REALITY NOW
RATINGS & REVIEWS | practical • unbiased • trusted
36TH anniversary | number 354

The Ratings | Fluoride — Silver Diamine

Riva Star Aqua

Manufacturer

SDI

www.sdi.com.au/

Prices

Unit dose kit (20)

$118.29 ($5.91/capsule)

Bottle kit (4.5ml)

$118.29 ($26.29/ml)

Shelf life

2 years

Raves & Rants

- ✔ **Minimal to no soft tissue effect**
- ✔ **Effective desensitizer**
- ✘ **Two components/two steps**
- ✘ **Doesn't completely stop staining**

2022 REALITY RATINGS & REVIEWS Five Star Award

REALITY'S CHOICES

4.6

Introduction/ Manufacturer's Claims

Silver diamine fluoride (SDF) has become a valuable foot soldier in the fight against caries and sensitivity, but one issue that has plagued all the available products has been the tissue irritation caused by the ammonia solvent. Tissue irritation is a particular problem when treating Class V lesions. When SDF finally was available in the U.S. several years ago, the mantra was to protect the soft tissue with ointments such as Vaseline or one of the light-cured resin shields that are commonly applied during power bleaching.

However, these approaches to gingival protection may not always be utilized since they can be a nuisance to apply especially if you are treating multiple teeth. Fortunately, the soft tissue irritation caused by SDF has been shown to be rather mild and healing usually proceeds uneventfully in several days after treatment.

Nevertheless, if the ammonia solvent can be eliminated, then the tissue irritation will presumably be negated and, as a bonus, the ammonia odor and taste will also be issues of the past.

Enter Riva Star Aqua, the first aqueous-based SDF. Actually, since the ammonia is gone, Aqua is not even considered to be "diamine" and it is badged as merely silver fluoride or AgF/SF. For this review, we will use SF to be more consistent with SDF.

Although it is still nominally a "tooth desensitizing agent" to stay on the good side of onerous government regulators, everyone using SDF/SF knows its real utility is the inhibition or even reversal and/or remineralization of a carious lesion including perhaps not having to remove all the carious tooth structure.

Concerning being aqueous-based vs ammonia-based when it comes to soft tissue irritation, half of the evaluators found Aqua had no or minimal soft tissue issues compared to ammonia-based products, 31% had no or minimal soft tissue problems, but had not used ammonia-based products so they couldn't compare them, 13% still had soft tissue irritation comparable to that caused by ammonia-based products, and the remaining 6% still had soft tissue irritation, but had not used ammonia-based products so they couldn't compare them. Some comments:

- Did not burn the tissue like ammonia-based products.
- I protected the lips and gingiva anyway.
- No gingival irritation, but I did have a drop on the edge of a patient's lip that did cause mild irritation.
- Gingival tissue would turn white, similar to a strong bleaching agent if it sits on the tissue.
- I never had any problem with Advantage Arrest, either, since I tried my best to not get it all over the tissue.
- Not as caustic.
- It's more convenient not to need tissue protection.
- In two cases, there was a very thin irritation layer same as caused by self-etch adhesives, but fewer than the regular, ammonia-based version of the product. No barrier was used and in the other cases, there was almost no irritation.
- Had minimal soft tissue irritation in 1 patient.
- Yes, much better than the original Riva Star! I only had one patient with minimal irritation.

For those evaluators who have used the original Riva Star, all except one preferred Aqua, while the lone outlier had no preference.

And for those evaluators who have used the ammonia-based Advantage Arrest, half had no preference, 33% chose Aqua, and 17% were AA fans. Some comments:

- A lot fewer issues with Aqua.
- I have used Advantage Arrest a lot and it seems to work nicely.
- Less staining with Aqua.

Only 31% of the evaluators followed the company line and only used it as a desensitizer, while the other 69% used it to arrest caries and as a desensitizer. Some comments:

- A good approach in the right direction!
- Easy to use.
- I did use it for both purposes even though the arrest caries property will take a while to assess its effectiveness.

- I used it on geriatric patients with furcal caries and root caries.
- It's great to have the ability to arrest caries and be conservative.
- Mostly as a desensitizer, but on 3 severe decay patients, I tried to arrest caries.
- The material is very effective as desensitizer. Immediately stops sensitivity just after the application. The patients normally have a trust problem for these kinds of materials. And generally they are not satisfied. They usually think that the dentist is doing it to make them relaxed emotionally. This material made the patients satisfied as soon as it was applied.
- I used only once to arrest caries. But yes, it is silver fluoride.

