



Regenerative Concept of Bioactive Glass (NOVAMIN, BioMin F) Based Toothpaste- Does it Claim Evidence or A Myth?

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Dental Caries and mechanical decay (Attrition, Abrasion, Erosion) are regarded as the most common findings in our day to day dental practice. Now a days, there is a growing attention towards a newly emerged medical concept called as Regenerative Dentistry which focuses on the strategy of prevention and preservation rather than surgical model which prioritize the restorative procedures. The everyday use of fluoridated Toothpaste yet recognized as effective primary and prophylactic prevention in dental caries because of the caries resistant property of Fluoroapatite crystal of enamel. The invention of Bioactive Glass (Bioglass) by Dr Larry Hench in late 1960s revolutionized the field of regenerative medicine and biomaterials which highlights the concept of bolstering the process of osteogenesis by enhancing the body's own mechanism. The original concept behind Bioactive glass (NovaMin) was to rehabilitate the soldiers returning from Vietnam war. Bioactive Glass provides plenty of remineralizing ions like calcium and phosphate bioactive ions in oral environment which can effectively incorporated into hydroxyapatite crystals of enamel which resist further detrition of tooth structure. It may be a great help in old patients with hyposalivation because of medications, Radiation therapy or sjögren syndrome. Also, females have higher caries susceptibility due to insufficient salivary calcium levels in certain period of life including ovulation, gestation, post menopause etc. Toothpastes, those successfully augment the remineralization are being researched globally, as it will minimize the need of removal of healthy tooth structure during routine restorative procedures like amalgam or composite preparation. There are two bioglass based toothpastes widely used now a days named as Biomin Fluoride and Novamin with sodium fluoride. NovaMin began to be incorporated into toothpastes in 1990s and essentially unchanged from original formulation till date. However, since NovaMin was not intended for dental use it has some shortcomings like bigger particle size which can occlude dental tubules and phosphate

concentration is not optimized for dental remineralization. Besides this, it doesn't contain fluoride in Glass particle, so soluble fluoride is added to the formulation. BioMin is next generation bioglass where fluoride is successfully incorporated into glass particle so that as BioMin dissolves, calcium, phosphate and fluoride ions are released gradually to form Fluoroapatite, which is more stable than hydroxyapatite of enamel and more caries resistant. It is designed as low fluoride (660 ppm; whereas normal toothpastes contain around 1450 ppm fluoride) controlled drug delivery system which slowly release ions up to 12 hrs which effectively incorporated into enamel structure. BioMin is reportedly has small particle size than NovaMin and 3x phosphate concentration which indicates it dissolves calcium, phosphate and fluoride in therapeutically effective ratio in saliva which is available for several hours in oral environment. Another smart property exhibited by Biomin is that it quickly dissolves in acidic pH releasing ions and kick-start the remineralization process. In addition, as bioglass breaks down, more phosphate will be available which raise the pH of saliva, thus acting as a buffer. Several studies have been published regarding the remineralizing property of bioglass. Omran TM., et al. (2021) performed a study where they used Environmental Scanning Electron Microscope (ESEM) to assess the degree of remineralization by two bioglass based toothpastes. They concluded that there was no statistically significant difference in remineralizing potential between two bioglasses but phosphate group percentage was quite higher in Biomin group. But both of them showed a promising remineralizing property when they were used in patients twice daily for couple of weeks. Another study by Doura Alomari H suggested that BioMinF has greater antibacterial potential than Novamin against *Streptococcus mutans*; thus BioMin has a definite edge over Novamin in remineralization of initial carious teeth. The research by Queen Mary University, London describes that BioMin is ten times more acid attack resistant than NovaMin. It not only

remineralize the teeth, also prevents the hydraulic conductivity of dentinal tubules which is necessary to prevent dental hypersensitivity. This indicates their various use like post scaling and root planing, post bleaching hypersensitivity and sensitivity due to mechanical decay of teeth. A study by Shah GA (2018) regarding dentine hypersensitivity on 100 subjects found that BioMinF is more effective than NovaMin in minimizing sensitivity when patient score were registered in Thermal tactile and VAS scale. Reddy J., et al. (2019) found BioMin as the most effective desensitizing agent than NovaMin and conventionally used 5% potassium nitrate and the desensitizing effect is highest in 4 weeks. Recently, these bioglasses are the one of the most suitable biomaterial in minimally invasive atraumatic restorative dentistry (ART) and some fields of endodontics. The UK based research product BioMin received FDA premarket clearance in 2021 for its significant impact in the regenerative approach in carious and non carious sensitive teeth. It is also a vegan alternative to GC Tooth Mousse Plus. It was commercialized in 2016 and now it is globally used in more than 20 countries with up to 100,000 tubes produced per month. In India, toothpastes containing NovaMin like composition (fluoro calcium phosphosilicate, Zinc hydroxyapatite, calcium sodium phosphosilicate; CSPA) are widely available, whereas availability and usage of BioMin are still insignificant. In third world countries, since poor oral hygiene practice and dental negligence are the serious concerns, so regenerative bioglass containing toothpastes have a little scope where expense is the major issue. Hopefully, along with the increasing dental consciousness use of the biomaterials will not only reduce the caries index of population but also will unveil the new horizon of regenerative dentistry.