



I Want To Know!

Questions and Answers about Bone Health Supplements

Since we introduced you to the health benefits of stable **Strontium** in *Advances* 2(3), we've been inundated with questions about this radical new bone health mineral. We're taking the opportunity to lay out the facts as we know them here.

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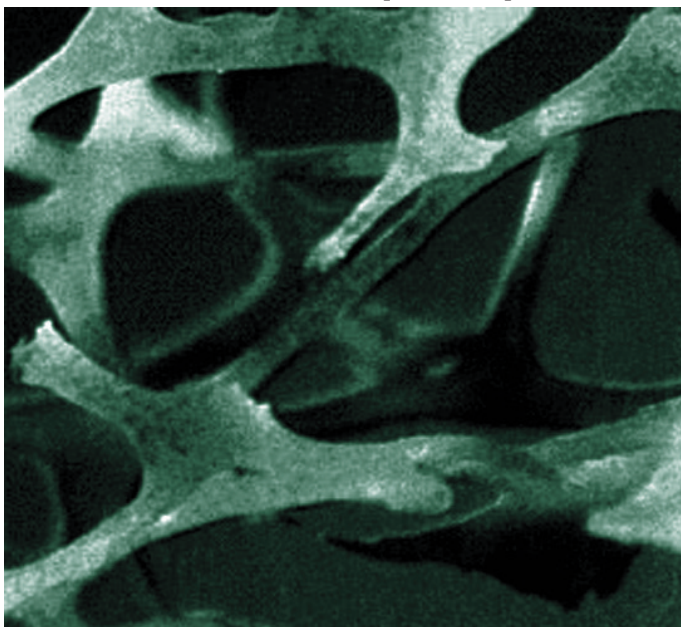


Strontium citrate enjoys the advantages of a relatively high elemental yield (about 300 milligrams elemental Sr²⁺ per gram of compound), so you won't be popping fistfuls of pills to get your daily dose, and of being very soluble, giving it good gastric tolerance and bioavailability compared to many other forms (such as the carbonate). Citric acid is also a *natural* ligand, and is available as a dietary supplement.

Q What do you think about all these new supplements which contain a full day's dose of **Strontium** along with calcium, magnesium, and other key nutrients all in one convenient bottle?

A They're a disaster.

In his review, Dr. Reginster specifically notes (pg. 1914) that "**The simultaneous intake of [Strontium] and calcium**



remarkably reduces the bioavailability of [Strontium]. This is probably due to competition at the sites of active absorption. Simultaneous food intake also has a negative influence on the bioavailability of **[Strontium]**". Based on this critical factor, Dr. Reginster recommends that high-dose **Strontium should not be taken "concomitantly with a meal or a calcium intake."**

The competition between **Strontium** and calcium for absorption has long been known, and is the basis for the fact that **all of the trials using strontium with major bone-health outcomes have carefully ensured that the supplement is taken on an empty stomach, away from calcium** in food or in supplements.^{2,3,11}



and it is the one that we recommend unless your doctor specifies otherwise. It is obviously impossible to follow this protocol if you're taking a supplement that combines calcium and **Strontium in the same pill or powder!** Such formulations are, therefore, not the "convenient," "inexpensive" deals they initially seem, but are ill-designed and likely ineffective "kitchen sink" hodgepodes. Persons taking these supplements will not reap the full benefits of



Strontium documented in the clinical trials. This is a major health issue, especially for people with advanced osteoporosis. If they and their physicians are taking these combination supplements instead of a reliable, separate supplement, or instead of an established drug therapy, the results could be ruinous.

Note that these problems do not hold if there is only a small, *nutritional* amount of **Strontium** in a core bone health supplement— doses in the range of 500 micrograms to 5 milligrams, which are typical of human dietary intakes. Such doses are appropriate, as they preserve the ratio of calcium and **Strontium** present naturally in whole-food diets. In fact, all natural calcium sources also have a small amount of **Strontium** in them, because of the similar metabolism of the two nutrients in living beings. The presence of calcium with *no Strontium* in calcium supplements might be expected to upset this natural balance, leading to suppression of whatever **Strontium** is in your diet, ultimately perturbing the natural balance of minerals in your bone.

