Repairing Fractured Teeth with Composite

Theory and Practice

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The 6 Stages of the Fracturing Process

Early sign

Hairline crack

Defect fracture

Central fracture

Lateral fracture

Root fracture

Each stage has a special type of repair and a different success rate.

What are the success rates?

There are many other classifications, most of them have an anatomical basis. This classification distinguishes two stages of the crack growth before the fracture occurs, and for different types of fracture with increasing difficulty to repair.

Success Rates

99%		96%		75%	
Early sign	Hairline crack	Defect fracture	Central fracture	Lateral fracture	Root fracture
99% 430 / 4	100% 44 / 0	100% 36 / 0	92% 38 / 3	60% 3 / 2	87% 13 / 2

successful
extracted

Early sign is the most frequent and most important stage.
Never say:
"it is nothing"

Central fracture has often an intact apex

Lateral and Root fractures have an unreachable area

Success =
Patient pays bill or reports «problem solved» +
Patient remains in active patient base.

What causes the fractures?

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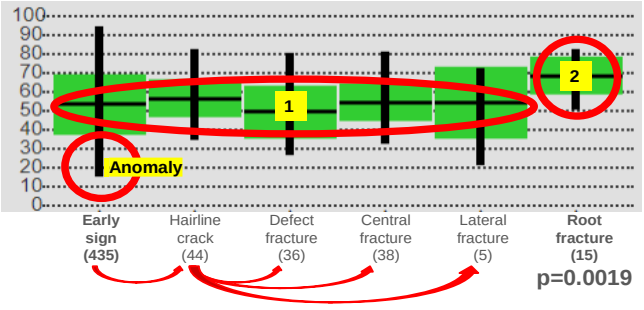
The root with the central fracture is held with a pincette which spreads the two fragments apart with a power of nearly 200 grams. Without the pincette the fracture gap would immediately go back to a small hairline crack.

Crack Growth: 2 Principles + 1 Anomaly



A Crack without growth is and stays harmless.

1 50 ± 15 years

Physical causes: occlusal loads, chewing cycles, crack growth from early sign to fracture.

2 70 ± 10 years

Chemical causes? dentine dehydration + shrinkage, endodontic failures?

Under 30 years

Anomaly 21 women, 4 men

Why so many women?

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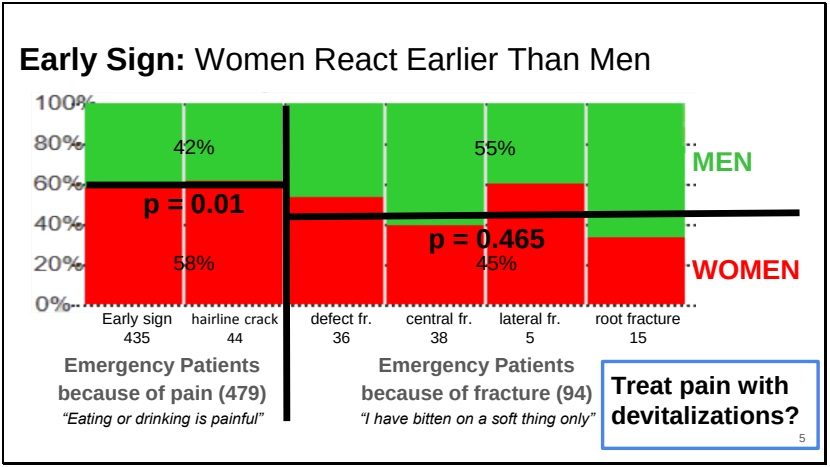
Black horizontal lines: mean age of the group

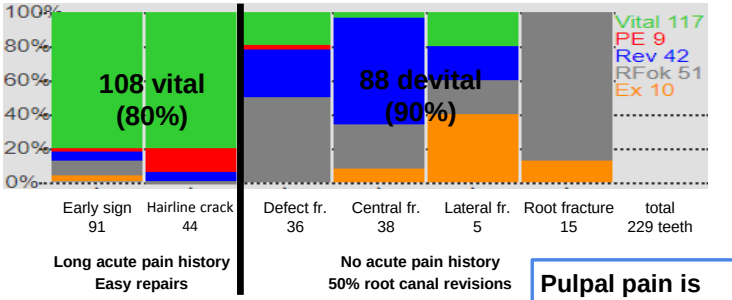
Green fields: +- standard deviation = area of 67% of the group

Black vertical lines = «whiskers», pointing to the oldest and youngest patient of the group.



