Does Activated Charcoal Actually Provide Any Benefits For the Oral Cavity?

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Introduction

In an era of people who have become increasingly interested in the aesthetics of their teeth, activated charcoal has become an increasingly popular ingredient that can be found in many teeth-whitening products in stores around the world. Activated charcoal can best be defined as a "nanocrystalline form of carbon with a large specific surface area and high porosity in the nanometer range, having consequently the capacity to absorb pigments, chromophores, and stains responsible for tooth color change" (Zamudio-Santiago, 2022). What this means essentially is that activated charcoal features a very porous surface that can bind to and remove the outer particles of your teeth which are often covered with stains and bacteria. The removal of the stained particles is what gives off a whitening effect. Activated charcoal can be found in oral care products such as dentifrices, mouthwashes, and even infused into the bristles of toothbrushes. Whitening treatments are also offered by dental professionals but activated charcoal has become a popular alternative that is sought out by many people due to its cheaper price, availability, and ease of use. On the other hand, many people refrain from using activated charcoal and argue that the very same porous surface of activated charcoal that removes extrinsic stains is too abrasive and can damage one's tooth structure. Activated charcoal has quickly become a popular ingredient and can be seen being endorsed by social media influencers, oral care brands, and dental care professionals but is activated charcoal truly a beneficial ingredient or is it just another scam?.

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Questions

-Does activated charcoal whiten teeth? If so, then how?
-Does activated charcoal give the same whitening effects as professional whitening treatments?
-Is activated charcoal safe for your enamel?
-Why should I choose activated charcoal instead of professional whitening treatments?
-How does activated charcoal dentifrices compare against other professional whitening alternatives?

Role of the Dental Hygienist

Dental hygienists should recommend activated charcoal containing whitening products to eligible patients that have healthy enamel and are interested in whitening their teeth but can't afford a professional whitening and or don't want to deal with the sudden onset of hypersensitivity which often comes with professional whitening procedures. It is also important that dental hygienists warn their patients of the abrasive side effects of activated charcoal. Use of activated charcoal dentifrices can lead to surface loss on one's enamel. A study conducted by Osmanaj et al (2022) that measured the abrasion behavior of different activated charcoal dentifrices found "overall, the abrasive dentin wear of the toothpaste with the highest wear was about 15 times higher than on enamel using the same paste and approach." Therefore, patients that have exposed dentin should avoid activated charcoal since they are at higher risk of surface loss. Patients that don't qualify for the use of activated charcoal containing dentifrices should also avoid toothbrushes that include activated charcoal infused bristles for the same reason. Patients that routinely get their teeth professionally cleaned should also be made aware of the fact that hygienists often use prophy paste towards the end of the cleaning to remove stains. Prophy paste is another abrasive that is used to remove stains that when combined with the regular use of activated charcoal can lead to a greater loss in tooth structure. Patients that already have weakened enamel should be recommended dentifrices that focus on preserving the enamel instead of whitening.

Research

-An experiment was conducted by Alofi et al (2021) to evaluate and compare both the whitening efficacy and amount of surface loss caused by activated charcoal powder and a whitening toothpaste that didn't contain activated charcoal. The experiment used sixty-six disk-shaped composite fabricated specimens stained with a coffee solution which were then divided into two groups of thirty-three. The samples were then brushed with a special brushing machine with a total of 1120 mechanical brushing cycles to mimic four weeks of brushing. The study found that although the use of both toothpastes did lead to a noticeable change in color, both toothpastes also lead to a change in surface roughness. The difference of color change and surface loss between both toothpastes were insignificant.

-An experiment conducted by Dionysopoulos et al (2020) that measured and compared the whitening efficacy of activated charcoal on human canines found that "the tested whitening toothpaste also increased color change (17.7%) compared to the regular toothpaste."