Its prime ingredients are, as noted previously, silver fluoride (SF) and, as in the original version, potassium iodide (KI). These components are stated to provide a powerful antibacterial effect, while in addition, there is a low-solubility precipitate that is formed, which seals dentinal tubules and thus the desensitizing effect is achieved.

KI is applied over SF so that free silver ions precipitate out as silver iodide and prevent the propensity for SF to stain either a glass ionomer/composite used to restore a prep and/or the surrounding tooth structure.

On this staining issue, 36% of the evaluators found it prevented staining most of the time, 36% thought it helped, but staining still occurred most of the time, and 28% did not find any staining. Some comments:

- Speaking of stain, it also stains your clothes.
- Staining isn't that much of a problem and it isn't the dark brown-black that I get with Advantage Arrest.
- Staining has not been a big problem in these cases.

Composition

Step 1 Silver Fluoride (SF)

- Silver 32.6%
- Fluoride 5.7%

Step 2 Potassium Iodide (KI) 58.3%

pH

Step 1 (SF)	~5
Step 2 (KI)	Not disclosed by manufacturer

Smell and Taste

Compared to ammonia-based products, most (62.5%) evaluators had no or minimal complaints from patients with Aqua, while the other 37.5% still had no or minimal complaints from patients with Aqua, but hadn't used any ammonia-based product, so they didn't have any ability to compare them. Some comments:

- Could not smell it at all.
- There was some bad taste with this one too.
- The ammonia-based Advantage Arrest product is fine if you use suction for the smell. Actually I like the smell of the ammonia!
- Definite improvement over the original version.
- I had no complaints from patients with the original version too.
- None of the patients mentioned taste or smell.
- I noticed a big difference compared to the original version.

Use

If you want to use it as a desensitizer for exposed roots and/or abfraction lesions, clean the sensitive area as you would with any product. Isolate and blot the tooth dry. If you are using the unidose kit, take a metallic blue capsule (SF), which looks like a glass ionomer or amalgam capsule that has been on a diet and, using the silver applicator tip, pierce the foil top seal and push the edges of the foil to the circumference of the aperture to open the capsule maximally.

This piercing motion requires moderate pressure, which can cause the applicator tips to bend at their thin necks. Apply the clear SF solution to the target site. The instructions do not detail the application technique, so we just applied it with gentle agitation without rubbing or scrubbing.

Next, working fast, take a lime green capsule (KI), pierce its foil top with the green applicator tip, and apply the KI

solution over the SF. Keep applying the KI until the creamy white mixture turns clear. Then blot dry.

If you are using the bottles instead of the capsules, you are supposed to dispense one drop of SF, apply it, and then dispense 2 drops of KI and apply as noted above.

For the evaluators who used it to desensitize teeth, the SF component was most often placed for 15 seconds (44%), followed by 30 seconds (31%), while 25% preferred 60+ seconds. Some comments:

- Applied the two layers and let it dry.
- Multiple coats.
- 10-15 seconds.
- I used almost 15 seconds for each.

As far as desensitization effectiveness is concerned, most (75%) evaluators found it worked most of the time, while 19% reported it worked all the time and 6% did not find it to be very effective. Some comments:

- Aqua worked initially as tested with cold water to the site, but its effect did not last until next hygiene visit.
- Probably on an average, it was 70% effective for decreasing the tooth sensitivity.
- I didn't get great results with desensitizing. Patients said it was better, but they would still have some sensitivity.
- Patients were amazed at its effectiveness.
- I compared the material with Gel desensitizer of Sun Medical. They both worked well immediately after application.
- I really had a good experience — sensitivity was greatly reduced.

What about the concept of leaving deep "affected" carious dentin and treating it with Aqua as opposed to removing all carious dentin and risk a pulpal exposure, assuming the patient is asymptomatic and there is no radiographic evidence of periapical involvement? Most (83%) evaluators agree with this approach, while the other 17% identified as old-school and were not in favor of leaving any type of carious dentin in the prep. Some comments:

- This approach can be combined with Fluorescence Guided Dentistry using Reveal.
- It is a much more conservative approach and always worth trying first.
- Old dogs do not change much.
- With gentle excavation, I say a prayer and place it in some of my geriatric patients with severe Alzheimer's or having a short life expectancy with medical condtions not amenable to surgery if needed. Just trying to buy time!
- Yes if no preop pain.
- Patients mostly would prefer to avoid endo if possible.
- My strategy is any way to avoid endo. I have used Clearfil SE Protect when I had to leave some decay on the pulpal wall.
- I am always looking for the most conservative approach.