Indeed, some evidence already exists that, over a lifetime, these low, nutritional doses of **Strontium** do have a role to play in your health. For example, it was discovered in the

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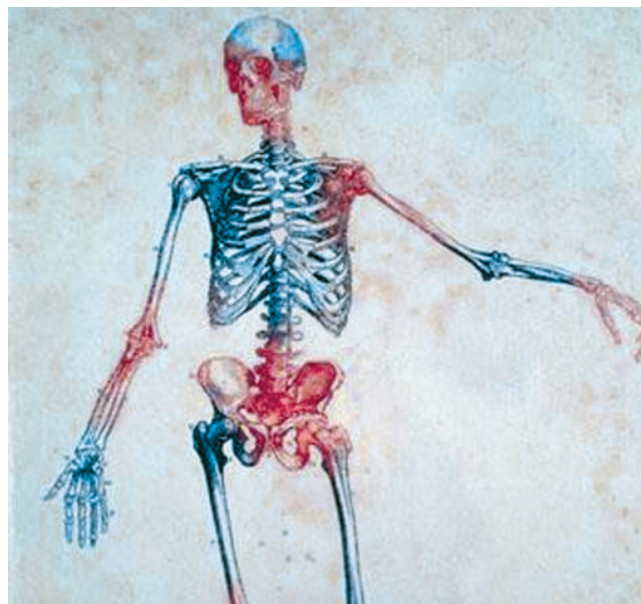
1960s that areas with more **Strontium** in the water have a lower incidence of dental caries^{14,15} – a finding which was to be reinforced by the findings of at least eight more studies over the course of the next few decades.¹⁶

Some of these **Strontium**-calcium combination products further shoot their users in the foot by using poor forms of key ingredients. Some, for instance, use poor forms of calcium, such as cheap **calcium carbonate** (which has low gastric tolerance and which reduces your absorption of other nutrients by neutralizing stomach acid) and synthetic **calcium hydroxyapatite** (an extremely poorly-absorbed synthetic calcium phosphate salt, not to be confused with **ossein microcrystalline hydroxyapatite complex (MCHC)**, an extract of bone-health nutrients contained in an intact calcium crystalline matrix). Others use **magnesium carbonate** as a magnesium source; this is another antacid, and like calcium carbonate is poorly absorbed. Likewise, one of these products is even trading off of the research on **Menatetrenone (MK-4)** – the *mammalian* form of vitamin K2 and the one used in all of the “vitamin K2” clinical trials – to sell *another* “vitamin K2:” the unproven, bacterial *menaquinones*.

Everyone concerned about their bone health needs a core calcium supplement, along with other key nutrients such as **magnesium, vitamin D3, and Menatetrenone**. In such a supplement, a small, nutritional dose of **Strontium** is a good balancing act, reflecting the trace levels of **Strontium** naturally present in food. But if you need the potent support of a “megadose” **Strontium** supplement, it should absolutely *not* come in a combination with calcium. You need a *separate* **Strontium** supplement, taken at a separate time.

Q The articles in *Advances* say that most trials have used dosages of **Strontium** in the 600-700 milligram range. But I keep hearing stories about trials using one or two *grams* of **Strontium**!

A This comes down to the question of *elemental yield*: the amount of **Strontium** *itself* that is present in a given amount of an **Strontium** *compound*. **Strontium**, like other minerals, does not come “naked,” but as part of a compound – a salt or chelate *form* of the mineral. And different forms of the mineral are more or less mineral-dense. For instance, one gram (1 000 mg) of *calcium carbonate* contains 400 mg of *elemental calcium*, while the same amount of *calcium citrate* contains just 210 mg of elemental calcium. Similarly, to get 420 mg of *elemental magnesium* takes 5 600 mg of true, fully-reacted magnesium aspartate, because this superior form of the



mineral is only 7.5% elemental magnesium by weight. By contrast, to get the same amount of elemental magnesium from cheap, dense, low-bioavailability magnesium oxide requires just 696 mg of the compound, because magnesium oxide is over 60% elemental magnesium by weight.

