

# SODIUM HEXAMETAPHOSPHATE AS AN AID IN THE TREATMENT OF PERIODONTAL DISEASE<sup>1</sup>

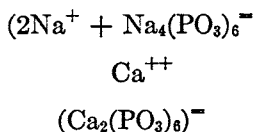
DONALD A. KERR, D.D.S., M.S. AND HENRY FIELD, JR., B.S., M.D.

*University of Michigan, Ann Arbor, Mich.*

## INTRODUCTION

Albright, Sulkowitch, and Chute (1) have described a non-surgical method for the removal of renal stones in which sodium hexametaphosphate was used as a solvent. This method gave the best results in cases in which the stones were of the phosphate type. It was this work which suggested to one of us (H. F.), that perhaps sodium hexametaphosphate would be effective in reducing the deposition of calculus on the teeth.

Sodium hexametaphosphate may be represented by the formula  $\text{Na}_2(\text{Na}_4(\text{PO}_3)_6)$ . Albright, Sulkowitch and Chute suggested the following reaction as being responsible for the dissolution of phosphate stones:



indicating that a complex Ca metaphosphate is formed. If this reaction takes place and sodium hexametaphosphate dissolves calcium phosphate stones, it should be a good solvent for salivary calculus which has been shown by many investigators to be composed chiefly of calcium phosphate.

Sodium hexametaphosphate is also used industrially, as reported by Hatch and Rice, (2) to prevent calcium carbonate scale from depositing on the water side of condensers or heat exchangers, and in water conducting systems. Hatch and Rice (2) pointed out that sodium hexametaphosphate has two properties which are of considerable interest with respect to colloidal phenomena. It possesses definite surface active properties of its own at solid aqueous solution interfaces, and it has the ability of forming soluble complexes with numerous multivalent cations, thereby reducing the concentration to such a low value as practically to eliminate their agglomerating action towards various colloidal systems. They report that 1 to 5 parts per million of sodium hexametaphosphate will prevent the deposition of calcium carbonate from waters containing several hundred parts per million of calcium carbonate while the total amount necessary for actual calcium carbonate fixation would be 1,100 p.p.m. The deposition

<sup>1</sup> Presented at the 22nd General Meeting of the International Association for Dental Research, Chicago, March 18-19, 1944 (*J. D. Res.* **23**: 189, 1944). Received for publication June 17, 1944.

of calcium carbonate scale from high carbonate waters to which ammonia has been added can be prevented by the addition of small amounts of sodium hexametaphosphate. Rice and Partridge (3) showed that not only is scale formation reduced by the addition of small amounts of sodium hexametaphosphate but that scale already deposited is removed.

Because of the ability of sodium hexametaphosphate to prevent the precipitation of complex calcium salts from colloidal solutions and its ability to dissolve the salts already deposited, it appeared, therefore, that it might be effective in reducing calculus deposition on the teeth. Also because of its action as a wetting agent it appeared possible that it would also have a detergent action.

#### PROCEDURE

Before sodium hexametaphosphate could be used in the oral cavity, it was necessary to determine what effects it would have upon the teeth and filling materials contained in the teeth. The effect was determined by the following procedures: 1. Immersion of extracted teeth in sodium hexametaphosphate solutions of graded concentration, including a saturated solution, for intervals of 1 week to 6 months. 2. Immersion of extracted teeth containing silicate fillings in solutions of the same concentration for the same intervals of time. 3. Immersion of silicate material separately in duplicate concentrations for the same periods of time. 4. Because Albright, Sulkowitch and Chute (1) reported that sodium hexametaphosphate could be tolerated by the renal mucosa, it seemed reasonable that the oral mucosa would exhibit an even greater tolerance. Therefore, no experiments on mucosal effect were carried out, except that one of us (H. F.) used it in his own mouth for several months without noticeable effect on the mucosa.

From the above tests it was found that: 1. There were no visible changes in tooth structure. The enamel surface remained hard and smooth and was not deformed when scratched by a sharp steel instrument (*fig. 1*). 2. Silicate fillings in the immersed teeth underwent complete disintegration after a period of 3 to 5 weeks. The filling material was still retained in the cavity but was of a semi-fluid consistency and could be washed away by running water or vigorous agitation of the solution. 3. Isolated masses of silicate filling disintegrated rapidly in all percentages, leaving a fine granular precipitate.

After demonstrating that tooth structure was not damaged by immersion in sodium hexametaphosphate of varying concentrations for periods up to 6 months we were ready to ascertain its effect upon calcular deposits.

Extracted teeth having moderate to heavy deposits of calculus on their surfaces were brushed well with an ordinary toothbrush and immersed in sodium hexametaphosphate solutions of graded concentrations including a saturated solution. The teeth were left undisturbed in the solutions for varying intervals of time.

#### RESULTS

Dilute solutions, *in vitro*, had very little effect. In saturated solutions the supragingival calculus was completely removed in 10 to 15 days. The dark,

hard subgingival calculus was partially removed in 10 to 15 days, but a longer interval was necessary to bring about complete dissolution. The organic matrix in which the calcium salts were deposited remained in situ unless disturbed by brushing or vigorous agitation of the solution. Much of the stain present on the teeth before immersion was easily removed by brushing after immersion for a few days.

From these observations it was believed that a saturated solution of sodium hexametaphosphate used as a mouth wash and a dentrifice might be effective in preventing the formation of calcular deposits on the teeth.



*Fig. 1.* Longitudinal section of tooth immersed in Sodium Hexametaphosphate for 6 months

To determine the effect of sodium hexametaphosphate on calculus formation a selected group of 10 patients undergoing periodontal treatment were used. All patients were known to acquire large amounts of calculus in a short period of time. Each patient was given a saturated solution of sodium hexametaphosphate to be used as a mouth wash and dentrifice once daily. They were directed to rinse the mouth with the solution every morning for 1 minute and follow this with their usual brushing procedure using sodium hexametaphosphate solution as a dentrifice. Patients were observed for intervals of a few weeks to a few months.

All patients using sodium hexametaphosphate daily ceased to have calcular deposits between appointments which were 1 week apart. The interval between

appointments was then increased to 1 month, and it was found that the same patients who had an appreciable amount of calculus deposited in 1 week now were free of deposit. The same results were obtained when the interval was extended to 6 weeks. There was also a reduction in the amount of stain accumulated during the same period. The teeth had an exceptionally clean appearance. If sodium hexametaphosphate as a mouth wash and dentrifice was discontinued for 1 to 2 weeks stain again accumulated and calculus was again deposited. In some patients calculus deposition could be prevented by using sodium hexametaphosphate in the prescribed manner every second day.

#### SUMMARY AND CONCLUSIONS

A preliminary report on the use of sodium hexametaphosphate as an aid in periodontal treatment indicates that:

1. Sodium hexametaphosphate in saturated solution does not have a deleterious effect on the teeth.
2. It does cause dissolution of silicate filling material at a rapid rate.
3. Supragingival calculus will be removed from extracted teeth in 10 to 15 days by a saturated solution, while dilute solutions have only slight effect.
4. Subgingival calculus will be partially removed in 10 to 15 days, but complete removal may take several days longer.
5. The use of a saturated solution of sodium hexametaphosphate as a mouth wash and a dentrifice prevents calculus deposition for periods up to 6 weeks and longer.
6. Because of its detergent action the accumulation of stain is also inhibited.

This should then be a valuable aid in the treatment of periodontal disease by preventing calculus and stain deposition.

#### REFERENCES TO LITERATURE

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