THE DIFFERENCE BETWEEN RIVA STAR AND CREIGHTON'S CSDS

BY SILVANO D'AMBRISIO, CREIGHTON DENTAL

From the number of emails and calls I have had it is obvious that there is a great deal of confusion about silver fluoride and its uses. I am often asked if I know where to source potassium iodide, to apply to the tooth treated with silver fluoride/stannous fluoride to negate the blackening effect" or "what is the difference between CSDS and Riva Star"?

To answer these questions we need to go back to the basic structure of CSDS's silver fluoride and that of Riva Star's silver fluoride. Essentially Riva Star is silver diamine fluoride (silver fluoride powder dissolved in ammonia) and CSDS is a water-based silver fluoride i.e. silver fluoride powder dissolved in water.

CSDS is used to treat open carious lesions in primary molars and root-surface lesions in the elderly.

Riva Star is designed to be used on vital asymptomatic permanent posterior teeth where some caries is left to avoid a pulp exposure. It is meant to facilitate the natural repair process in dentine and must be used in conjunction with glass ionomer cement (GIC) base or restorations. It was not designed for use on open carious lesions; it acts as a continuous source of fluoride helping the repair process.

CSDS is water-based and contains no ammonia, has no pungent odour and a pH of 6.3 (water pH 7).

The technique for using Riva Star differs from that of CSDS in the following way:

1) The initial stage is the same with both products namely isolation of the area to be treated with cotton rolls.
2) However, after that if Riva Star is to be used near gingival tissues these tissues have to be protected with a gingival barrier (the product has a very high pH)
3) Silver fluoride is applied with the silver brush provided taking care to apply the solution to treatment site only.

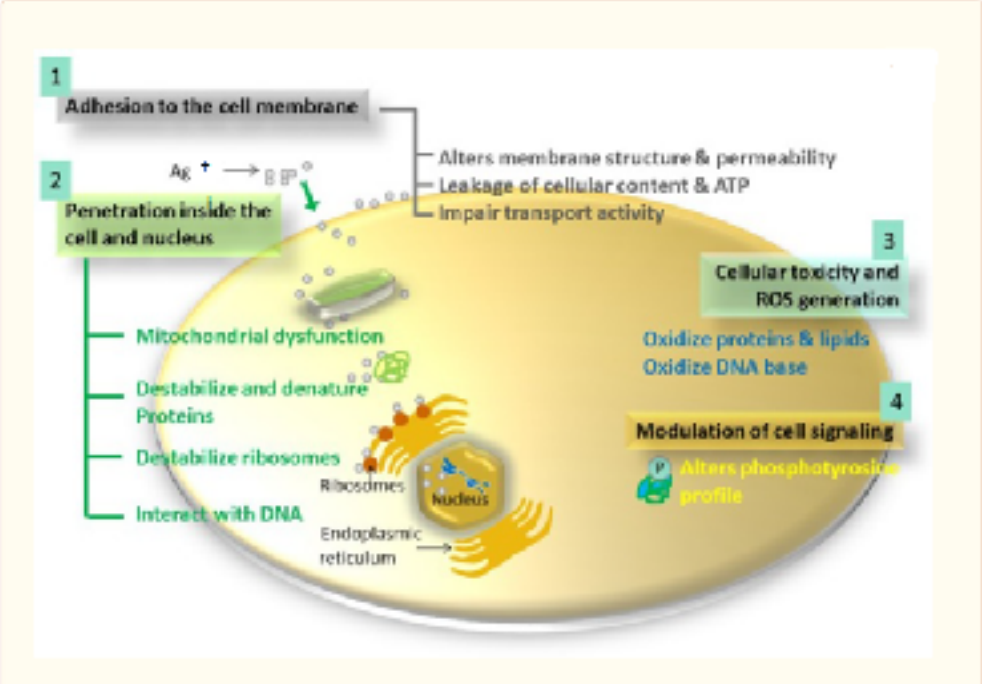
4) Immediately after, use the green brush to apply a generous amount potassium Iodide to the treatment site. The treatment surface initially appears creamy white; more potassium iodide needs to be applied until it turns clear.
5) The gingival barrier is removed and the cavity is blot dried. A Glass ionomer (GIC) base or restoration is placed.

The technique for using CSDS is as follows:

1) The teeth to be treated are not cleaned if there is gingival or occlusal food impaction it is removed. Soft caries is not removed.
2) The teeth to be treated are isolated with cotton rolls.
3) CSDS is water-based with a pH near that of water; therefore, the adjoining soft tissues are unlikely to suffer chemical burns; thus, no gingival barrier is needed.
4) Using a microbrush silver fluoride is applied to the lesion for a minimum of one minute, ideally for three minutes.
5) Stannous fluoride solution is then applied with a new microbrush. The stannous fluoride precipitates elemental silver, and turns the lesion black.
6) The treated area is covered with Orabase Protective Paste (Convatec).
7) Ideally the patient is examined two to three weeks after this application. If the lesion remains black it means caries has not progressed, and it can either be left open or restored with GIC. If the black colour of the treated lesion is starting to fade, this is a sign that caries is still progressing and another application of CSDS is warranted. This black staining of a treated carious lesion is an important property of CSDS, as it serves as a visual indicator of the status of the carious lesion.

THE SCIENCE:

Silver fluoride in solution contains silver ions, which actively destroy bacteria in the following ways:



1) Silver ions attach themselves to the bacterial cell membrane which:
   a) Alters the membrane structure and permeability
   b) Causes leakage of the cytoplasm and ATP
   c) Impairs the cells transport activity

2) Silver ions penetrate inside the cell and nucleus causing:
   a) Mitochondrial dysfunction
   b) Destabalise and denature proteins
   c) Destabalise ribosomes
   d) Interact with DNA
3) Induce cellular toxicity and oxidative stress by the generation of reactive oxygen species (ROS) and free radicals the result is:

a) Proteins and liquids are oxidised

b) DNA base is oxidised

4) Modulation of cell signalling, altering the phosphotyrosine profile. Tyrosine phosphorylation is considered to be one of the key steps in signal transduction and regulation of enzymatic activity.

STANNOUS FLUORIDE (SNF2).

Metals, like tin (Sn), actually sterilize themselves after a certain period of time. This is called the oligodynamic effect; defined as "a toxic effect of metal ions on living cells" (including bacteria), even in relatively low concentrations. The exact mechanism of this action is still unknown, but some data suggest that the metal ions denature protein of the target cells by binding to reactive groups (proteins contain functional groups from each amino acid these groups are reactive and contribute to protein function) resulting in their precipitation and inactivation.

CSDS not only has the silver ion that disrupts the cell wall by binding with the sulfhydryl groups in the protein of the cell wall forming silver sulphides destroying cell membranes, and inhibits enzyme activity, but it has the added benefit of the stannous (Sn 2+) ion, also denaturing bacterial protein by binding to reactive groups in the same way silver ions do, to kill bacterial. CSDS with the added advantage of the Sn2+ ion is able to launch a two pronged attack on bacteria resulting in the more efficient and quicker demise of bacteria. In addition the stannous 2+ ion is oxidised by surrendering to electrons to form the stannic ion Sn 4+ in so doing it reduces silver ions to metallic silver. The stannic ion Sn4+ exerts a very powerful electrostatic force that is able to bind together all the denatured proteins, from the dead bacterial cells and the remaining sludge, the remnants of the carious lesion, as well as calcium and phosphates from saliva into a hard black callous; forming a diffusion barrier over the treated carious lesion depriving any remaining organisms, if any should survive this vicious attack by silver and stannous ions, of any substrate to reactivate caries.