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Assessment of the Genotoxic Effect Caused by Herbal and Synthetic Toothpaste

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Abstract: ***The purpose of the paper is to highlight the advantages of using the herbal tooth paste over synthetic toothpaste and to identify if there is any significant difference between the varieties of herbal toothpaste with ingredients such as Anacyclus pyrethrum, Azadirachta Indica, Xanthoxylum alatum, Mentha spicata, Syzygium aromaticum, Piper sylvaticum, Barleria prionitis, Curcuma longa, Salvadora persica, Quercus infectoria. These herbal mixture acts as antioxidants which may protect the cell against genetic metabolic damages. The study is carried out on micronuclei. We have carried out the study on women population. 52 subjects of age ranging from 17 to 20 years were included. Paired t-test has been carried out to know whether there is any significant difference in presence of micronuclei due to herbal and synthetic toothpaste in the subject. The results show that herbal toothpaste has significantly lower number of micronuclei compared to synthetic toothpaste which represent nuclear DNA damages; the comparison was made for the number of micronuclei between herbal and synthetic toothpaste since the number of micronuclei is a discrete reflection of nuclear DNA damage. To identify if there is any significant difference in the range of micronuclei between the varieties of herbal toothpaste, Chi-square test for independence of attributes has been performed and it was found that there is no significant difference between varieties of herbal toothpaste.***

Keywords: Genotoxicity, Micronuclei, Antioxidants, Toothpaste, herbal, synthetic.

1. Introduction

Antioxidants are substances that may protect cells in your body from free radical damage that can occurs from exposure to certain chemicals, smoking, pollution, radiation, and as by-products of normal metabolism. Dietary antioxidant includes selenium, vitamin A and related carotenoids, vit-C & E, plus various phytochemicals such a lycopene, lutein and quercetin.

These antioxidants can be seen in different foods that you're probably eating right now. There are large amount of antioxidants in fruits- Such as blue berries, straw berries etc, vegetables, nuts and whole grain and smaller amount of antioxidants in meats, poultry and fish. Junk food such as highly processed fast food tends to be much lower in antioxidants.

Excess of oxygen tension (i.e. oxidation) in the cells can produce peroxides. This peroxide leads to the damage of DNA by chromosome breakage. The herbal toothpaste has mixtures of herbs such as Anacyclus pyrethrum, Azadirachta India, Xanthoxylum alatum, Mentha spicata, Syzygium aromaticum, Piper sylvaticum, Barleria prionitis, Curcuma longa, Salvadora persica, Quercus infectoria. Arimedas Tailam, Eugenia caryophyllus, etc. These herbs acts as antioxidant agent which can control the production of peroxides their by protecting the micronuclei from the damage.

Micronuclei Assay Test

The study of DNA damage at the chromosome level is an essential part of genetic toxicology because chromosomal mutation is an important event in carcinogenesis. Micro nucleus test have emerged as one of the most preferred method for assessing chromosome damage because they enable both chromosome loss and chromosome breakage to be measured reliably.
The method is now applied to various cell types for population. Monitoring of genetic damage, screening of chemicals for genotoxicity potential & for specific purpose such as the production of the radio sensitivity of tumors.

The purpose of the paper is to highlight the advantages of using of the herbal tooth paste with that of synthetic paste. The approach is to make use of naturally available herbs.

2. Materials and Methods

The study was carried out in St. Ann's College for Women, Hyderabad. The sample size was 52 students from St. Ann's College for Women, Hyderabad, selected randomly in the age groups of 17 to 20 years. Each student was given a herbal toothpaste and toothbrush, they were instructed to brush their teeth with the provided brushes and paste like they usually do when using their brand of toothpastes. The toothbrushes were the same for all the students, they were instructed to do so for 50 days.

Inclusion criteria
Subjects who met the following inclusion criteria were included in this study:
Having a minimum of 26 teeth, good general health, brush two times a day, has used a synthetic tooth paste for more than a month.

Exclusion criteria
Exclusion criteria were: Subjects under antimicrobial therapy, pregnant women, using orthodontic appliances, having used mouth rinse containing chemical agents in previous 3 months, and having a history of allergy to herbal toothpastes.

