Innovative complex formulation as topical treatment for peri-implantitis

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Abstract

The application of an active mixture of melatonin, hyaluronic acid and tetracycline, as antibiotic adjuvant therapy in peri-implantitis is exploited. The hyaluronic acid gel has been used as matrix for this topical mixture. The mixture of active ingredients has been structurally studied applying UV-Vis and FT-IR spectrophotometry and fluorescence microscopy. Our target was to put in evidence if melatonin, hyaluronic acid and tetracycline were preserving their specific characteristics when they would be mixed together. The recorded results are encouraging as each active compound maintains its characteristic functional groups imparting their biological action. The improved topical treatment based on melatonin, hyaluronic acid and tetracycline is presenting itself as a promising candidate for topical treatment in peri-implantitis.

Results

Background and Aim

Peri-implantitis, pathological condition occurring in tissues around dental implants, characterized by inflammation in the periimplant mucosa and progressive loss of supporting bone, is of major interest in contemporary dentistry. Mechanical debridement associated with the use of chlorhexidine, eventually combined with administration of systemic or local antibiotics, could reduce bleeding and probing depth but with no regenerative effects.

A pharmaceutical combination of melatonin, hyaluronic acid and tetracycline was prepared to be used as topical treatment for peri-implantitis.

The aim of the present study was to investigate if each component of the proposed treatment formulation would maintain its specific characteristics.

Conclusion

The experimental results put in evidence unique spectra which combine the specific absorption bands/peaks for each individual compound. Also, the fluorescence microscopy proved that no structural changes occurred at the level of the functional groups of the components. Thus, it is possible to conclude that no interactions occur between the compounds used to obtain the complex mixture and they would preserve their specificity in mixed formulations.

Therefore, it is expected that the obtained formulation would combine the specific local action of melatonin, hyaluronic acid and tetracycline and may be effective for topical treatment of peri-implantitis.

λ^{-1} (cm^{-1})	Functional group	Vibration
3422	O-H	Sym. stretching
3306	N-H	Amide bending
3260	C-N	Stretching
3016	C-H aromatic	Sym. stretching
2918	CH_3	Asym. stretching
1654	$\text{CONH}(\text{C}=\text{O})$	Stretching
1546	C-C aromatic	Stretching
1473	CH_2	Bending
1397	C=C	Sym. stretching
1303	C-O	Asym. stretching
1245	C-O	Sym. stretching
1161	C-O (alcohol)	Sym. stretching
1078	C-O (alcohol)	Asym. stretching
962	C-C-H	Sym. stretching
937	C-C-C	Asym. bending

The FT-IR spectrum detail for the complex matrix, clearly highlights the presence of characteristic absorption bands for each drug used.

Methods and Materials

Melatonin, with proved antioxidant and anti-inflammatory effects, acting as a mediator in bone formation and resorption, hyaluronic acid with high molecular weight, having beneficiary role in tissue injury repair, wound healing and immunosuppression and tetracycline, with antimicrobial effect, were mixed in a new proposed formulation for topical use in peri-implantitis.

The structural changes of the new material's components have been investigated with fluorescence spectroscopy, ultraviolet-visible spectrophotometry (UV-Vis), Fourier-transform infrared spectroscopy (FTIR) and microscopy techniques. In order to take advantage of the specific fluorescence behavior of melatonin and tetracycline the confocal fluorescence microscopy (instrument equipped with a fluorescence metal-halide lamp Leica EL6000) was applied.

References

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