Abstract:

Tooth is the second hardest substance in the world. It is composed of enamel, pulp-dentin complex and cementum. Enamel is the highly mineralized tissue. Bio mineralization is the process by which living organism controls precipitation of inorganic nanocrystals with organic matrices to form unique hybrid biological tissue. Caries is a dynamic process with balance between demineralization-remineralization.

Traditionally dental caries was treated by a “surgical method” of drilling out the decayed part of the tooth and restoring it with various restorative materials. This way of treating dental caries is not ideal as the filled tooth enters the “Repetitive Restorative Cycle” as this process of drilling and refilling continues as ultimately each restoration fails. A new technique, Electrically Accelerated Enhanced Remineralisation (EAER) has been developed which shifts the balance towards remineralisation thus emphasising the use of remineralizing agents. The review article focuses on this method of tooth remineralization.

Key words: Remineralization, EAER, tooth and Dental Caries.

Introduction

Maintenance of Oral health is integral for maintenance of general health and teeth play a pivotal role in oral health. Enamel, dentin, cementum and pulp are the components of tooth. Cementum, dentin and pulp are specialized mesenchymal tissues, while enamel has an ectodermal origin and higher inorganic content when compared with that of dentin and cementum. The inorganic content is made up of hydroxyapatite, $\text{Ca}_{10}$(PO$_4$)$_6$(OH)$_2$. The hydroxyapatite crystals are hexagonal in shape and are bigger and highly oriented in enamel when compared to dentin and bone, this makes it the hardest tissue in human body. Though formation of Enamel is restricted only to the developmental period, remineralization and demineralization process of enamel continues throughout life time of the individual which is called biomineralization.

Dental caries is the most common disease which occurs due to the loss of minerals from enamel by acid producing bacteria. In the past years, the treatment of dental caries involved the drilling and restoring the tooth following the techniques given by Dr. G.V Black which
emphasise “Extension for Prevention,” thereby involving all morphological defects on the tooth surface. But with the advent of adhesive dentistry and with the idea of preserving the healthy tooth structure, restoration of decayed teeth has been governed by the principles of Minimally Invasive Dentistry (MID).

In line with the understanding of caries balance and demineralization-remineralization cycle and with early diagnosis there has been a paradigm shift in the treatment of dental caries. Hence repair of incipient lesions using remineralizing agents has become the mainstay of treatment.

Many remineralizing agents such as fluorides, CPP-ACP, Novamin, Bio active Glass have been used with varying success. Iontophoresis also has been reported to result in successful remineralization of the tooth structure.

In view of these principles and understanding, a new technique EAER (electrically Accelerated Enhanced Remineralization)-Reminova has been developed by Professor Nigel Pitts, kings college, University of London.

**EAER – An End to Dental drill:**

The sound of dental drill and pain from injection prevents people from seeking dental treatment. The latest evolution in dentistry to get rid of fear is EAER-Electrically Accelerated Enhanced Remineralization.

The procedure involves two steps - First involving the preparation of damaged part of the enamel, followed by using a small “healing handpiece” that delivers a tiny electrical current of a few micro Amps. This accelerates the remineralization process of the tooth, thereby helping in treating caries by natural process. This procedure can be applied only in the initial stages of dental caries. A tooth treated by EAER remains stronger and develops resistance to caries.

**Device:**

The device works on the principle of iontophoresis, it has probe made of electrode and counter electrodes that are used for detection of electrical characteristics of tooth. They (electrode) are coupled to opposite poles or terminals of a voltage sources. The active agent can be cationic or anionic and the voltage source can be configured to apply the appropriate voltage polarity based upon the polarity of the active agent. The active agent may be stored in for example, a reservoir such as a cavity or in a porous structure or a gel.

Iontophoresis may also be used in conjunction with fluoride containing compounds to treat dentin hypersensitivity and to remineralise non-cavitated dental caries lesions.

**Mechanism of Action:**

- EAER works on the principle of “Iontophoresis”. Iontophoresis is the non-invasive procedure which is used to propel charged substance, bioactive agents or medication using electrical current.
- This process is most commonly used in transdermal drug delivery.
- Level of tooth decay alters the electrical characteristics of a tooth.
- Increased current is measurable from a demineralised tooth, compared with a healthy tooth, on application of potential difference. Demineralization increases the
porosity of the enamel surface and the number of ions also increases. Hence conductivity of the electrical current increases

- The remineralizing agents used are casein phosphopeptide-amorphous calcium phosphate, Fluoride, inorganic amorphous calcium sodium phosphosilicate (novamin), tri-Calcium phosphate (TCP) etc.\textsuperscript{5,14,16,19}

- The damaged part of the tooth surface is conditioned and remineralizing agent is applied over the surface. The remineralisation of the tooth is accelerated by using high frequency ultrasound signal through “healing handpiece”, which also delivers milliamperes of current. Hence remineralisation is increased by electrosonophoresis (the combination of ultrasound and iontophoresis).\textsuperscript{19}

**Conclusion:**

This is one of the novel techniques used for remineralisation and thus helps the profession in moving away from the conventional surgical model of drilling and filling to a medical model of remineralisation thus bringing a paradigm shift in treatment of dental caries.
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