To understand the difference on a supplement label, understand that “Calcium citrate ... 1 000 mg” means 1000 mg of calcium citrate *compound* (yielding 210 mg of *elemental calcium*). By contrast, “Calcium (from calcium citrate) 1 000 mg” or “Calcium (citrate) 1 000 mg” both mean 1 000 mg of *elemental calcium* is present in the number of capsules or tablets listed, in the form of calcium citrate.

Q Can I combine **Strontium** supplements with a bisphosphonate drug, such as alendronate (Fosamax®)?

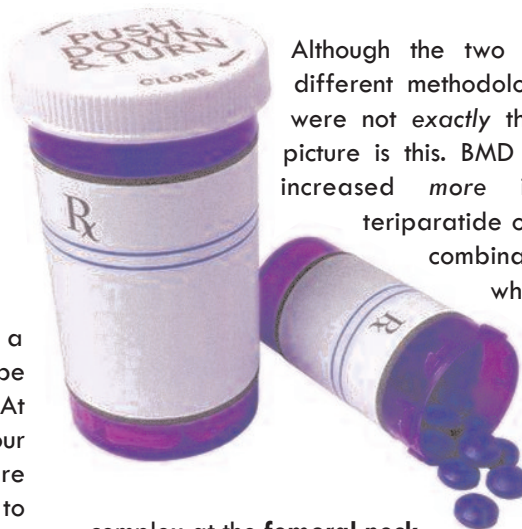
A That's an important question. **Strontium** is a nutrient, not a drug: you get it in your food, and it may be an essential mineral like calcium, magnesium, or zinc. At high doses, studies show that has the power to help your body to create *new* bone. Bisphosphonates, by contrast, are drugs – purely synthetic molecules, designed explicitly to treat a *disease* (osteoporosis). These drugs don't actually *build* bone – they work by merely *slowing down the rate at which it is torn down (resorbed)*. That's why bisphosphonates are called "**antiresorptive**" drugs.

But that isn't the *only* effect of bisphosphonates on bone. Within weeks after you start taking a bisphosphonate, it also begins to impair your body's formation of *new* bone.¹⁷ Because the rate at which old bone is torn down is reduced by much more than the bone-building activity osteoblasts is hampered when you take a bisphosphonate, the *total mass of bone* slowly increases. But by allowing old bone tissue to hang around longer without speeding its replacement, bisphosphonate use results in bone tissue that is, on average, *older* – and thus, of poorer quality. Because this older bone tends to be more brittle, the overall architectural quality of the bone is decreased.¹⁸⁻

²⁰ The resulting bone is less prone to fracture, but is not the same as youthful, healthy bone.

So the idea of combining a bone-*building* nutrient like **Strontium** with an antiresorptive drug seems to offer a great way to get the best of both worlds. But does it actually work?

The quick answer is: *the trials haven't been done, so we don't know*. However, two recent trials published in the *New England Journal of Medicine*^{21,22} may give us some hint as to the *most likely* impact of a **Strontium**/bisphosphonate combination. These trials did not involve **Strontium**; instead, they were designed to test the effects of combining a bisphosphonate with **teriparatide (Forteo®)**, a snipped-down version of human **parathyroid hormone (PTH)** that has been modified using biotechnology to include only the biologically active "business end." But teriparatide, like **Strontium**, works by increasing the formation of new bone. So they *probably* give a good picture of the results that we can expect from taking **Strontium** along with a bisphosphonate drug.



Although the two studies had slightly different methodologies and the results were not *exactly* the same, the overall picture is this. BMD of the *spine* clearly increased *more* in women taking teriparatide *only* than it did in the combination-therapy group, who in turn seem to have done somewhat better than the women taking Fosamax® alone.^{20,21} Things were a little more

complex at the **femoral neck** – the actual site of most so-called "hip fractures," where the tapered area of bone at the top of the thigh that connects the main length of the high bone to the "ball" that fits into the "socket" of the hip.