Then, although not specifically recommended by SDI, we believe cleaning the prep with a pumice slurry (very inexpensive) or any non-fluoridated cleaning paste is also a prudent step. Follow this by rinsing and drying with air or blotting the prep dry.

Apply SF liberally followed by KI, then rinse again and blot dry. For the evaluators who used it to arrest caries, 45% placed the SF component for 60+ seconds, while the other 55% were evenly split among 15 seconds, 30 seconds, and 45 seconds. This wide range of application times is probably due to SDI not recommending a specific time for this purpose. Some comments:

- Does this have a correct time?
- I followed manufacturer's recommendations to apply bottle 1, then immediately apply bottle 2 and scrub until white precipitate was removed.
- I let it dry and didn't wash it off.
- Kept applying.
- Depended on size of lesion. Used a bit longer for larger lesions.
- I had no problems applying it longer.

Restore the entire cavity with conventional, self-cured glass ionomer if the restoration is intended to be interim or the glass ionomer can replace the lost dentin and you can veneer it with composite for more durability and much better esthetics.

Nevertheless, most (67%) evaluators favored a bonded composite as the material of choice after treating the preps with Aqua, while the other 33% used some type of ionomer. Some comments:

- GIC beneath resin.
- I only tried using this as a caries arresting agent on 1 deep occlusal filling. It did stain a little, but I then used Vitrebond to cover the deep affected dentin. The Vitrebond minimized the stain. Then I used a 5th Generation bonding agent with total etch to bond a composite restoration. I also applied it to a few class V buccal decalcification areas. It did stain initially, but the patient reports that the staining has resolved.
- I would place the composite over a glass ionomer (not an RMGI).
- In one case, we used the material in an old caries affected dentin surface. The patient had sensitivity within the cavity, however the tooth did not require endo. We used a bonded composite over it. However we did not have chance to track the case for long term. If I use it on caries-affected dentin, I would always prefer bonded composite resin over it.

For the restorations placed over SF-treated tooth substrate, no debonds were recorded.

Finally, there is a stern warning that it can stain teeth if the product is "incorrectly used".

Packaging

Unidose Kit Comes in a shrink-wrapped, conventional, white cardboard box with a photo of the capsules on top. Product identification is on the top and two sides. Unlike the original version, you no longer need to refrigerate it. A label on the back has both the manufacturing and expiration dates.

Inside is a white plastic tray securing the contents, which are nicely organized. The color-coded metallic blue and lime green capsules are housed in separate recesses adjacent to silver and green applicator tips. The tray is labeled Step 1: Silver Blue capsule and Step 2: Green capsule.

Bottle Kit Small white cardboard box sealed with tape with product identification on the top, front, and one side. A label on the side has both the manufacturing and expiration dates. Inside is a cardboard tray meant to be removed and used as a dispensing holder for the two bottles, which are secured in cutouts labeled Step 1 and Step 2.

The Step 1 bottle, which is the smaller of the two, contains the SF and has a silver blue label that identifies the product, notes that it is AgF, and includes the expiration date. The larger Step 2 bottle has a lime green label that also identifies the product, notes it is KI and includes the expiration date. Both of these bottles are conventional black squeeze types with screw-off/on caps.

Most (75%) evaluators preferred the bottles or had no preference, while 25% chose the capsules. Some comments:

- Less waste with bottles.
- They both work, but the capsules are more awkward.
- The bottles were easier to dispense, but multiple drops would come out and it did stain our plastic dappen dish.
- I get more precise dispensing with the bottles. Plus the cheap applicators can bend at right angles when you pierce the foil sealing the capsules.
- Capsules are more Covid friendly, less chance of cross contamination and less waste.
- For the patients who require the treatment for 3 or more sites, I preferred capsule pairs. When the patient has hypersensitivity on one site, I preferred bottles.
- Capsules for treating more than one tooth, but the bottle is more economic for single teeth.
- Capsules are disposable, which is better for schools.

Overall, the packaging was considered to be adequate by most (75%) evaluators, while the other 25% found it to be exemplary. Some comments:

- The capsules look interesting, but some were hard to break through the foil.
- I really liked the colors!
- The packaging is practical and convenient.

Directions

Our kits came with multi-lingual, plain paper directions. The font is small, but you should be able to read the instructions without loupes. The information is reasonably easy to follow, but as noted previously, there is no mention about how long to apply the SF.

