

Efficacy of controlled-flux electrolyzed acidic solution in dogs with otitis externa

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Article Info	Abstract
<p>Article history:</p> <p>Received: 17 May 2020 Accepted: 03 October 2020 Available online: 15 June 2022</p> <p>Keywords:</p> <p>Controlled-flux electrolyzed acidic solution Dog Mexico Otitis externa</p>	<p>Otitis externa is an inflammatory disease of the external ear canal; a therapeutic alternative is the controlled-flux electrolyzed acidic solution (SAEFC) with bactericidal and bacteriostatic properties. The purpose of this study was to evaluate the clinical and cytological efficacies of SAEFC in otitis externa. A total of 30 dogs were examined. The clinical and cytological evaluations were on days 1, 7 and 14; the following was considered: Pain, erythema, exudate, inflammation, ulcers, putrid odor and pigmentation. Cytological evaluations were carried out to examine the presence of polymorphonuclear leukocytes (PMN), intra-cellular bacteria (cocci; IC), extra-cellular bacteria (EC) and yeasts on days 1, 7 and 14. A cotton swab saturated with SAEFC was applied for each dog's ear. The values of PMN diminished having a significant difference between days. The presence of IC (cocci) had a difference in evaluations from day 1 to day 7 and from day 7 to day 14 demonstrating an important drop. The evaluation of pain showed a sustained decrease until reaching 95.00% of remission, erythema diminished 68.33%, the exudate dropped to 90.00%, inflammation was no longer present by day 14 in 78.00% of the cases and 21.67% showed a slight inflammation, the putrid odor dropped to 95.00% and 5.00% presented a mild odor and by day 14 ear pigmentation was no longer present in 51.67% of the cases and the 48.33% had slight pigmentation. The use of SAEFC is an effective alternative treatment in dogs with otitis externa.</p> <p style="text-align: right;">© 2022 Urmia University. All rights reserved.</p>

Introduction

Otitis externa is an inflammatory disease of the external ear canal.^{1,2} The cytological examination of the otic exudate is the common diagnostic method used to direct and control the treatment of otitis externa.³ Treatments for this condition include topical therapy; the use of glucocorticoid has been known to help reduce pain and inflammation. Generally, the systemic antibiotic therapy for the treatment of otitis externa is not recommended as it results in anti-microbial resistance.¹ The otitis externa will have an increase in earwax production throughout the external ear canal providing the environment suitable for a secondary infection by bacteria like *Staphylococcus spp.* or *Pseudomonas* generating biofilm and yeasts like *Malassezia spp.* developing an allergic response and pruritus;⁴ this can result in the recurrence of infections and chronic diseases and may lead to the ablation of the ear canal;⁵ hence, the

importance of controlling the balance of microbiota in the ear is why researches regarding alternative therapies such as extracts and essential oils of plants and honey have been completed.⁶

Another substance of recent appearance is the controlled-flux electrolyzed acidic solution (SAEFC) by its initials in Spanish creating an acidic atmosphere in which the microbial reproduction is prevented. This solution, with a pH less than 3.00, has been used to disinfect wounds (aerobic or anaerobic bacteria), treat diabetic ulcers and infected surgical wounds and prevent burn wound infections.⁷⁻⁹ In addition, since there is an important bacterial dysbiosis in the otitis infections, this solution could be useful to diminish the microorganism habitats. Therefore, the aim of this study was to examine the clinical and cytological efficacies of SAEFC (Natural ElectroBioral®, EJ Laboratories, Guanajuato, Mexico) in dogs with otitis externa.

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Materials and Methods

The study was developed in the Dermavet Veterinary Hospital, Mexico City, Mexico. All the patients' owners signed a consent agreement form that clearly outlined the clinical treatment trial for each patient. The study was supported by the Committee on Ethics of the Autonomous University of the Mexico State, Toluca, Mexico, with record number of 240/CUAMECAMECA/UAEMEX/2020.

Animals. A controlled, randomized study was conducted for a period of 14 days which included 30 dogs of different genders, breeds and ages with clinical and cytological evidence of otitis externa and a diagnosis of canine atopic dermatitis. The clinical signs consisted of otitis externa including at least one ear with evidence of erythema, pain and secretion of the external ear canal. Dogs with cytological evidence of infectious otitis externa (presence of cocci, bacteria and yeasts) were included and the cases that had received some treatments or ear topical cleanser within two previous weeks to the sample taking and systemic anti-fungal or antibiotics medication within three previous months as well as dogs with some other dermatological or systemic diseases were excluded. The necessary information was gathered to generate an epidemiological and clinical data base.

