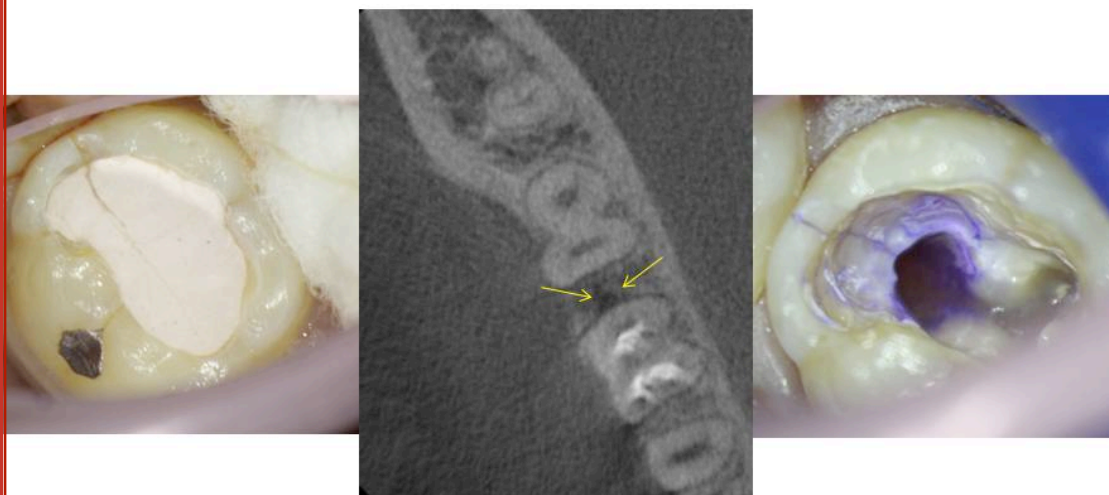


# VRF CBCT DX?

23/05/11

## Bone loss associated with root fracture



A discussion on ROOTS about correct and incorrect interpretation of vertical root fractures on CbCT.

Einste

## Can we diagnose VRF on CbCT?

**By Rooters**

**Fred**

*Bone loss associated with VRF--CbCT*

**John**

*Kendo,*

*There is a reason that many of us don't post.*

*When I see repeated posts like the above...I kinda don't know were to start...*

**Ken**

*Not really sure it's an excuse lad, we're still talking about NiTi files*

**Fred**

*Uh oh.....John,*

*Is that area of apparent bone loss unrelated to the tooth fracture?*

*Educate us.*

*Fred*

**John**

You've seen my CBCT lecture twice.

Last time, I created multiple fracture areas by placing crowns outside the field of view.

That is simply an image reconstruction issue related to Z4, and can manifest in a variety of not entirely predictable and non-linear ways.

Further, even without the Z4, Nyquist is 150um.

Those fractures are clearly smaller than Nyquist at that sectioning level.

I realize that you're not claiming to see the fracture here...but the implication is there none-the-less.

That "finding" may very well be as you claim...but...

It is completely inappropriate to post such imagery with such conclusions as an educator.

Simply, if you don't understand this, what are the chances that Joe Lunchbox DDS will?

Lastly...**regarding the CBCT**...and this is related to Bayes...and trumps the above issues...is that **you're not actually interpreting the CBCT**. You are looking at the data through your hypothesis.

Then, there are all the issues with how the case was clinically managed that didn't get mentioned.

**Ken**

*Milan – would you care to comment??????*

**Fred**

*John,*

*You are right that I DID **NOT** CLAIM TO SEE A FRACTURE, BECAUSE I DID NOT SEE ONE ON ANY SLICE. And I understand Nyquist from your lecture in NJ.*

*But why is it inappropriate to show an area of bone loss adjacent to a fracture. While working the scan, this radiolucency was evident only in the cervical portion of the root adjacent to where the fracture was.*

*Fred*

**John**

*Weed says "How do you know where the fracture is?"*

*I say "How do you know that is bone loss and not reconstruction artifact from the Z4?"*

*The unified voice from the endodontic community should be:*

***"You cannot reliably image these kinds of fractures with CBCT when there are obturants in the root."***

*You are not interpreting the CBCT.*

*Your interpretation is the prior, masquerading as the posterior.*

**Fred**

*While working the scan, this radiolucency was evident only in the cervical portion of the root adjacent to where the fracture was.*

### John

Right.

Since you don't know that the fracture is there on the CBCT, but only clinically, you view the CBCT through the clinical prior.

Thus, you are viewing the data through the hypothesis...which here...isn't much of a hypothesis...as the tooth is clearly cracked.

Epistemic certainty here ("acceptably") violates Cromwell's rule. **The tooth is cracked.**

So you go out and have a "finding" that matches the hypothesis.