In the unidose kit, there is also a plastic-coated, double-sided technique card with well-done color illustrations demonstrating its use in a step-wise manner. This is much better than the paper version and uses a font that can be read without creating eyestrain, but it only covers the desensitizing function.

Note: In the directions, SDI still recommends protecting the soft tissue despite the fact that there is no ammonia in this version. However, the marketing info states gingival protection is no longer necessary.

In addition, it states it should only be used "in adults over the age of 21", which of course is ridiculous since its successful use in kids is well documented. Finally, it states "Do not repeat treatment on pregnant or lactating women." Does this mean you can apply it once but not twice?

Most (81%) evaluators found the directions to be adequate, while 19% thought they were exemplary. Some comments:

- The laminated card was an easy reference for the capsule use; the quick tips on bottle package was helpful.
- A little confusing on technique.
- I always like pictures.
- Just okay.
- Clear and concise; clearly stated precautions.
- Very informative and practical.

Strengths

- Another addition towards a minimally invasive approach!
- Good desensitizing.
- Good for pedo.
- No ammonia.
- Seems to work pretty good especially with sensitivity.
- The color coding makes this a good product, the lack of odor was preferred.
- I believe this would serve our pediatric patients or elderly patients as a caries arresting agent.
- No smell if that bothers you. Minimal tissue irritation without the high pH ammonia.
- Less staining.
- Effective, no bad taste or smell, no need for tissue protection, ability to arrest caries.
- Less tissue irritation, no gingival barrier needed, no need to store in the fridge, effective in reducing cervical hypersensitivity.
- This is a nice product and the patients feel good just after application in the same session. Storing condition is convenient. There is almost no irritation in gingival tissues. No barrier is needed. The results are significant in every stage of sensitivity.
- Very good desensitizer. Easy to use. No smell.
- No ammonia, less tissue irritation, very effective as desensitizer.

Weaknesses

- Additional step.
- Stains.
- 2 step process.
- A bit challenging to use, had to be careful to use and could not use on children or pregnant women.
- It stains and it can irritate tissue especially on unattached gingiva and lips.
- The capsules were not easy to penetrate without an additional instrument — the waste seemed excessive with them.
- I didn't receive great results with desensitizing, but would still use it and with more experience and time, may get better results.
- Not sure if it works 100% of the time.
- Potential for staining, not able to use in esthetic zone.
- Window of usage is quite narrow.
- Staining potential (one patient reported low level staining on the tooth).
- Capsule form seems not economical for one tooth cases.
- Irritation to gingiva.
- Two steps.

BOTTOM LINE

- Definitely worth the effort.
- Useful in specific cases.
- I loved the product.
- I would not purchase.
- Good for sensitivity, but uncertain on caries arrest.
- Riva Star Aqua is a nice addition to the restorative material armamentarium. SDF/SF should be in every office in some form or another.
- I would probably use this as more of a caries arresting agent.
- I can see this for pediatric caries treatment due to the lack of smell and tissue irritation.
- Nice product. Dispensing was easy.
- Would definitely recommend this product.
- To my type of practice, this has not too much value.
- With its ammonia-free formulation, it is much safer than the original version.
- This product is a promising material. I did not have chance to test the product for caries arrest. However as a desensitizer, it seems it is very successful. The patients feel the effect immediately after the application. Long-term clinical controls, the effect on bond strength when used to arrest caries, and post-op *in vivo* studies about the caries arrest effect should be studied.
- Very good desensitizing material.
- I like it. I would recommend as a desensitizer.

To become a member of *REALITY* RATINGS & REVIEWS, please visit our Web site at www.realityratings.com.

NO COMMERCIALIZATION POLICY

We accept no advertising and are not beholden to any commercial interest. Product evaluations and ratings are intended only to guide our readers to make wise and informed purchases. The unauthorized use of product evaluations and ratings in advertising or for any other commercial purpose is strictly forbidden.

REALITY RATINGS & REVIEWS (ISSN#1041-8253) is an online information service from Revera, Inc., 1322 Eagle Point Dr., Georgetown, TX 78628, U.S.A., 512-688-3423, Fax 512-489-9225. A one-year membership includes access to the online database plus periodic PDF issues of **REALITY *NOW***. Call for membership and publication rates or access our Website for enrollment information. Payments by check must be in U.S. funds drawn on a U.S. bank, or by Visa, MasterCard, or American Express.

