Original Research Paper

Volume - 16 | Issue - 03 | March - 2026 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Dental Sciences

RISE FROM THE ASHES- AN ORIGINAL ARTICLE REVIEW

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ABSTRACT Charcoal has been used for oral hygiene practices since ancient times and continues to be employed in various forms, particularly in low-resource and traditional settings. In public health dentistry, charcoal-commonly derived from wood or coconut shells-has been utilized for tooth cleaning due to its abrasive, adsorptive, and purported antimicrobial properties. Traditionally, powdered charcoal has been applied using fingers or chewing sticks to remove stains and debris from tooth surfaces. While its abrasiveness may contribute to plaque and extrinsic stain removal, excessive or improper use has been associated with enamel wear, dentin exposure, and increased tooth sensitivity. In recent years, the commercialization of charcoal-based dentifrices has renewed interest in its role in oral hygiene, though scientific evidence supporting claims of whitening, detoxification, and antimicrobial benefits remains limited. From a public health perspective, charcoal use reflects cultural practices, accessibility issues, and economic constraints influencing oral hygiene behaviours. This abstract highlight the historical use, potential benefits, risks, and public health implications of charcoal as an oral hygiene agent, emphasizing the need for evidence-based guidance and community education to ensure safe and effective oral health practices.

KEYWORDS : Charcoal, Oral Health practices, Adsorption, Dental care, Tooth whitening

INTRODUCTION

Oral hygiene practices have evolved significantly over time, shaped by cultural traditions, availability of natural resources, and advances in scientific understanding. Among the earliest materials used for maintaining oral cleanliness is charcoal, a carbon-rich substance produced through the controlled combustion of organic materials such as wood, coconut shells, or bones. Long before the development of modern toothpaste formulations, charcoal was widely employed across various civilizations as a natural tooth-cleaning agent. Its continued use in traditional medicine and its recent resurgence in commercial oral care products highlight the enduring interest in charcoal as a tool for maintaining oral health.

Charcoal has been traditionally valued for its abrasive and adsorptive properties, which were believed to aid in the removal of stains, food debris, and unpleasant odors from the oral cavity. In many cultures across Africa, Asia, and the Middle East, finely ground charcoal or charcoal sticks were routinely used to clean teeth and freshen breath. These practices were often passed down through generations and were rooted in empirical observations of charcoal's ability to polish tooth surfaces and reduce discoloration. Unlike synthetic oral hygiene products, charcoal was easily accessible, inexpensive, and perceived as a natural alternative with minimal chemical additives.

From a scientific perspective, the effectiveness of charcoal in oral hygiene is primarily attributed to its porous structure and mild abrasiveness. Activated charcoal, in particular, possesses a high surface area capable of adsorbing pigments, toxins, and microorganisms. This characteristic has led to claims that charcoal-based oral products can whiten teeth, reduce bacterial load, and improve overall oral cleanliness. However, concerns have also been raised regarding the potential risks associated with frequent charcoal use, including enamel abrasion, increased tooth sensitivity, and the lack of fluoride protection essential for caries prevention.

Fig 1 Shows The Structure Of Raw Charcoal

Fig 2 Shows The Structure Of Activated Charcoal

Review Of Literature

John K brooks et al (2017) conducted a literature search identified 118 potentially eligible articles. Thirteen studies reported brushing the teeth with raw charcoal or soot; however, none of these studies met the inclusion criteria. Two studies offered nonspecific caries reductions, 3 studies reported deleterious outcomes (increased caries, enamel abrasion, non-quantified negative impact), and 1 study indicated only that brushing with raw charcoal had no adverse effects on oral hygiene. Seven other studies reported only on the use of charcoal for oral hygiene. Internet advertisements included unsubstantiated therapeutic claims-such as antibacterial, antifungal, antiviral, and oral detoxification, as well as potentially misleading product assertions. One-third of the charcoal dentifrices contained bentonite clay, and 1 contained betel leaves. The results of this literature review showed insufficient clinical and laboratory data to substantiate the safety and efficacy claims of charcoal and charcoal-based dentifrices. Larger-scale and well-designed studies are needed to establish conclusive evidence.