This is the classic Frequentist "Fisherian" view of the world that is widely held, and has no theoretical base.

In fact, it's such a perverse, inconsistent way of viewing the world that it leads to the contradictions rife in every aspect of clinical practice. It leads to the utterly worthless body of literature on imaging fractures with CBCT...more than worthless...because it actually misleads well-intentioned clinicians that they can see something that they can't with abominations like p values and statistical significance.

If you hadn't kicked me off that GoogleGroup I setup for you, you would be six months farther along in understanding what has been obvious to me for two decades...

I make no apologies.

It has been incredibly frustrating to watch people make these kinds of posts for 20 years.

When you get it...you will see that I have been acting with restraint, and sugar coating things for over a decade.

The decade before that, I didn't say anything. I just watched people put the bus into the wall.

### Rob

*ion artifact from the Z4?"*

*The unified voice from the endodontic community should be:*

***"You cannot reliably image these kinds of fractures with CBCT when there are obturants in the root."***

*If that is the case, does it not call into question one of the main "reasons" that Endodontists are being sold these*

*cbCT devices?*

*If the presence of obturants renders the images suspect, then how valuable are they, really?*

*Clinical A priori knowledge ( coupled with symptoms or suspicions) is the whole motivator for taking these images, is it not?*

*Does that knowledge necessarily skew our opinions in an improper way? Or does it help us decide WHEN to consider taking an image?....Considering that many are being bought in order to evaluate the sequela of treatment (with obturations/posts) , which comes first, the chicken or the egg? Can we reliably use these to confirm a priori knowledge? or does that knowledge ( and the knowledge of HOW the images are generated) skew the interpretation? Many questions, few answers.*

### Milan

*Hello everyone, I'm late to the party, but I find this discussion very interesting.*

*It appears that the point of contention here is whether or not that area of radiolucency adjacent to the tooth root is real or an artifact. I have never seen an artifact manifest this way. Generally, if an artifact is present at the root surface due to an obturant, then there is a concomitant change in the density of the pixels on the line between the obturant and the altered density on the root surface. I see no evidence in this slice to support the hypothesis that this is, in fact, an artifact.*

*I agree that cracks cannot be reliably visualized directly. Neither can gravity, for example.*

*However, by indirectly observing or measuring the effects of gravity on objects, we can draw conclusions about the nature of gravity. In the same way, once it is established that what we are observing in this image is not actually an artifact, it's trivial to infer that the source of a long narrow well-defined pocket is a root fracture.*

**Milan (continuation of previous post)**

*Long story short: It looks like we're going to radiographically diagnose cracks by the appearance of a long narrow well-defined pocket at the root surface, rather than by looking for the crack directly. Not every tooth that is cracked develops one of these pockets, but I would venture that every single time you discover a long, narrow pocket (that is not an artifact), the tooth is fractured.*

*If anyone can think of an alternate reason why a very well-defined very narrow and long pocket can form adjacent to a tooth root, I would be interested to hear about it, because it will help broaden my horizons as far as a differential diagnoses go.*

**John**

*Kendo,*

*Like I said, I don't know where to start, and it will end in an argument.*

**John**

*Rob,*

*Good.*

*Asking questions is making progress over "arguing" about  $2+2 = 4$ .*

*Thanks bud...that makes replying worth it...*

*You are on Chat, and you can see the change in Carr...he is on the other side of the river with me, and is beginning to explore...actually...more accurately...see...*

*This was a **five year process for him**...starting with me objecting to the TDO outcomes study...so please don't think that "you get it..."*

*If that is the case, does it not call into question one of the main "reasons" that Endodontists are being sold these cbCT devices?*

*Yep.*

*Having people like Fred, MartyL and now this guy from Canada...and others in positions of authority only serves to perpetuate this poor understanding.*

*It's identical to the Board Certification Process. The people in positions of authority have perpetuated a body of literature that reflects no understanding of how to actually do outcome based research, they educate others in this, and the fraud continues...*

*If the presence of obturants renders the images suspect, then how valuable are they, really?*

*How valuable is the microscope?*

*Do you have any actual outcome data in the form of an RCT to justify the expense?*

*How valuable is the microscope then...really?*

*Clinical A priori knowledge ( coupled with symptoms or suspicions) is the whole motivator for taking these images, is it not?*

*Very roughly, those are all lumped into your prior(s), coupled with the actual clinical evidence (including existing radiography) which may sum to an action threshold of "order imaging test"...which is in a sense...a new prior that you are subjecting to the imaging test to get a new posterior.*

*Unavoidably in **clinical practice, the interpretation task is clouded by the prior that led to ordering the test.***

*In **actual clinical practice, this occult loading trumps** the actual interpretation task, and the **posterior is simply the prior**, "supported by" the test...leading the clinician into thinking the test is something special. Well...JHC...my chimp can see this tooth is cracked.*

*If you remember from my Fall TDO lecture where I focused on the technical problems, one of the take-homes was that "Explicit mental discipline..." must be used to identify and subtract out the priors...*

**John (continuation of previous post)**

Does that knowledge necessarily skew our opinions in an improper way?

