



Effectiveness of bio-adhesive gels in control of dental plaque and gingivitis in pediatric subjects

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Dento-periodontal diseases of children and adolescents are still widely prevalent in the world, and also in Italy, especially in those situations characterized by socio-economic imbalances. Preventive strategies are mainly oriented towards the nutritional control of fermentable carbohydrates, the education of school-age subjects in dental hygiene, and the use of fluorides. Fluorides are added to the oral cavity of growing subjects with different methods. The main route of administration is toothpaste, the benefit of which is linked to the concentration of fluoride, which must be modulated to avoid the risk of fluorosis. In addition to fluoride, other substances have been shown to be effective in controlling the harmful effects of biofilms on the periodontium of children and adolescents. Among these, Cetyl-pyridinium chloride and essential oils are now at the center of interest of researchers. The present study highlights the positive effects on the dento-periodontal tissues of a group of adolescents, deriving from the coordinated use of two innovative gels (Hobagel 365 Junior and Hobagel Plus Junior). The active ingredients contained in them (CPCs, essential oils, fluorides, A.H.) combined with a system of bio-adhesion to the tissues allow optimal control of supragingival plaque and bleeding on probing. Quintessence Int. 2022; 36(3):XX-XX.

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Introduction

With particular reference to subjects of growing age, dental caries is considered as a progressive manifestation of an imbalance in the interaction of specific bacterial strains of dental plaque and fermentable carbohydrates present in the oral cavity. Bacterial biofilm is also the primary cause of periodontal diseases, which in younger subjects are mainly represented by the different forms of gingivitis. Epidemiologically, dento-periodontal diseases in children and adolescents are still widely prevalent especially in those social realities marked by socio-economic imbalances, as well evidenced by a very recent review of the literature and meta-analysis by Knorst and Coll.¹ out of more than 3000 publications published between 1966 and 2021. Even in Italy, the prevalence of these diseases (and periodontal diseases in particular) in the school population is not yet under control, especially in young people with a low socio-economic background.² The preventive strategies implemented in the various countries are mainly oriented towards the nutritional control of fermentable carbohydrates and the education of school-age subjects in dental hygiene and the use of fluorides. In Japan, for example, the progressive reduction of the DMFT (Decayed Missed Filled Teeth) index has gone hand in hand with the reduction in sugar consumption from 1955 onwards and the numerical increase in dental professionals and the clinical and home use of fluorides since 1969.³ A complete review of the literature by Walsh et al.⁴ has unequivocally demonstrated the benefits of using fluorinated toothpastes for preventive purposes in children and adolescents compared to non-fluorinated ones. The anti-caries effect that occurs is linked to the concentration of fluorides in toothpaste which must be modulated to avoid the risk of dental fluorosis. In addition to these, other active ingredients (cetylpyridinium chloride, essential oils) are now accepted as active ingredients in toothpastes for the control of childhood caries and, above all, periodontal diseases.^{5,6} In Pediatric Dentistry, on the other hand, less emphasis is now placed on the various devices containing chlorhexidine. Despite the undoubted antiseptic effect, the evidence of actual anti-caries efficacy has been questioned by important research in the literature.^{7,8} The risk of ingestion by children of products for home use containing this bis-guanide should also not be underestimated.⁹



Clinical question

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Purposes

The present clinical research was developed to clarify whether the integrated use of two different bio-adhesive gels, designed for subjects of growing age, proved effective in the control of supragingival bacterial plaque and on gingival survey (BOP) sanguinament, compared to simple home brushing carried out with one of them. We wanted to experimentally document any changes in an improving sense, in a short period of time.

Materials and methods

Twenty subjects, both sexes, in the 12-15 age group were included in the research. The parents or guardians of the parents or guardians of the same have been correctly informed about the purposes and methods of conducting the study and have therefore produced an informed consent in this regard. The criteria for inclusion of the participants were, in addition to the aforementioned age group, good general health, the absence of fixed orthodontic equipment in the arch, the absence of carious lesions or other dental defects capable of producing biofilm retention. Our investigation is a study with a cross-over design, in which the enrolled subjects also act as a control for themselves. It included a quantitative evaluation of plaque according to the O'Leary technique and a dichotomous detection of bleeding on probing. The implementation time of the research was four weeks with three measurements: T0 at baseline, T1 at two weeks and T2 at four weeks. Before the three survey visits, subjects had to refrain from procedures

Table 1.