Meltem Nermin Polan et al (2025) conducted a study a total of 105 disc-shaped specimens were fabricated using a supra-nano spherical-filled composite resin and immersed in a coffee solution to induce staining. Color and surface roughness were measured before (T0) and after staining process (T1). The specimens were randomly allocated into seven groups (n = 15): a negative control (Distilled water, DW), a positive control (Colgate Total 12, CT12), and five groups treated with charcoal-containing whitening toothpastes: Colgate Optic White (COW), Curaprox Black Is White (CBW), R.O.C.S. Black Edition Whitening (ROCS), Ipana 3D White (IPW), and Signal Nature Elements Charcoal (SNE). Brushing was performed using an electric

toothbrush three times per day for 30s over a two-week period, followed by final color and surface roughness measurements (T2). Statistical analyses were performed using one-way ANOVA, Kruskal–Wallis, Tukey's HSD, Tamhane's T2, and Dunn's tests ($p < 0.05$).

Color alterations (ΔE00) in all groups treated with charcoal-based whitening toothpastes exceeded the clinical acceptability threshold. However, no statistically significant differences in ΔE00 were noted among these groups ($p > 0.05$).The SNE group exhibited significantly higher Δb values than the COW and CBW groups ($p < 0.05$), while the CBW group presented considerably lower ΔL values than the COW, IPW, and SNE groups ($p < 0.05$). A significant increase in surface roughness was detected in all groups exposed to charcoal-based whitening toothpastes ($p < 0.05$),with statistically significant variations observed among groups ($p < 0.05$). Charcoal-containing whitening toothpastes effectively reduced coffee-induced discoloration on composite resin surface while causing a significant increase in surface roughness. The toothpastes used exhibited similar effects on color change but showed variations in surface roughness among groups.

Ali Al Ahmad et al (2010) conducted a study where comparisons were made between 62 silver-coated and 62 non-coated toothbrush heads which were contaminated by different standardized microbial suspensions. The following microorganisms were investigated: Streptococcus oralis, Streptococcus mutans, Streptococcus sanguis, Actinomyces viscosus, Lactobacillus casei and Candida albicans. For cultivation of the microorganisms as well as for the subsequent determination of the colony forming units (CFUs), Columbia blood agar plates or Sabouraud agar were used. The cycle of daily toothbrushing was imitated by rinsing the brushes with 200 ml sterile tap water to reduce the number of microorganisms and the brushes were then placed upright to allow drying overnight. Colony counts were done initially (time 0) and again at 20 hours. The rinsing fluid was also examined in order to determine the decrease of microorganisms due to this step. All experiments were done twice and the means were calculated and statistically evaluated. There was no significant reduction in CFUs by silver-coated toothbrushes ($P > 0.05$) for all of the microorganisms tested. On the contrary, the colony counts for S. sanguis ($P = 0.02$) and C. albicans ($P = 0.01$) were significantly higher on silver-coated toothbrushes compared to the controls. Silver-coating in the current form did not improve any antimicrobial effects against residual bacteria present on the toothbrush head.

Janice Lee et al (2017) conducted a study was to evaluate the bacterial contamination of charcoal bristles compared to non-charcoal bristles in used toothbrushes. Ninety participants were involved in the study. They were given standard brushing instructions on the use of a charcoal toothbrush, and were asked to return the used brushes after 1 week of usage. After a 1-week washout period, the participants were then provided with similar brushing instructions and a non-charcoal toothbrush, and were instructed to return the brush after another week of usage. Bristles of the used toothbrushes were sectioned and placed in a nutrient broth. A pipette was used to extract 0.1 mL of nutrient broth to smear on agar plates. A colony counter was used to measure colony forming units (CFU) after 24 hours of incubation. Data collected were analysed using a paired sample t-test. The mean CFU count for non-charcoal bristles was almost double (106.3; 95% CI 53.39, 159.28) that of charcoal bristles (58.8; 95% CI 15.09, 102.55). However, there was no statistically significant difference between the two groups ($p = 0.198$). This study shows no statistically significant difference in bacterial counts between bristle types, despite substantially lower CFUs in the charcoal bristles compared with non-charcoal bristles after 1 week of use.