Sampling. After general dermatological and otic examinations, a sterile cotton swab was inserted in both external ear canals and rubbed in at least 180 degrees. The cotton swab was then smeared in different directions on a glass microscope slide and it was dyed with Diff-Quik to be seen under the microscope. The clinical and cytological evaluations were on days 1, 7 and 14 and included pain, erythema, exudate, inflammation, ulcers, putridness and pigmentation, considering a scale of negative (0), mild (1), moderate (2) and severe (3). The evaluations of the presence of polymorphonuclear leukocytes (PMN), intra-cellular (IC) bacteria (cocci), extra-cellular bacteria (EC) and yeasts were on days 1, 7 and 14.³

Treatment. After the examination, sample taking and revision of cytology, a saturated cotton swab was applied for each dog's ears. The saturation solution was consisted of SAEFC (Natural Electrobioral®) and remained in the ear for 15 min, four times a day for 14 days.

Statistical analysis. The data were analyzed through the Wilcoxon test between day 1 and the measurements of days 7 and 14, with a 0.05 alpha. The analysis was also made through test of Wilcoxon rank test (pairs) to determine if there is a difference between days of each variable with 0.05 alpha using JMP statistical Software, (version 0.8; JMP Statistical Discovery LLC, Cary, USA).

Results

The comparison between evaluations of each variable of days 1 and 7 and days 7 to 14 showed that the values of

PMN diminished significantly between days 1 to 7 and from days 7 to 14 and the IC (cocci) showed a difference in evaluations on days 1 to 7 and from days 7 to 14 demonstrating an important drop. The average of EC (cocci) presented a significant difference between days 1 to 7 and from days 7 to 14 and the yeasts diminished significantly from days 1 to 7 and from days 7 to 14 (Table 1). Table 2 shows the frequencies for each variable during the days of clinical evaluation.

Table 1. Comparison of the presence of polymorphonuclear leukocytes (PMN), intra-cellular bacteria (IC), extra-cellular bacteria (EC) and yeasts in ears treated with controlled-flux electrolyzed acidic solution.

Microorganisms	Day 1	Day 7	Day 14
PMN	3.93	0.85*	0.10*
IC	0.80	0.16*	0.03†
EC	10.00	2.36*	0.63*
Yeast	4.23	1.30*	0.23*

*† indicate significant differences between the two adjacent columns at $p = 0.0001$ and $p = 0.03$, respectively.

Table 2. Frequencies (%) of clinical evaluations in ears treated with controlled-flux electrolyzed acidic solution.

Parameters	Day 1	Day 7	Day 14
Pain			
No	7(11.66)	51(85.00)	57(95.00)
Mild	48(80.00)	9(15.00)	3(5.00)
Moderate	4(6.67)	0(0.00)	0(0.00)
Severe	1(1.67)	0(0.00)	0(0.00)
Erythema			
No	8(13.33)	30(50.00)	41(68.33)
Mild	19(31.67)	26(43.33)	19(31.67)
Moderate	21(35.00)	3(5.00)	0(0.00)
Severe	12(20.00)	1(1.67)	0(0.00)
Exudate			
No	14(23.33)	48(80.00)	54(90.00)
Mild	26(43.34)	10(16.67)	6(10.00)
Moderate	17(28.33)	2(3.33)	0(0.00)
Severe	3(5.00)	0(0.00)	0(0.00)
Inflammation			
No	9(15.00)	18(30.00)	47(78.33)
Mild	17(28.33)	39(65.00)	13(21.67)
Moderate	21(35.00)	3(5.00)	0(0.00)
Severe	13(21.67)	0(0.00)	0(0.00)
Ulcers			
No	19(31.67)	46(76.67)	56(93.33)
Mild	24(40.00)	11(18.33)	4(6.67)
Moderate	11(18.33)	3(5.00)	0(0.00)
Severe	6(10.00)	0(0.00)	0(0.00)
Putrid odor			
No	9(15.00)	50(83.33)	57(95.00)
Mild	31(51.67)	10(16.67)	3(5.00)
Moderate	18(30.00)	0(0.00)	0(0.00)
Severe	2(3.33)	0(0.00)	0(0.00)
Pigmentation			
No	16(26.66)	22(36.67)	31(51.67)
Mild	32(53.33)	33(55.00)	29(48.33)
Moderate	11(18.33)	5(8.33)	0(0.00)
Severe	1(1.68)	0(0.00)	0(0.00)

The pain evaluation showed a sustained decrease until reaching 95.00% remission in the ears, erythema decreased by 68.33%, the exudate dropped to 90.00% of the ears, inflammation was no longer present by day 14 in 78.00% of the cases and 21.67% presented mild inflammation, ulcers decreased by day 14 in 93.33% of the cases and 6.67% had mild ulcers, by day 14 of the treatment putridness decreased to 95.00% and 5.00% presented a slight odor and by day 14 ear pigmentation was not present in 51.67% of the cases and 48.33% presented mild pigmentation.