BMD was definitely highest in women taking the bone-building agent only, with NO bisphosphonate drug.

In the relatively short term (a year²⁰ to a year and a half,²¹ the femoral neck BMD was unchanged in the teriparatide-only groups, or may have been slightly decreased, and any such decrease was prevented by combining teriparatide with the bisphosphonate. But in the *longer* term (30 months), **BMD of the femoral neck was definitely highest in women taking the bone-building agent only, with no bisphosphonate drug.**²¹ Meanwhile, the bone size at the femoral neck was increased by teriparatide – and Fosamax® *impaired the effect.*²⁰

Taken together, the trials give the pretty clear picture that antiresorptive drugs, in the long term, wind up *reducing* the



effectiveness of teriparatide.^{20,21} The most likely reason for this is that, as we've noted, bisphosphonates don't *just* slow down the resorption of bone, but also reduce the overall "turnover" of bone by impairing the bone-forming activity of osteoblasts. But it's just these bone-building cells that teriparatide depends work, by helping them mature more quickly, boosting their activity, and allowing them to live a little longer on average. So ultimately, teriparatide's full bone-building potential is straightjacketed by bisphosphonate use. There is some direct molecular evidence that this is the case: one of the two studies²¹ measured markers of the rate at which *new* bone was being laid down, and found that **only people taking teriperatide without Fosamax® showed evidence of increased bone formation.**

While we can't say for sure, it seems very likely that the same thing would apply with **Strontium**. Overall, then, the results seem to suggest that **Strontium** supplementation will be much less effective if it is combined with bisphosphonate use.

While you'll have to consult with your doctor to decide what these data means for you as an individual (and certainly, you should *not* discontinue taking a bisphosphonate drug without your physician's full understanding and consent), these studies do not necessarily mean that a person using **Strontium** should never use a bisphosphonate – or vice-versa. For one thing, it bears repeating that these studies were not performed with **Strontium**, and it is possible that future studies will show that bisphosphonates do not have the same restraining effect on **Strontium** that they do on teriparatide. Alternatively, you may decide in consultation with your doctor do adapt a protocol in which you take either **Strontium** or a bisphosphonate drug for a period of two to three years, and then to switch over to the other. In fact, there are already some preliminary data for just such a protocol, in osteoporotic women taking teriparatide for two years and then switching over to alendronate.²³

While you weigh the implications of these findings, remember that your physician must be an actively-involved, fully-informed player in *any* decision about your bone health – but especially where prescription drugs are involved.

Q **AOR** emphasizes the importance of its use of calcium hydroxyapatite in its bone supplements. I recently saw an ad in a popular health magazine which indicated that calcium hydroxyapatite isn't even as good as calcium carbonate at slowing bone loss, and was much less effective than a new form of calcium. Can you comment?

A There are two things to note regarding the alleged results of the 'study' reported in the ad you enclosed. First, there is no such study published in the medical literature as indexed by MEDLINE, the National Library of Medicine's

medical database of over 15 million citations. Likewise, while a visit to the manufacturer's website provides a link to what are described as "published research articles," few of the articles are actually published in any medical journal – and *none* of them compare this new calcium form to "calcium hydroxyapatite." We even contacted the company that placed the ad to ask them where

the supposed "data" came from; they said they didn't know! [Note: since this article was originally written, the website has been temporarily shut down, following a Federal Trade Commission investigation into the company and its ultimate conviction for making unsubstantiated claims for some of its other products].

In any case: even if such a trial really does exist, and the results are exactly as shown on the graph, it actually tells you nothing about the efficacy of *ossein microcrystalline hydroxyapatite complex (MCHC)* – the calcium source used in **AOR's** new **Ortho-Bone**, and an earlier formulation, *Calcium-Magnesium Plus*. As we have explained in past issues of *Advances*, "**calcium hydroxyapatite**" is **not the same as MCHC!** "Calcium hydroxyapatite" – also known as "calcium orthophosphate" – is a *synthetic calcium salt*, whereas MCHC is a natural, calcium-containing *bone nutrient complex*, which contains a variety of growth factors, mucopolysaccharides, and peptides in addition to its calcium content. These nutrients are not found in calcium hydroxyapatite.