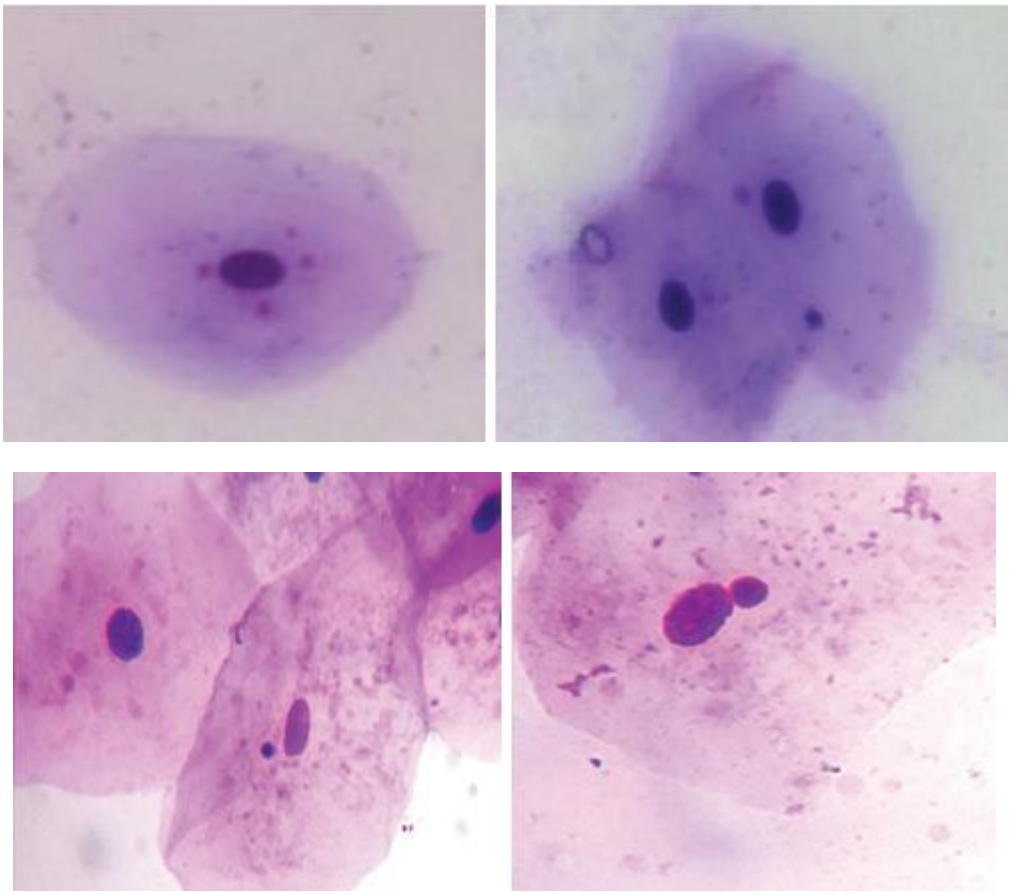
Design
The study was designed as**:**
1. Comparative study between herbal and synthetic toothpaste:
Subjects who were using a synthetic toothpaste for more than a month were given a herbal toothpaste were instructed to brush their teeth with the provided brushes and paste like they usually do when using their brand of toothpastes for 50

days and checked for genotoxicity by performing micronuclei test.

2. Comparative study between four herbal toothpaste:
Subjects were divided into four groups each having 13 subjects. Group A subjects are using **Dabur Toothpaste** for more than one month, Group B subjects are using **Ayush Toothpaste** for more than one month, Group C subjects are using **Himalaya Toothpaste** for more than one month and Group D subjects are using **Patanjali Toothpaste** for 50 days and checked for genotoxicity by performing micronuclei test.

3. Experimentation

52 students from St. Ann's College, Hyderabad volunteered for the study they have been using a synthetic toothpaste for more than a month. Their buccal mucosal smear was prepared and micronucleus test was performed and slide was checked for cells containing micronuclei cells containing. The most repetitive number of micronuclei, they were instructed to brush their teeth with the provided brushes and paste like they usually do when using their brand of toothpaste. The toothbrushes were the same for all the students, they were instructed to do so for 50 days. Their buccal mucosal smear was prepared and micronucleus test was performed and slide was checked for cells containing micronuclei cells containing. The most repetitive number of micronuclei present in cells on a slide was noted.