*Absolutely...and...almost every time.*

*I've shown multiple examples of this on Chat.*

*I showed it in that Fall lecture with Mullin's case.*

*Or does it help us decide WHEN to consider taking an image?*

*That depends on the question you want to ask or hypothesis you want to test, and the tests ability to answer that.*

*If you want to know if there is an MB2, the CBCT has the capability of doing that with at least some reliability.*

*If you want to know if Fred's tooth is cracked, the CBCT cannot answer that in a definitive way, especially in the case where you really need to know...that is...the endodontically treated tooth with a post and crown where...unlike the case he has presented here...you cannot see the crack clinically first...then go find the "evidence" for it on the CBCT.*

*Like I said...my chimp can see that tooth is cracked.*

***If the CBCT evidence was so compelling, why was this case taken apart?***

*...Considering that many are being bought in order to evaluate the sequela of treatment (with obturations/posts) , which comes first, the chicken or the egg?*

Yes.

*Can we reliably use these to confirm a priori knowledge? or does that knowledge ( and the knowledge of HOW the images are generated) skew the interpretation?*

*Many questions, few answers.*

*If you are looking for an "answer"...a p value, statistical significance or epistemic certainty...then you will be disappointed...*

*Ask Carr...*

## Bottom Line:

*The way these images are fabricated is stacked against accurate representation on the kinds of imagery the endodontist will be called upon to render an opinion.*

*Endodontically involved cases are more likely to be edgy and contrasty...the exact kind of imagery that is prone to artifact.*

*Explicit mental discipline must be employed to subtract out Physics Based, Math Based and Cognition Based artifact.*

**Ken**

Ah Milan our resident specialist in Oral Radiology.....like the song from Chess.....we need an arbiter.

Thanks lad.....my premise/concept on life is when you hear hoofbeats, ain't a unicorn. Now if I could only get friend to respond re; an animation on fracturing related to cbCT images.....he has the clinical images, **we could arrange to overlay animations** over the clinical images to replicate the natural state – it would add a dimension to cbCT images I've never seen.....

**John**

We did that over 20 years ago with medical CT, MRI and PET...

If you dig around in the RSNA archives, you might find an abstract of a presentation.

**John**

The problem is the "tears" in the sinograms that result in interruption of the Radon space by the Z4 materials which leads to and the subsequent interpolation that takes place...essentially...fabrication of the missing data. That fabrication is subject to non-linear transformation that have problems with the...

**Milan**

Hi Dr. \*\*\*\*\*,

Thanks for the physics lesson. I've been there and done that. Here's the fun video:

<http://www.youtube.com/watch?v=sjJSWTpNHKg>

Now, instead of talking to me like I'm a moron, take a long hard look at Dr. Barnett's image. That is not an artifact. That is real. I'm sure Dr. \*\*\*\*\* will treat us to a photo of the socket when this tooth is extracted.

Best regards,

Milan

**John**

Milan,

It is probably not an artifact here **in this particular case**.

The problem is extrapolating a case like this to the typical case presenting, where people don't understand the physics, don't understand the image generation process, don't understand the interpretation process, and morons are out there lecturing that show crowned teeth with posts and "similar" imaging findings.

**Cases where you don't roll into the interpretation process knowing definitively that the tooth is cracked on the distal.**

The CBCT brings nothing to the case here, as we already knew it was cracked.

Christ! The 500lb fat man doesn't need a scale to know he is fat.

It's a problem with that body of literature as well...the "CBCT detecting cracks" body of literature is so bad...

It is simply irresponsible to make the kinds of statements that you are making as they are getting misinterpreted by people who don't understand any of this, and think there is some skill-set transfer from traditional radiographic interpretation (which is also very poorly done).

**Fred**

***It is probably not an artifact here in this particular case.***

John,

I clearly understand that that the cbct does **not** show cracks that are 150u in width or less. And artifacts associated with posts, etc. obscure many findings. But, what the cbct **MAY** show is a pattern of bone loss associated with some cracks/fractures. This was a particular 'finding' on a particular case.

Fred

**John**

Hi Dr. \*\*\*\*\*,

Thanks for the physics lesson. I've been there and done that. Here's the fun video:

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Best regards,

Milan

We piloted this 20+ years ago with ITI FG-512 frame grabs of the RS-170 signal coming from the old RVG, displayed on an Ikegami monitor. Weber wrote about it with like an eight head device doing limited angle reconstruction probably 20 years ago too...

