Feng Q, Jafarzadeh S, Munshi K, Lockhart P, Thornhill M, Henderson R, Fraser V. Centers for Disease Control and Prevention Epicenters. An evaluation of dental an-

tibiotic prescribing practices in the United States. J Am Dent Assoc [Internet]. 2017 [Cited 2021 Nov 25]; 148(12):878-886. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5705569/pdf/nihms907191.pdf

29. Alzahrani A, Alzahrani M, Aldannish B, Alghamdi H, Albanghali M, Almalki S. Inappropriate Dental Antibiotic Prescriptions: Potential Driver of the Antimicrobial Resistance in Albaha Region, Saudi Arabia. Risk Manag Healthc Policy [Internet]. 2020 [Cited 2021 Nov 25]; 13:175-182. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7062393/pdf/rmhp-13-175.pdf

30. Durkin M, Feng Q, Suda K, Lockhart P, Thornhill M, Warren K, Munshi K, Henderson R, Fraser V. Centers for Disease Control and Prevention Epicenters. Longitudinal antibiotic prescribing trends among US dental specialists within a pharmacy benefits manager, 2013 through 2015. J Am Dent Assoc [Internet]. 2019 [Cited 2021 Nov 25]; 150(10):846-853. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7954126/pdf/nihms-1676914.pdf

31. Torres D, Villavicencio E, Cuenca K. Automedicación en el campo odontológico en una población adulta. Archivos Venezolanos de Farmacología y Terapéutica [Internet]. 2021 [Cited 2022 Jun 21]; 40(8):1-4. Available at: https://zenodo.org/record/5792254

32. Cuenca K, Pacheco E, Granda Y, Vélez E, Zarzuelo A. Phytotherapy: A Solution to Decrease Antifungal Resistance in the Dental Field. Biomolecules [Internet]. 2022 [Cited 2022 Jun 21]; 12(789):1-16. Available at: https://www.mdpi.com/2218-273X/12/6/789/htm

33. Guamán J, Sarmiento J, Sarmiento P, Pacheco E. Avances y perspectivas en films bucales aplicados en odontología. AVFT [Internet]. 2022 [Cited 2022 Jul 20]; 41(3):163-171. Available at: https://www.revistaavft.com/images/revistas/2022/avft_3_2022/3_avances_perspectivas_films.pdf

34. Alvarracin M, Cuenca K, Pacheco E. Nanopartículas Antimicrobianas en Odontología: Estado del arte. AVFT [Internet]. 2021 [Cited 2022 Jul 20]; 40(8):839-847. Available at: https://www.revistaavft.com/images/revistas/2021/avft_8_2021/15_nanoparticulas_antimicrobianas.pdf