Vineet Kini (2019) et al conducted a cross-over study was conducted in 2 phases of 6 weeks duration each with an intervening 2-week washout. Twenty-five participants meeting inclusion criteria were randomly allocated into groups A (13) and B (12). In phase 1: group A was assigned T1 and group B was assigned T2. Toothbrushing was advised twice daily for 2 minutes by modified bass technique after meals. At baseline, 3 weeks and 6 weeks the wear index (WI), plaque index (PI) and gingival index (GI) were recorded. Following washout in phase 2 group A was assigned T2 and group B was assigned T1 and the same study protocol was followed. Intra-group comparison between baseline, 3 and 6 weeks by the paired t-test resulted in significant reduction in PI, GI and increase in WI ($p < 0.05$) for T1 and T2. Inter-group comparison using the unpaired t-test resulted in WI for T1 being significantly higher ($p < 0.05$) at 3 weeks and lower at 6 weeks ($p < 0.05$) compared to T2. PI for T1 was significantly higher at 3 weeks ($p < 0.05$) and lower at 6 weeks ($p < 0.05$) compared to T2. No significant difference in GI scores between T1 and T2 at 3 and 6 weeks was observed ($p > 0.05$). Charcoal infused bristles demonstrated less wear and more plaque removal compared to nylon bristles.

Sinjini Banerjee (2020) et al conducted a single-blind, randomized clinical study was on thirty 10–14-year-old schoolchildren. The plaque score using Quigley-Hein plaque index (modified) and stain score using Lobene index were assessed at baseline visit (pre brushing and post brushing), after 30-day follow-up, and data collected were analyzed using paired t-test and independent t-test. No statistically significant difference was found for plaque removal efficacy between normal and charcoal toothbrush ($p = 0.749$). Charcoal toothbrush (mean = 0.6554) showed 28.82% better stain removal efficacy ($p = 0.006$) in comparison with normal toothbrush (mean = 0.1889). Charcoal toothbrush has better stain removal efficacy in comparison with normal toothbrush.

Darshana Gothane et al (2021) conducted a randomized clinical trial among 30 participants (male and female) in Sharad Pawar Dental College, between the ages of 33 to 44 years having at least 20 permanent teeth (excluding the third molars and crowns prosthesis). As per the Plaque Index given by Silness P. and Loe H, the first plaque range should be between 3 in 1970 is participated in the study. Following the randomization, each participant will provide a specific available toothbrush and asked to 1 minute of brushing, following which the plaque index was measured again. They were advised to brush their teeth two times a day for one minute with the allotted toothbrush in the morning and night after dinner with a commercially available toothpaste using a modified bass technique. At baseline, 7th day, and 15th day, the plaque index scores (before and after brushing) were collected, data was recorded and statistically analysed. On day baseline, 7 days, and 15 days after brushing, the mean plaque indices decreased. There was also a decrease in mean plaque indices from day one to day seven and fifteen. These decreases were all statistically significant ($P < 0.001$). The current study demonstrated a significant change in plaque scores with the use of toothbrushes with bristle containing Neem and Charcoal. The continues usage of the assigned toothbrush resulted in an even greater changes in plaque scores.