Discussion

The election of a treatment for canine otitis externa is a subject that must be analyzed at great length. Recent studies have demonstrated a change in the bacterial populations between allergic and healthy dogs and this can explain the tendency of allergic dogs to develop bacterial otitis. Microbiota of the ear canal have shown changes in diversity; there is evidence of dysbiosis in atopic dogs and with otitis externa.¹⁰ It is important to maintain the balance of the otic microbiota to avoid a chronic and persistent disease by secondary infections of bacteria and yeasts; therefore, diverse topical treatments have been reported; glucocorticoids may be used for a short period of time to help to reduce the pain and inflammation. However, they should be used with caution and in some geriatric patients they are contraindicated.¹ As an anti-microbial treatment, the systemic antibiotic therapy to treat otitis externa is discouraged due to the global problem of anti-microbial resistance.¹¹ The use of alternative treatments of natural substances, like honey and herbal extracts for otitis externa has positive results.^{6,12} In recent years, SAEFC (Solución Ácida Electrolizada de Flujo Controlado in Spanish) has been used in wounds, burns and total matricectomy healing protocols for diabetic patients.⁷ In this study, this treatment was used as the only therapy for canine otitis; no other anti-microbial or anti-fungal drug was administered to avoid attributing the results of the variables evaluated in this work. It was also determined that patients with severe pain represented only 1.67% of all the dogs in the study; so, it was not necessary to administer any analgesic or anti-inflammatory drug during the treatment with electrobioral; however, electrobioral can be effective in combination with other drugs. The cytological evaluations of this research showed that PMN, IC, EC and yeasts decreased between day 1 of application and day 7 and from days 7 to 14; these results can be explained because electrobioral has a pH minor to 3.00. In previous studies, this quality of the product has shown effectiveness to create an atmosphere preventing the inappropriate reproduction of microorganisms;

however, this has been analyzed only in the bacterial load.⁷ In this study, the effectiveness of treatment in otic infection was also observed in the decrease of the presence of yeasts. The clinical evaluations showed that pain had a sustained decrease until reaching 95.00% of remission, erythema diminished 68.33%, the exudate dropped to 90.00% in ears, inflammation was no longer present by day 14 in 78.00% of the cases and 21.67% showed a slight inflammation, the ulcers were in remission by day 14 in the 93.33% of the cases and 6.67% presented mild ulcers, by day 14 of the treatment, putridness was reduced by 95.00% and 5.00% presented a mild odor and by day 14, ear pigmentation was not present in 51.67% of the cases and the 48.33% presented slight pigmentation showing the effectiveness in the control of the clinical signs agreeing with Marcos-Tejedor *et al.*,⁹ reports saying that SAEFC is useful to control ulcers without clinical infection that do not require antibiotherapy as it can be used as a prophylactic to control the excess of bacterial load and to prevent the development of possible later infections. In infected ulcers, it could be a useful adjuvant to the treatment with antibiotics for Gram-positive infections (mild) or Gram-negative and obligatory anaerobic ones (moderate and severe). Nevertheless, that study did not carry out clinical evaluations; just evaluations by bacterial culture. In this study, there was a total recovery by day 14, having a result faster than the one reported by Martínez Nova *et al.*,⁷ in which the total time of recovery was 29 days; this difference can be due to the type of infection. In comparison with some ototoxic medications like aminoglycoside antibiotics,¹³ SAEFC did not produce any ototoxic change and was safe during the 14 days of treatment; thus, agreeing with Marcos-Tejedor *et al.*,⁹ who used SAEFC in healthy hallucal skin determining that this solution has a bacteriostatic and bactericidal effect. This effect is observed when there is a greatly increased bacterial load in the wound; thus, favoring the normal formation of granulation tissue in the skin and normal healing of otitis.

In conclusion, the use of SAEFC as the only alternative treatment is effective for dogs with external otitis. This is the first report of effectiveness of use of the solution to prevent bacterial replication in the external auditory canal. Furthermore, it is important to mention that it was also helpful for yeast infection. The acidic solution of controlled flow is adequate for the management of the main clinical signs in patients with external otitis. The topical use of electrobioral was effective as the only treatment given; however, it could be combined with other drugs as it did not produce any ototoxic effects in this study.

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None.

Conflict of interest

The authors declare no conflict of interest.

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