The difference between women and men in the two pain emergency groups is highly significant (p=0.01). In the for groups with fractures there is no difference.

Devital Teeth Fracture Far More Than Vital Teeth

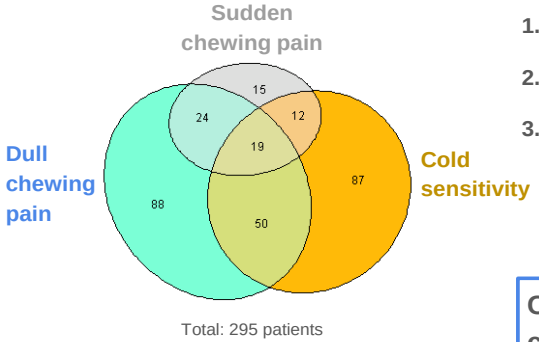


Pulpal pain is stronger then periodontal pain.

Devitalizing an early sign tooth = preparing a tooth fracture.

90% of the fractured teeth are devital. Still many colleagues make a root canal treatment to stop the pain of the vital teeth instead of removing the cause of the pain.

The Nonbacterial Pains of Early Sign



Total: 295 patients

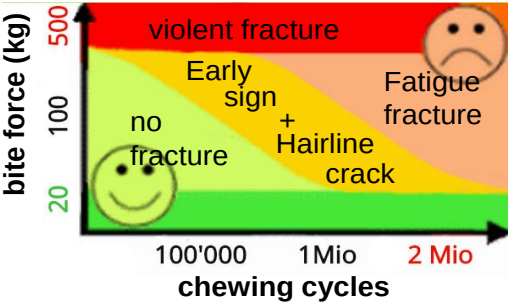
Bacterial pain lasts longer than chewing pain.

1. **Dull chewing pain (61%)**
   Heavy biter, group of teeth
2. **Sudden chewing pain (24%)**
   Occlusal overload, single tooth
3. **Cold sensitivity (57%)**
   Nonbacterial pulpitis
   Time to heal: 2-14 days
   Otherwise: bacterial pulpitis?
   hidden caries? other tooth?

Cariology is over. Now comes Tooth Fatigue.

Patients do not clearly differentiate between these three types of pain. That's why dentists must ask closed questions in the patient interview to get a good diagnosis that can distinguish the pain of the crack growth from the pain of a caries. Main difference: the pain of the caries starts when eating sweet things, it lasts half an hour, and it never starts in the middle of the night.

Tooth Fatigue = Successor of Cariology



Woehler curve / Woehler line / SN curve / Stress-cycle curve / ISO standard 14801

Worn occlusions have increased bite forces and chewing cycles.

Composite is more fragile than dentine and fractures earlier.

How can a dentist improve occlusion and composite?

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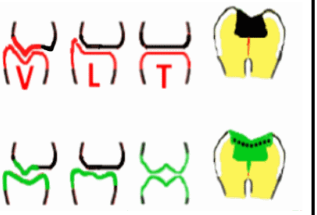
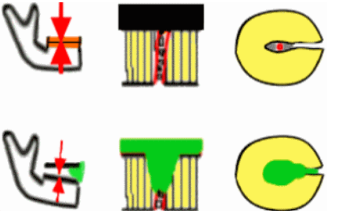
Reduce the bite force by minimizing the occlusal contacts with drainage grooves. So, the contacts become cutting edges, and the patient needs less effort to soften the food to swallow.