A publication member of the American Association of Dental Editors

MANUFACTURER'S PAGE

SDI | RIVA STAR AQUA

THE NEXT GENERATION SDF SYSTEM

NEW

SDF (Silver Diamine Fluoride) has a proven clinical history of arresting caries and treating dentin hypersensitivity for over 50 years.

Riva Star Aqua is the latest innovation to the SDF treatment category. The patented water based silver fluoride solution is not only antimicrobial, it is also a bio film eliminator and a powerful desensitizer.

INDICATIONS: **BRAZIL / LATIN AMERICA:** Desensitizing cervical tooth hypersensitivity, arresting caries, detecting caries.
AUSTRALIA / EUROPE: Desensitizing cervical tooth hypersensitivity.
USA: Treatment of dentinal hypersensitivity, for use in adults over the age of 21.
Each product kit contains Instructions For Use to ensure correct use as indicated.

SDI | YOUR **OUR** SMILE. **VISION.**

SDI (North America) Inc.
1279 Hamilton Parkway
Itasca, IL 60143
www.sdi.com.au

Call 1-800-228-5166
Fax: 630-361-9222
usa.canada@sdi.com.au

05-2021 M100433 A
+DO36M1004331Z

50 YEARS DENTISTRY SCIENCE

NEXT GENERATION SDF: RIVA STAR AQUA

SDI continues to innovate SDF solutions by releasing Riva Star Aqua, a next generation water based silver fluoride solution that is also as effective as an SDF solution, with additional patient benefits.

Similar to Riva Star (SDF), Riva Star Aqua (AgF) is also a non-invasive 2 step patented system used to desensitize tooth pain in a few drops. Riva Star Aqua is an aqueous silver fluoride solution without the Ammonia base.

Riva Star Aqua Kit 10 x Riva Star Aqua Step 1 Silver-Blue Capsules 10 x Riva Star Step 2 Green Capsules Accessories	8800527
Riva Star Aqua Bottle Kit 1 x 1.5mL Riva Star Aqua Step 1 Bottle 1 x 3.0mL Riva Star Step 2 Bottle	8800532

RIVA STAR AQUA KEY BENEFITS

1 CLINICAL MATCH TO SDF
Clinical studies have shown that Riva Star Aqua's 38% Silver Fluoride (AgF) is also as effective as Riva Star SDF solution containing 38% Silver Fluoride.[7]

2 IMMEDIATE SENSITIVITY RELIEF
The silver fluoride and potassium iodide in Riva Star Aqua blocks the microscopic tubules that make up dentin. A low-solubility precipitate is formed that gives instant relief.

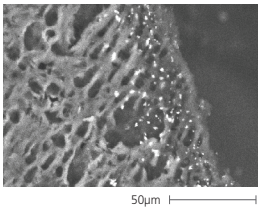

Image shows the reaction of AgF and KI to AgI in the first 50 microns below the surface.

Image courtesy of Dr. Geoff Knight

3 REDUCE STAINING
Just like Riva Star, Riva Star Aqua includes a Potassium Iodide (KI) Step 2 solution, for significantly reducing unsightly black stains.

4 TWO YEARS DESENSITIZING EFFECT
A clinical study supports the immediate effect after one application with Riva Star, desensitization lasts for 2 years.[5]

5 EFFECTIVE BIOFILM INHIBITOR
Studies support that Riva Star is an effective Biofilm inhibitor. Riva Star has a higher inhibition zone against four bacterial species compared to sodium hypochlorite[6].

6 NO TISSUE BURN RISK
Riva Star Aqua is water based and ammonia free. This reduces soft tissue irritation and eliminates odors while improving storage stability.

7 NO GINGIVAL BARRIER REQUIRED
With no ammonia present, Riva Star Aqua can be safely used without a gingival barrier as soft tissue irritation is significantly reduced. Treatment time is quicker and more comfortable on patients.

8 IMPROVED SMELL
The ammonia free solution tastes and smells better, leading to happier, more compliant patients.

[5] Clinical evaluation of a diamine silver fluoride/potassium iodide as a dentin desensitizing agent: 2-year follow up. Craig G G - 2014.

[6] Heo J Tomkins GR, Love RM ; Evaluation of the antimicrobial activity of combined Silver Diammine Fluoride (SDF) and Potassium Iodide (KI) as an Endodontic Medicament, University of Otago, New Zealand, 2010

[7] Turton B, Horn R, Durward C. Caries arrest and lesion appearance using two different silver fluoride therapies on primary teeth with and without potassium iodide : 12 month results. Clin Exp Dent res 2020;1-11