GROUP A	T0: BASELINE I.P. + BoP Hobagel 365 Junior	T1: 2 WEEKS I.P. + BoP Hobagel 365 Junior	T2: 4 WEEKS I.P. + BoP Hobagel 365 Junior
GROUP B	T0: BASELINE I.P. + BoP Hobagel 365 Junior	T1: 2 WEEKS I.P. + BoP Hobagel 365 Junior + Hobagel Plus Junior	T2: 4 WEEKS I.P. + BoP Hobagel 365 Junior + Hobagel Plus Junior

home hygiene or gel intake for 24 hours, as well as abstaining from food or drink intake in the previous two hours. The O'Leary Plaque Index (Plaque Control Record) involves recording the presence of biofilm on the four dental surfaces (mesial, distal, lingual, vestibular) using an erythrosine detector. The total number of surfaces with plaque is divided by the total number of surfaces examined and multiplied by one hundred. Bleeding at probing was instead recorded dichotomously as present or absent in the 20 seconds following a delicate probing in the depth of the gingival sulcus of the examined teeth. The subjects participating in the study were divided (Table 1) into two groups (A and B) of 10 cases each. In group A, the subjects used only a gel, called "Hobagel 365 Junior", for accurate home brushing of the tooth surfaces with the modified Bass technique, twice a day, for all four weeks planned. The subjects of group B followed the same procedure but, starting from the third week, they added to the brushing the application and rubbing with clean pulp or cotton swab of a second gel (Hobagel Plus Junior) on the dento-gingival margins of the elements in the arch.

This procedure took place only once a day after evening home hygiene, following dinner. The two gels tested were made with a mix of substances that make them suitable for use in adults of growing age. The first (Hobagel 365 Junior) contains cetylpyridinium chloride with a strong antiseptic action on all gram+ bacteria and almost all gram- bacteria in the biofilm. It is associated with a mix of essential oils including *commifora myrrh*, *eucalyptus*, *thyme*

vulgaris and, above all, *melaleuca* and *manuka* which have a marked bactericidal and bacteriostatic action due to the presence of specific monoterpenes and sesquiterpenes. There is no triclosan, replaced by stabilizing substances (O-cimen-5 and P-anisic acid). Three fluorides (Na monofluorophosphate, Na fluoride and potassium fluoride) are also present in the gel. These are concentrated below 500 ppm, to avoid the risk of dental fluorosis, but they have a continuous mineralizing action as they are retained on the enamel by an effective adhesive system. In addition, specific restructuring components on gingival tissues have been included such as hyaluronic acid, Na hyaluronate, provitamin B5, vitamin E, bisabolol. Finally, specific hydrated silicas confer low abrasiveness of the gel towards the dental tissues (declared RDA 30) which make the product very suitable for subjects with teeth still in development.

The second gel (Hobagel Plus Junior) has been designed for local application to the soft tissues of children and teenagers. The temporal persistence of the tissues is guaranteed by an innovative adhesive system that makes use of the mixed salt of Na/Ca of the methylvinyl-ether copolymer, polyvinylpyrrolidone and Na carboxymethyl cellulose. As in the previous gel, there are active substances (cetylpyridinium chloride, mix of essential oils, hyaluronic acid and its oligomers, allantoin, bisabolol, vitamin E acetate) to which are added enhancing active ingredients such as hexetidine (antibacterial) and hydrogen peroxide (antioxidant).

Results

The results of our clinical research are summarized in tables 2 to 7.

Table 2.

GROUP A Hobagel 365 Junior	I.P. MEDIUM	T0: 31,15 Q1: 28.40 (-8.83%) total Q2: 27.88 (-1.90%) -10.5%
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Table 3.