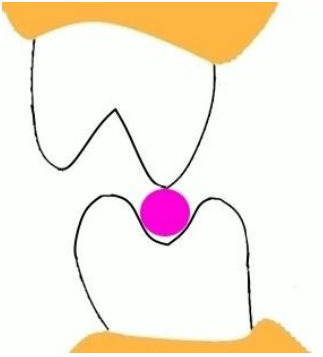
Reduce the chewing cycles with an NTI-tss splint when the patient has also muscle pain.

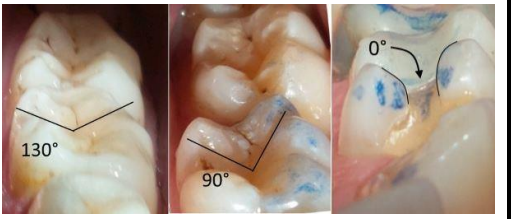
The Causes Matter More Than the Repair Fillings

VLT-Contacts, weak Composite		**Grinding, Bacteria, unknown Causes**		
				
reshape VLT-contacts *a daily task*	**reinforce composite** *cheap & easy*	**reduce grinding** NTI-splint	**remove bacteria**	**root canal treatments**

the “critical number” matters

V-Contact: Changes the Bite Force to a Splitting Force





130°-angle: splitting force = 0.5 x chewing force

90°-angle: splitting force = 1 x chewing force

0°-angle: one small hard peppercorn can fracture a tooth

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Link to the movie:

http://zahnarztweilenmann.ch/Leistung/Frakturen/Bilder/Hoeckerwinkel.mp4

The movie shows how the bite force acts as a splitting force on two teeth with a cusp angle of 90°

L-Contact: Generates Cold and Bite Sensitivity

Both inflammations are reversible and non-bacterial

Is this a bite collapse?
A somatization disorder?
Cervical spinal segment C5?
Need a splint or a T-Scan?
Need a bite elevation?
Is it a „cusp of death"?

Is this occlusal adjustment enough?

Which pain goes away?
Which one comes next?

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Link to the movie:

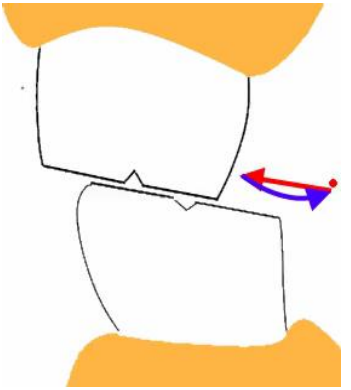
http://zahnarztweilenmann.ch/Leistung/Frakturen/Bilder/kaltdruck1.mp4

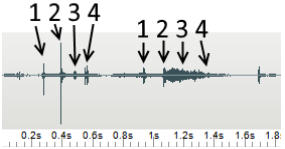
The movie shows how a L-Contact generates two inflammations:

1. the periodont is contused at the alveolar margin
2. the pulp is contused around the apex

After removing the L-Contact the cold sensitivity disappears in a few days. But now there is a T-contact. The patient starts to chew again but probably will feel a dull pain because of the T-Contact. Then the tooth needs drainage grooves.

T-Contact: Breaks a Tooth with the Stick-Slip-Effect





Sonic Visualization of 1 movement

1 movement = 8 sounds
125 movements per night =
1000 sounds =
1000 switches between
stiction and sliding friction =
1000 horizontal tensions per night

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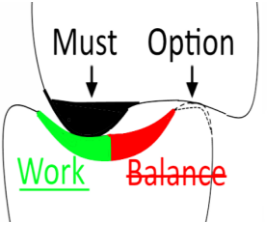
Link to the movie:

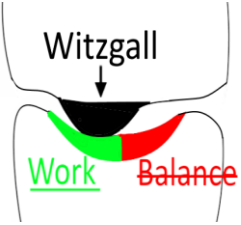
http://zahnarztweilenmann.ch/Leistung/Frakturen/Bilder/Knirschen6.mp4

The movie shows how two molars are pressed together and moved horizontally against each other. The pressure makes them stick together because of the roughness of their surfaces = stiction.
To move the teeth against each other, the patient applies a sliding force that is higher than the stiction = sliding friction.
The sound is generated in the moment of the start of the movement.