CONCEPTUAL SECTIONS

Activated charcoal has gained popularity as a "natural" oral hygiene product, particularly in dentifrices and powders. Historically, charcoal was used in ancient civilizations such as Egypt and India for cleansing purposes. In modern dentistry, charcoal-containing toothpastes are marketed for whitening, detoxification, and plaque removal. However, scientific validation of these claims remains limited.

Activated charcoal is a highly porous form of carbon produced by heating carbon-rich materials (e.g., coconut shells, wood) at high temperatures. The activation process increases surface area and adsorption capacity.

In oral care products, charcoal is incorporated into:

- Toothpastes
- Tooth powders
- Mouth rinses
- Toothbrush bristles

Proposed Mechanism of Action

Charcoal in oral hygiene is claimed to work through:

1. Adsorption: Binding stains, toxins, and bacteria to its porous surface.
2. Abrasive Action: Mechanical removal of extrinsic stains and plaque.
3. pH Modulation: Some claims suggest neutralization of oral acidity (limited evidence).

However, adsorption of bacteria in vivo remains scientifically unproven.

Types of Charcoal Used

- Activated charcoal
- Binchotan charcoal (Japanese white charcoal)
- Bamboo charcoal

Clinical evidence does not significantly differentiate their oral benefits.

Fig 3 Shows The Indian Brands

Fig 4 Shows The International Brands

Critical Analysis Sections

Evidence on Plaque Control

- Few randomized controlled trials exist.
- Short-term studies show mild plaque reduction, comparable to conventional toothpaste.
- No strong evidence supports superiority over fluoridated toothpaste.

Whitening Claims

- Effective in removing extrinsic stains.
- Does not alter intrinsic tooth color.
- Whitening effect mainly due to abrasive action, not chemical bleaching.

Fluoride Concern

- Many charcoal products lack fluoride.
- Fluoride absence may increase caries risk.
- Some products now combine charcoal with fluoride, but evidence is limited.

Abrasiveness And Enamel Safety

- Charcoal particles may increase surface roughness.
- Excessive use may lead to:

o Enamel wear
o Dentin exposure
o Hypersensitivity

Relative Dentin Abrasivity (RDA) values vary widely among products.

Antimicrobial Claims

- Limited in vivo evidence.
- No robust clinical trials confirm long-term antimicrobial effectiveness.

Clinical Implications

Adjunct Use Only: Should not replace fluoridated toothpaste.

Short-Term Whitening Aid: May be recommended for extrinsic stain removal.

Caution in High-Risk Patients:

- Patients with abrasion
- Gingival recession
- Hypersensitivity

Professional Supervision: Dentists should counsel patients regarding frequency and duration of use.

Public Health Perspective: In community dentistry, fluoride-based preventive strategies remain superior.

Future Research Directions

- Long-term randomized controlled trials assessing enamel wear.
- Standardization of abrasively (RDA values).
- Comparative studies between charcoal and conventional whitening dentifrices.
- Evaluation of fluoride-containing charcoal products.
- Microbiological studies assessing plaque biofilm modification.
- Public perception and awareness studies in community settings.

Drawbacks

- Lack of standardized formulation
- Absence of fluoride in many products
- Potential enamel and dentin abrasion
- Limited scientific evidence
- Marketing-driven claims
- Black residue accumulation in restorations or gingival margins

CONCLUSION

Charcoal-containing oral hygiene products are increasingly popular due to natural and cosmetic appeal. Evidence suggests modest effectiveness in removing extrinsic stains; however, there is insufficient high-quality scientific data supporting superior plaque control or antimicrobial benefits. The potential for enamel abrasion and the frequent absence of fluoride raise concerns regarding long-term safety. Charcoal may be considered as an adjunctive cosmetic aid, but it cannot replace evidence-based fluoride-containing dentifrices in routine oral hygiene practice. Further rigorous clinical trials are necessary before definitive recommendations can be made.

Long term study concentrating on indigenous oral hygiene aids - starting from the processing till the usage are needed, thus fulfilling the aim of **"Atmanirbhar Bharat"**.

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