Bop POSITIVE	T0:	7	- 30%
10	T1:	T2: 4	- 60%

GROUP B
Hobagel 365 Junior
+ Hobagel Plus Junior

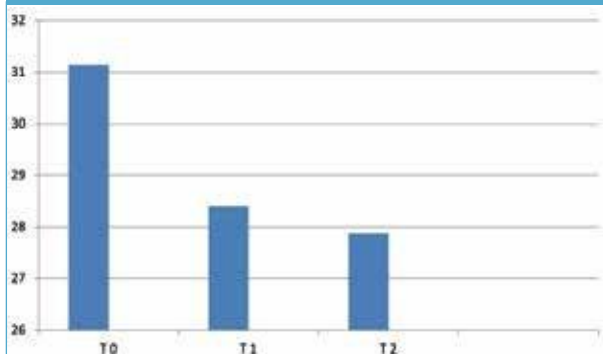
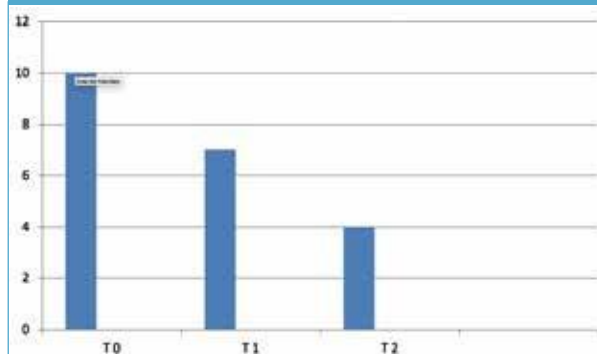
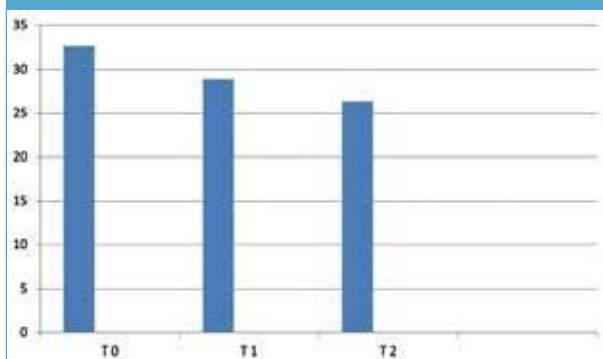
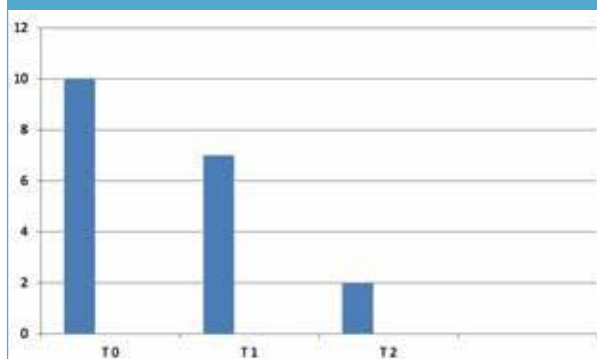
I.P. MEDIUM
Bop POSITIVE

T0: 32,68
Q1: 28.80 (-11.88%) total
Q2: 26.37 (-8.44%) -
19.31%
T0: 10
T1: 7 - 30%
T2: 2 - 80%

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Table 4. Trend of the average P.I. in Group A**Table 5. Trend in BoP (positivity) in Group A****Table 6. Trend of average P.I. in Group B****Table 7. Trend of BoP (positivity) in Group B**

In particular, in the subjects who used only the "Hobagel 365 Junior" gel for dental brushing twice a day in the four weeks of the study, the average plaque index fell in the first two weeks by 8.83% and in the second two weeks by a further 1.9%. The overall reduction in the observation period was therefore -10.5%. The percentage of cases that no longer submitted sanitation in this group fell by 30% in 15 days and by 60% in 30 days.

A more marked increase in reduction in both plaque index and bleeding on the survey was instead found in the subjects included in the group of those who not only used the "Hobagel 365 Junior" gel in the prescribed four weeks, but also applied the second "Hobagel Plus Junior" gel once a day in the two second weeks of study. In these subjects, the decrease in plaque index was reduced from base-line to the second detection (after 15 days) by 11.88%. The additional investigation period of two weeks, during which the two gels covered by this

study, resulted in a further reduction of 8.44%. With an average final value of lowering of 19.31%. In the same period, the percentage of BoP reduction was identical in the first 15 days (-30%), but fell by 80% calculating the entire survey period.