Flat V-Contact: a Minimal Goal



Normal Tooth Relation



Head Bite Relation

1. Must / Witzgall: palatinal / central cusp
2. Working side
3. No Balancing side
4. Option: 2nd bearing contact or free space

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Depending on the circumstances a Witzgall cusp can also be built on a lower molar.

Reinforce Composite: with Nonmagnetic Stainless Steel

orthodontic wire
0,41 x 0,56 mm
Unitek

wire mesh
10 x 10 cm
Dentaurum

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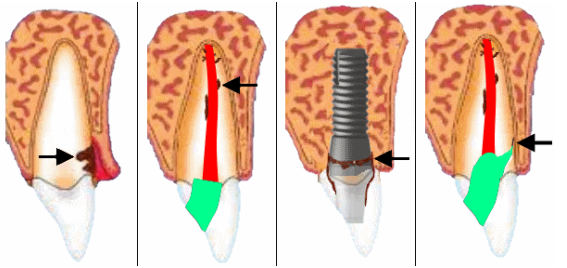
The wire mesh 10 x 10 cm is a product of Dentaurum and costs about 60 Euros. One filling needs a piece of 7 x 7 mm.

Bacteria below the Critical Number



Subgingival Tartre | Root Canal Filling | Inside the Implant Crown | Remaining Gap of Repaired Fracture

These bacteria are in most cases very harmless.

Grinding

NTI-splints:

2010: 7
2011: 9
2012: 10
2013: 8
2014: 8
2015: 14
2016: 18
2017: 19
2018 august: 16

Women 84
Men 38

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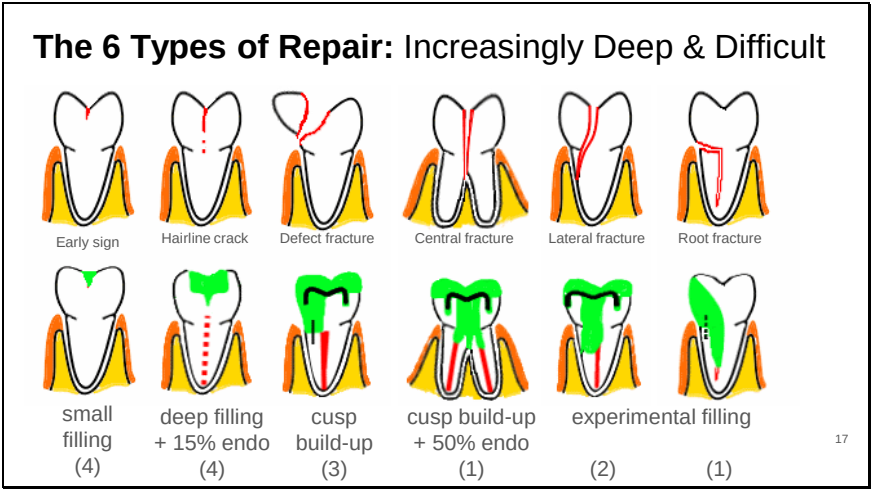
There was a discussion about the stress level in the patients.
My data of the NTI-splints tell me, that in Wetzikon the number of the heavy grinders with headaches is rising.
Some colleagues argued, that the patients during world war I+II had also a high stress level and must have been heavy grinders.
Possibly the stress level keeps always on the same level.
So grinding with headaches is not only related to stress but also to other factors.