I did this with the bike axel for the TDO meeting...remember the rotating bike axel?

If you notice in his video...there is **no metal**.

No high Z...

Do you remember what happened to the reconstruction on that axel when I put that tiny bleb of Hg in there?

Let's put some metal in there and see how his reconstruction works.

But these are the technical issues, and are **identified**.

What Fred and Milan, and the rest of the dental community are missing, is that the interpretation process is jacked by the prior knowledge of not just "the tooth is cracked" but "the tooth is cracked at the distal." Excuse me, but the "prevalence" of "cracked tooth at the distal" was 100%. You don't need much of a test if you already know your population is 100% diseased before you run the test. My chimp can do that.

The CBCT brings nothing to the process here...if the case was closed, then why was it "opened"...???

These occult priors load everything...and I've been talking about it for five years, and yelling for the last two.

These kinds of posts only serve to mislead...kinda like trying to teach EoM to someone who can't find the canals.

It is far bigger than CBCT...as these same types of priors load regular PA interpretation, endodontic outcome studies, post vs. no post, single vs. multi...everything. Again, you're not a 'tard...you just have decades of misinformation by the Fred's and Milan's to overcome.

You'll note that they are either:

1) Arguing with me

or

2) Utterly missing the point

Can you see how they have the cart before the horse?

This Frequentist/Fisherian view of the world through the hypothesis?

If you already know the tooth is cracked...well...what would you expect to see?

The whole field of inference is getting turned upside down...actually...more accurately...it is getting "righted" from being upside down for nearly a century. Decades have been lost.

The PG directors are worse than in the way.

They are propagating the problem.

**Fred**

The PG directors are worse than in the way.

They are propagating the problem.

I guess I owe the world an apology.

Fred

**John**

Fred,

*You owe me one too.*

*Fortunately, and despite appearances, I actually care about you, your residents, endodontics, dentistry and health care in a serious way (as Carr would say), and I'll get my apology in 5-10-15-20 years. This is not to be construed that you don't care. You're just misguided.*

*That is not to be construed as you're stupid either. Just ignorant of these issues. That is not to be construed as "it's your fault", as it is what you were taught, and had no reason to question it, because it's what everyone got taught, including me.*

*I just happened to bump into the right people at the right time professionally, and learned how upside down your view of the world is.*

*What is to be construed is that you're still part of that problem.*

*The question then becomes...as I've asked you several times before...what are you going to do about it?*

**Mark**

*Ok so I decided to start reading Roots emails again at the right time. :-))*

*I'm really comfortable using my cbct to help me spot suspected missed anatomy (off centered fills in roots such as the case I just presented), and discovering findings suggestive of pulpal necrosis on teeth in which such findings aren't readily apparent on 2D rads and I'm having a hard time making sense of clinical testing.*

*I'm particularly attuned to the beam hardening issue after having seen JK's lecture, and reading threads like this one.*

Mark

**Craig**

*the "good" implant guys that i know dont completely trust the cbct either...*

*you still can't "aim" anything.....you gotta be able to "drive" just like in the "old days" did i read somewhere that "it's not the car, it's the driver"?*

**Nareg**

John,

*so basically.. if i understand correctly, the question to Fred and Milan is:*

*"would you have come to the conclusion of cracked tooth based on the CBCT, had you had not seen a crack clinically?"*

*or more pragmatically, "how clinically relevant are CBCT findings when it comes to bone destruction?"*

*so, what's the solution here?*

*have the CBCT interpreted by an uninformed third party? (radiologist?) (get your positive-biases out of the way)*

*create enough data on CBct artifacts, in order to start having a decent "prior value" for the CBct? (the field being new, there are no "a priori"s to reinforce our current interpretations) i fear a future where aggressive treatments will be justified (unnecessary endo or even exo) by CBCT findings in the absence of other clinical signs, all in the name of progress.*

*coming back to Bayes, on a more abstract note,*

*can we say a test that returns very simple results (like a cold test: yes, no, lingers) benefits from our clinical biases (it was performed on a normal tooth, and the one with a huge decay) whereas a test that returns a very complex result (say a CBCT: a lot of data to interpret) is hindered by our clinicial bias (the data is already easy to misinterpret, the bias just pushes it further..)?*

nareg

**Fred**

*There is no question that artifacts are a problem with CT (medical and dental). But as you work the scan (drive the car) you may or may not be able to visualize a 'finding' (ie: radiolucency). As Marc pointed out, visualizing a missed MB2 canal for example, is often apparent, as are areas of bone loss, that may not be visible on regular PA's.*