Many studies have confirmed that, whereas conventional calcium supplements – such as calcium gluconate, calcium

True MCHC consistently halts, or even reverses, bone loss in controlled human clinical trials

citrate, calcium carbonate, and even calcium citrate-malate – can only *slow* menopausal bone loss, whether taken alone or with vitamin D, **true MCHC consistently halts, or even reverses, bone loss in controlled human clinical trials.**¹⁷ When compared against other calcium supplemental forms, MCHC consistently trumps the conventional calcium supplement in its effects on parameters important to bone health.¹⁷⁻²²

Importantly, studies show that neither calcium hydroxyapatite, nor MCHC which has been heat-treated to destroy its rich nutrient matrix, have the same effects on bone as true, intact MCHC.¹⁹⁻²² Therefore, it is hardly surprising that calcium hydroxyapatite would not deliver on MCHC's promises: it is in no way a comparable supplement.

Regarding the new form of calcium hyped in the ad to which you refer: this is a form of calcium (called “active absorbable algal calcium” (AAA-Ca) in the scientific literature, but also sold under a trade name) is made from calcium derived from heated oyster shells and bound to organic matter from seaweed. Although a lot of claims are made for this form of calcium, it is backed by very little scientific research. As we noted a moment ago, much of the so-called “published research” cited in promotional material on this product has *not* been published in any medical journal – it has not, in other words, managed to pass the scrutiny of the peer-review process of science.

As nearly as we can tell from searching the MEDLINE database and the company's website, there is exactly *one* published clinical trial on this material's effects on bone density in comparison with other calcium forms,²³ whose results have been rehashed twice.^{24,25} This study compared the heated oyster/seaweed calcium product to calcium carbonate, and did indeed find the AAA-Ca product to be superior. However, the study has to be interpreted cautiously. For one thing, it involved very few women: there were less than *twenty* subjects in each group! For another thing, it is only *one* study. By contrast, there are multiple controlled trials demonstrating the superior bone-health effects of MCHC;¹⁷ these trials involved many patients, and have explored MCHC's effects in women whose osteoporosis has a variety of different origins. In short: we can be confident of MCHC's benefits in women's bones; we have very little idea of the effects of the

oyster/seaweed material.

Other studies involving AAA-Ca seem a little bit pointless. One study, for example, tested the oyster/seaweed calcium product on back and joint pain, and found that it did indeed improve measures of both subjective pain and

electrical impedance (a surrogate measure of neurological pain levels) in response to exercise loads like standing up, squatting, or climbing stairs.²⁶ This

might suggest some kind of effect of AAA-Ca on skeletal or joint health – except that the women receiving the oyster/seaweed calcium supplement were all *also* taking 3500 milligrams per day of a glucosamine-containing collagen and matrix supplement, which of course is well-demonstrated to improve joint pain *all by itself*.

Another study is cited as showing that AAA-Ca is better absorbed than calcium carbonate;²⁷ unfortunately, this study relied on *urinary excretion* of calcium to determine calcium absorption. It has now been established that this is an unreliable method of measuring bioavailability.²⁸

It's also curious that *all* of the studies on AAA-Ca that we could find in the medical literature were performed by *the same group* of Japanese investigators. No *independent* studies appear to have been allowed into any peer-reviewed, scientific forum.

In short, while there is some interesting preliminary information available about the new calcium source, **there appears to be no reliable evidence that the heated oyster shell/seaweed calcium source is any better than calcium carbonate** – and certainly, no evidence that it is

better than MCHC, which remains, on the basis of the primary medical research, the best calcium supplement for bone health.

There appears to be NO reliable evidence that the heated oyster shell/seaweed calcium source IS any better than calcium carbonate



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