Practical Experiences: Preliminary Notes

- The patients who want to save a fractured tooth are often high fear patients and do absolutely reject the idea of an extraction. 25% of the 227 come from far away. But they are happy for every year the tooth keeps in the mouth.
- I do not apply minimal dentistry around the fracture. I open the gap 4-6 mm wide.
- I start without anesthesia and excavate to the point where the pulp starts to hurt.
- We plan 3 hour sessions for much explaining and perhaps a root canal treatment.
- For such a session we often get 600 to 800 Euros.

Nobody wanted a pause, so the next slides followed without a break.

Because of the tiredness of the audience I showed them with rather little comment.



Because of the uncertainty of the root canal treatment in cracked teeth or central fractured teeth, such repairs should be done at the end of a day.

Early Sign and V-Contact: Splitted Marginal Ridge

No pain
2 molars already fractured

Treatment:

- open the gap
- put composite
- shorten the antagonist
- flatten the V-Contact.

Early Sign and V-Contact: Cracked Composite

deep abrasion with 2 facets

last layer: V-Contact?

shorten the opponent

Cold sensitive

deep V-Contact

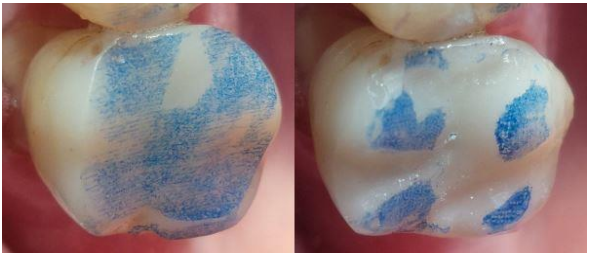
flat V-Contact

Treatment:

Last layer:
- patient bites into the soft composite to check the contact
- use of **thistle oil**
- shorten opponent and reshape composite
- bite again
- polymerize

Early Sign and T-Contact: Drill Drainage Grooves!

Cold and bite sensitive



Treatment:

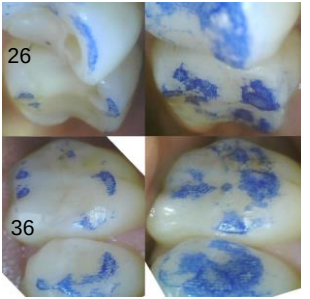
- drill as many drainage grooves as possible

- test with cotton rolls.

The bite should immediately be better. The cold sensitivity disappears after 2 -14 days.

T-Contact and Head Bite: the Witzgall Cusp

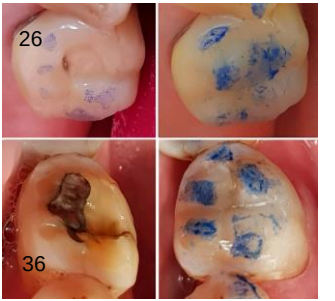
First sign: dull pain



26: Lateral contacts
36: Lateral contacts

Witzgall cusp
Central contact

Hairline crack, no pain



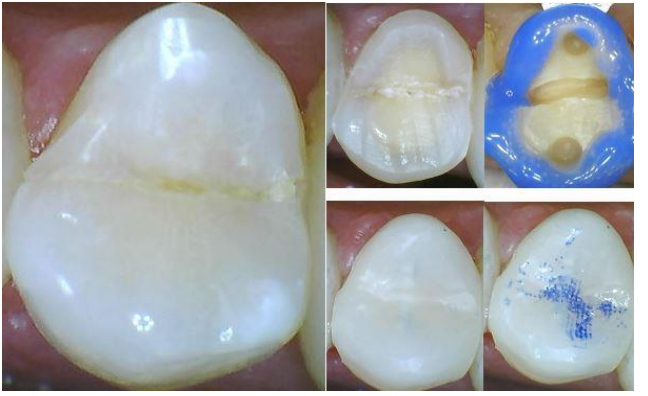
26: PMF crown
36: Hairline crack

Witzgall cusp
Drainage grooves

Treatment:

- Witzgall cusp
- Central contact
- Flat V-Contact with grooves

Hairline Crack: Reinforced Composite

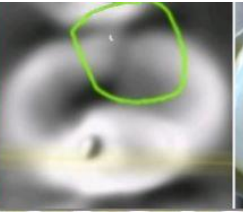


Many cold sensitive teeth, sudden pain when biting

Treatment:

- open the gap
- shorten the antagonist
- place wire
- put composite

Hairline Crack (1): Cat-Scan and False Diagnosis



Pain only when chewing

Treatment #1:

- excavate
- make foto
- be suspicious and look for the causes

Diagnose:
fractured tooth

Medical Proposal:
extraction & implant

CT-Layer 2 mm beneath the occlusal plane:
fracture

Cavity 4 mm benath the occusal plane:
no fracture

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A Cat-Scan shows only a small section of a fracture. In this case 2 mm below the Cat-Scan layer there was no fracture visible. This case shows also that cusps are much more flexible than enamel or glass.

Hairline Crack (2): Check with Thistle Oil

New contact not acceptable

Shorten this antagonist!

New contact now acceptable

Treatment #2:

- check the occlusion with thistle oil
- shorten the antagonist
- be suspicious and check other teeth

Hairline Crack (3): Check the Contralateral Side!

repaired tooth

finally found: Cause = V-contact!

right

left

missing central contacts

near the end of treatment #3

Treatment #3:

- 6 teeth built up with composite

Took one more hour treatment time.

Hairline Crack: 15% Need Endo!



Extremly cold and warm sensitive

Treatment:

- clear crack
- put wire
- composite
- flat indentation

Causes:
- old amalgame
- contacts on working and balancing side

Failure:
- Crack not deep enough excavated?

50 days later:
Granuloma without Pain

This slide led to a discussion about whether amalgam can cause fractures. Multicenter statistics show the same rate of fractures with amalgams and with composites despite the crevice corrosion of the amalgam.

These statistics do not document the grinding activity, the age of the amalgams, the signs of corrosion (black colored hairline cracks, dark discolored dentin), the absence of caries, etc.

The discussion ended in the consensus, that the different countries, populations, treatment levels etc. make it impossible to apply such statistics on a single private office.

Defect Fracture: Don't Repair the Cementum Tear!

No pain since fracture

Treatment:

- cusp build up
- cementum tear not repaired.

No periodontitis around the cementum defect (not before and not after the cusp build up).

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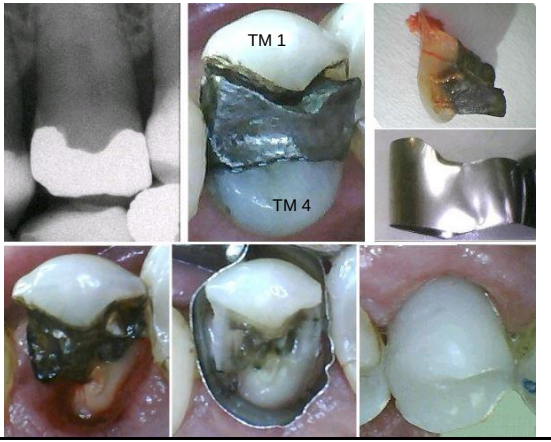
There was a question, if the missing cementum does not generate an inflamed pocket. The normal sulcus can have a biologic width of 3 to 8 Millimeters. The cementum tears lie all in this range.

Defect Fracture: The Art of Matrixing



pain when chewing

Treatment:

- remove loose fragment
- fit a matrix to the defect
- put matrix and stop bleeding (use gingival thread etc.)
- proximal box elevation and cusp build is one procedure

No periodontitis around the defect (not before and not after the cusp build up).

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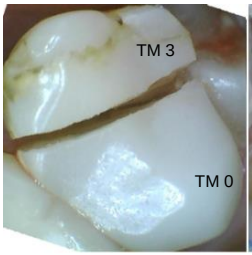
Some colleagues do not feel comfortable with such a simple technique and make much better sealing matrixes.