4. Discussion and Results

4.1 Discussion

Toothpastes have increasingly been used by patients for daily dental care; however, the effects of these agents on oral mucosal cells have not so far been precisely evaluated. Since this material is in constant contact with the mucosa, all adverse effects of such agents should be verified. The main objective of the current study was to evaluate the genotoxic effect of herbal and synthetic toothpaste. The results of the clinical study demonstrated that the tested herbal toothpaste were effective and led to an improvement in oral hygiene and in the periodontal status. After 50 days, considerable improvement of periodontal condition was observed in all groups.

The use of herbal toothpaste led to a considerable reduction in the number of micronuclei present in the buccal mucosal surfaces. Final values of micronuclei indices in herbal test groups were significantly lower compared to the corresponding values in the synthetic toothpaste group. Using the herbal toothpaste increased the effectiveness of genotoxic (chemical agents) control, especially in difficult inter proximal areas. Probably, active ingredients of the herbal extracts of toothpaste penetrate the bio film and prevent the formation of micronuclei.

Results of other clinical studies confirm the micronuclei reduction after the using of herbal toothpaste. In this study, herbal tooth paste was more effective for the reduction of dental problems than with synthetic tooth paste.

The genotoxicity showed by most of these toothpastes do not contribute to any major problems for public health. Potentially harmful chemicals in toothpaste can affect the health of your teeth and gums as well as your general health. The presences of micronuclei were assessed using paired t test and the varieties of herbal toothpaste were assessed using Chi-square test for independence of attributes.

Paired t test

The paired sample t-test, sometimes called the dependent sample t-test, is a statistical procedure used to determine whether the mean difference between two sets of observations is zero. In a paired sample t-test, each subject or entity is measured twice, resulting in pairs of observations i.e. paired t-test is used to compare two population means where two sets of observations are taken on same subjects.

Chi-square test

The Chi Square statistic is commonly used for testing relationships between categorical variables. The null hypothesis of the Chi-Square test is that no relationship exists between categorical variables in the population; they are independent.

4.2 Results

The values of micronuclei assessed are shown in figure1.

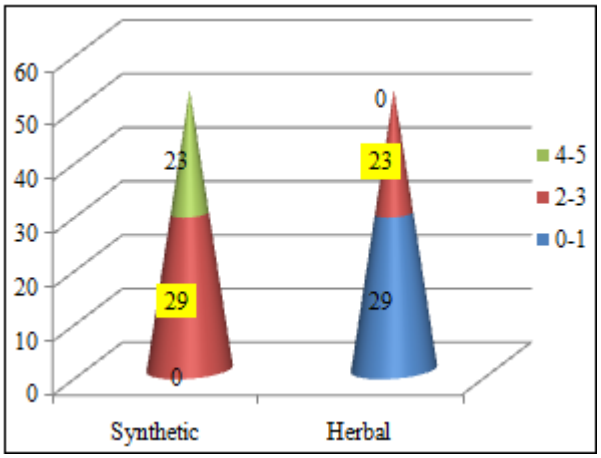


Figure 1

Among the subjects using herbal tooth paste, 56% are having micronuclei in the range 0-1 where as there is no subject with micronuclei in the range 0-1 among the subjects using synthetic tooth paste. Also it has been observed that there are no subjects with 4-5 micronuclei when herbal tooth paste was used, but there more than 44% of the subjects having 4-5 micronuclei when synthetic tooth paste was used.

The mean & standard error of micronuclei test assay on synthetic and herbal tooth pastes are shown in the following table.

	Mean	Standard Error
Synthetic Paste	3.42	.127
Herbal Paste	1.29	.130

To know the difference between number of micronuclei present after using synthetic paste & herbal toothpaste, paired t-test has been performed and the P-value is 0.000 < 0.05, which is considered to be significant at 5% level of significance. To identify if there is any significant difference in the range of micronuclei between the varieties of herbal toothpaste Chi-square test for independence of attributes has been performed and its P-value is 0.835652857 > 0.05, which is not significant at 5% level of significance.

5. Conclusion

In this study, it was found that the herbal toothpaste has significantly lower number of micronuclei compared to synthetic toothpaste. Hence the study concludes that herbal toothpaste is better than synthetic toothpaste with respect to genotoxicity. It was also found that herbal toothpaste helps in reduction of genotoxicity as number of micronuclei decreased after using herbal toothpaste. However it has been observed that there was no significant difference in the range of micronuclei between the four varieties of herbal toothpaste.

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