Discussion

The clinical investigation we conducted involved the use of two gels, one of which for daily brushing of the tooth surfaces of the young subjects enrolled, and another for topical gingival application, with the aim of evaluating their effects on the plaque index and bleeding on the probing. The issue of the best formulation of toothpastes for growing ages has been the subject of much research, in the awareness that the products used by adults cannot simply be repurposed in children and adolescents. For young people, the consensus that has been developing¹⁰ indicates not only the need for toothpaste to have an acceptable taste, but also the need to minimize the substances

surfactants and foams. The ideal formulation also provides for optimal availability of fluorides, low abrasiveness and an appropriate ability to remove biofilms. These characteristics are important for all young people, but especially for those "special needs", for whom specific oral hygiene protocols are required to obtain the same preventive results desired for other members of the social context. In children or adolescents with "special needs", the use of chlorhexidine is indicated, but only with spray products, which integrate the other home hygiene procedures.¹¹

In all pedodontic subjects, the use of fluorides in toothpastes is indicated. The preventive effectiveness of these has been repeatedly demonstrated compared to non-fluorinated products. The effects are dose-dependent in both deciduous and permanent dentition and must be modulated with respect to the risk of inducing fluorosis.⁴ The lowest effective doses are manifested by fluoridated toothpastes applied to the deciduous teeth in small quantities ("pe-a-size amount") between two and six years of age,¹² while use before 12 months of age considerably increases the risk of fluorosis.¹³ The efficacy factors of a fluorinated toothpaste in subjects of growing age seem to be the presence of medium/high dosages, while low dosages are similar to the availability of fluoride in drinking water, application in home hygiene 2 times a day, possibly without final flushing and with parental supervision, use in small quantities on a soft toothbrush from the age of two.¹⁴ Finally, toothpaste for children must also be able not to induce any abrasiveness on the tooth surfaces. In fact, it has been reported that, while there is an awareness of the role of the potentially abrasive toothbrush, much less attention is paid to toothpastes, although they are able to remove enamel up to the dentin with subsequent hypersensitivity already in young subjects.¹⁵ The abrasive effect can, in general, also be present in toothpastes designed with desensitizing characteristics and already after a few days of use.¹⁶ Taking these arguments into account, the present study has shown that, in the short period of two weeks, the prescribed protocols (use of toothpaste alone or use of this in combination with topical gel for gingival application) are able to clinically improve both the mechanical removal of biofilms and marginal gingival inflammation. From this point of view, the second protocol has proved to be

superior to the first because it is more suitable for controlling gingivitis which, as is well known, tends to increase in children until puberty. In fact, marginal gingivitis can be considered a clinical parameter of the level of dental hygiene of the young subject. With the aids proposed in our study, the appreciable results obtained are justified by the possibility of correct brushing, without foaming, and by the presence of anti-plaque active ingredients (essential oils and CPC). The toothpaste gel has also been designed to include different low-dose fluorides, in order not to cause fluorosis, but with a long persistence thanks to an original formula capable of binding the fluorides to hard tissues for a long time. This adhesive characteristic is particularly evident in the topical application product (Hobagel Plus Junior) and justifies the increased effectiveness on gingivitis. Finally, the low abrasiveness of the brushing gel (RDA 30 declared) completes the clinical picture of a system of products, specifically indicated for children and adolescents.

The results discussed do not make us forget the limitations of the present study, which can be identified in the low number of subjects enrolled and in the fact that, in the two groups into which the subjects were divided, the baseline values were not perfectly homogeneous. No generation is therefore possible without adequate in-depth analysis. However, the clinical results on the control of supragingival plaque and marginal inflammation are encouraging.

Conclusions

The use of an innovative toothpaste gel (Hobagel 365 Junior) in home hygiene of a group of adolescents is able to significantly reduce the presence of supragingival bacterial plaque and the subsequent gingivitis. In subjects of the same age who, in addition to the dental gel, have applied an additional periodontal bio-adhesive gel (Hobagel Plus Junior), the beneficial clinical results obtained are considerably increased.

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