The statistical benefit of a better matrix is difficult to find out, because I apply this simple technique for 40 years and have never seen a disadvantage. I think, composite (Syntac + Tetric/EvoCeram) is less delicate as many colleagues think. Syntac removes the smear layer and sulcus fluid. The limit of this simple matrix system comes only when the gum is bleeding.

Lateral Fracture? Transform it to a Defect Fracture!



pain when chewing

Treatment:

- extract cusp
- matrixing
- stop bleeding
- cusp build up

Recurrence after 4 years. Why?

V-contact
No drainage grooves
No reinforcement

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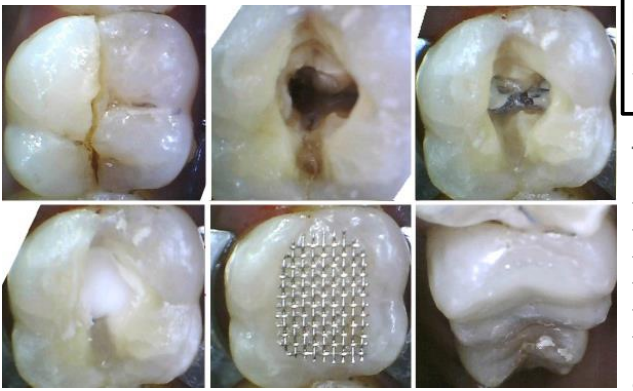
Why is this composite fractured? This question led to a long discussion.

One colleague argued, that an amalgam filling would not have split in two pieces but separated from the cusp as one piece. And the cause of the fracture was the polymerizing shrinkage of the composite.

But: this patient is a heavy grinder. He has broken this molar only four years ago in the same manner. No other composite filling in my office has ever had such a fracture, and the polymerizing shrinkage was always the same.

Central Fractures: 50% Need a Revision



Pain when chewing.
First signs 2 years ago.
Several dentists said:
"it's nothing".

Treatment:

- open the gap wide
- seal bottom of gap
- revision & Ledermix
- Ketaczem
- wire mesh
- temporal composite

Session time: 3 hours

Lateral Fracture: The Deeper you Drill The Better

fractured central incisor

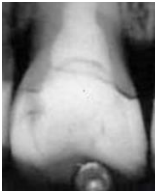
cleared gap and post space

Titan-post

repair palatinal

repair buccal

Chewing impossible.
Extreme dispair.
Fear patient.



No periodontitis around the defect (not before and not after the repair).

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This slide led to the discussion about the cases of doubt.

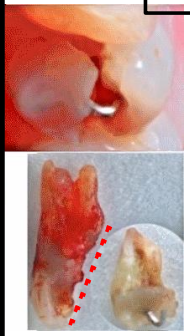
It would have been possible to extract the crown, to put a temporary filling with Ketaczem for example, to wait a few days until the wound is healed, and then to continue the treatment without bleeding.

Lateral Fracture: A Limit to our Possibilities

2015

Treatment: minimal invasive excavation

2018



inclined plane

Chewing impossible

Recurrence:

- insufficient adhesion to the inclined plane
- insufficient excavation of fracture gap

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It is impossible to drill a horizontal step and a retention near the bottom of the inclined fracture gap down in the apical third of a root, when the fracture is not visible on the X-ray.

Root Fracture: A Limit to our Possibilities

June 2016

No pain.
Patient **rejects** extraction.

- Hairline crack
- Pocket 10 mm
- Fistula

Critical number not exceeded

Dec 2017

Constant pain.
Patient **wants** extraction.

- Root fracture
- Pocket 10 mm
- Fistula

Critical number exceeded

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Nobody knows the critical number, but the absence of pain and a healthy feeling are a good measuring system.

Thank you for listening

Take home:

"Don't be afraid of a fractured tooth.
You can repair it and remove the cause."

At the end of the presentation many colleagues asked for a copy of the slides. That's why I wrote these comments the day after the presentation while I could remember the interesting discussions.