-An experiment was conducted by Osmanaj et al (2022) that measured and compared the abrasive effect of activated charcoal. Several different dentifrices were tested on the enamel and dentin of bovine incisors which were then later examined for surface loss (SL). The experiment found that "the toothpaste with the highest abrasion in the current study (Group C) also showed the highest amount of silica." Hydrated silica is another abrasive ingredient found in toothpastes (often along with activated charcoal) and this research shows that hydrated silica may be a bigger cause for surface loss than activated charcoal.

-An experiment conducted by Thamke et al (2018) with the focus of measuring and comparing the antimicrobial properties of activated charcoal infused toothbrushes took bristles from both regular toothbrushes and activated charcoal infused toothbrushes that were used by the same subjects who used and stored both toothbrushes the same way for one week. Scientists took bristles from both toothbrushes and placed them onto blood agar plates and found "about 10 mm of the zone of inhibition was found around charcoal bristles as compared to 3 mm for non-charcoal bristles" (Thamke et al., 2018). This research helps prove that activated charcoal's toxin neutralizing properties can in fact be used to help restrict bacterial contamination on the bristles of toothbrushes.

-An experiment was conducted by Osmanaj et al (2022) to measure the abrasion behavior of different activated charcoal toothpastes on human dentin when using an electric toothbrush. The results found that activated charcoal had a small influence on the abrasion of the human enamel but a much higher abrasion effect on exposed dentin.

Conclusion

Activated charcoal has been put through countless studies and has proven that it can indeed be a useful whitening ingredient but comes with a caveat. Although studies have proven that activated charcoal containing toothpastes do in fact help whiten teeth, studies have also shown that they can lead to surface loss. Therefore, people with weakened enamel and or exposed dentin should avoid using activated charcoal since they are at a higher risk for surface loss. Studies have also shown that activated charcoal's toxin neutralizing properties help make it a great additional barrier for toothbrushes to help reduce the level of microbial contamination. For the right people, activated charcoal can be an amazing substance that is very convenient and easily attainable for consumers who want to boost their oral care without spending too much money, deal with hypersensitivity, or adding extra oral care steps to their daily life. Activated charcoal may not be safe for everyone but there is still indeed a demographic for whom activated charcoal can help aid in achieving whiter smiles.

References

Alofi, R. S., Alsuayri, H. A., Mohey, L. S., & Alofi, A. S. (2021). Efficiency of activated charcoal powder in stain removal and effect on surface roughness compared to whitening toothpaste in resin composite: In vitro study. *The Saudi Dental Journal*, *33*(8), 1105–1110. https://doi.org/10.1016/j.sdentj.2021.03.010

Aydin et al.. (2021). Activated charcoal toothpastes do not increase erosive tooth wear. *Journal of Dentistry*, 109, 103677. https://doi.org/10.1016/j.jdent.2021.103677

Dionysopoulos et al. (2020). Effect of novel charcoal-containing whitening toothpaste and mouthwash on color change and surface morphology of enamel. *Journal of conservative dentistry*: JCD, 23(6), 624–631. https://doi.org/10.4103/JCD.JCD_570_20

Osmanaj et al., (2022). Abrasion Behavior of Different Charcoal Toothpastes on Human Dentin When Using Electric Toothbrushes. *Dentistry Journal*, 10(3), 46–. https://doi.org/10.3390/dj10030046

Thamke et al.,(2018). Comparison of bacterial contamination and antibacterial efficacy in bristles of charcoal toothbrushes versus noncharcoal toothbrushes: A microbiological study. Contemporary Clinical Dentistry, 9(3),463. https://hs1.farmingdale.edu:2157/apps/doc/A551302475/AONE?u=sunyfarm_main&sid=bookmark-AONE&xid=cd0b4dd0

Zamudio-Santiago et al.,(2022). Effect of 16% Carbamide Peroxide and Activated-Charcoal-Based Whitening Toothpaste on Enamel Surface Roughness in Bovine Teeth: An In Vitro Study. Biomedicines, 11(1), 22. https://doi.org/10.3390/biomedicines11010022

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