THE WORN DENTITION –
PATHOGNOMONIC PATTERNS OF ABRASION & EROSION

by Thomas C. Abrahamsen, D.D.S., M.S., F.A.C.P.

AXIOM - RECOGNITION OF ABNORMAL REQUIRES THE COMPARISON TO NORMAL

AXIOM – NON-CARIOUS LOSS OF TOOTH STRUCTURE IS ABNORMAL !

Attrition - the **pathologic** wear of teeth from **abrasion** and **erosion**

Abrasion - the **pathologic** wear of teeth from a mechanical/rubbing process

Erosion - the **pathologic** wear of teeth from a chemical/dissolving process

Pathognomonic Wear Pattern - the non-carious loss of tooth structure collectively based on the quantity and juxtaposition of **all** the worn teeth in an entire arch and the relationship of **both** arches to each other that is consistently specific to the cause

ETIOLOGY of the FIVE MAJOR CAUSES

A. ABRASION
1. **Bruxism**
2. **Toothpaste Abuse**

Miscellaneous

B. EROSION
1. **Regurgitation**
2. **Coke-Swishing**
3. **Fruit-Mulling**

Miscellaneous

Cupping or Cratering - the non-carious invaginations on the surfaces of teeth caused by either **abrasion** or **erosion**

revision 01/08

A. ABRASION

1. Bruxism

a. Wear Pattern

- loss of tooth structure is progressively greater toward the anterior due to unfavorable leverage changes created by eccentric posterior interferences which increases the force applied to the anterior teeth
- only exception is the anterior open-bite
- wear pattern is same with mutually protected occlusal scheme (immediate posterior disclusion)

b. Type of Person

- stressed

c. Additional Facts

- cupping or cratering very common, but not from bruxism; it is most often due to toothpaste abuse because people tend to brush their teeth with the same vigor that they brux
- bruxism is the grinding/rubbing of teeth together with mandibular movement in an unaware subconscious mental state
- clenching is teeth together without movement and cannot abrade teeth
- ***ALL* people brux**; therefore, wear from bruxism always evident and in combination with all other causes

d. Diagnostic Confirmation

- recognition of wear pattern
- wear facets of hand-articulated casts will match-up

A. ABRASION continued

2. Toothpaste Abuse

a. Wear Pattern

- facial surface of mandibular canines and premolars are worn the most
- anatomical details of all affected surfaces are faded with a sandblasted appearance

b. Type of Person

- overzealous horizontal toothbrusher
- dislikes color of teeth
- fearful

c. Additional Facts

- cupping or cratering can occur from toothpaste alone
- type of toothbrush does not wear teeth; it is from the toothpaste delivered by the toothbrush
- toothbrush determines the shape because of filament deflection
- toothbrush wears gingival - recession
- all-inclusive term "toothbrush abrasion" inadequate and misleading
- can be in combination with all other causes

d. Diagnostic Confirmation

- recognition of wear pattern
- worn surfaces of hand-articulated casts do <u>not</u> coincide
- have patient demonstrate toothbrushing style:
  - use their own toothbrush
  - question frequency and length of time
  - note speed, pressure of stroke, and what tooth surfaces they are spending the most time cleaning

New Terminology:

toothbrush can damage gingiva - ***Toothbrush Recession***

toothpaste can damage teeth - ***Toothpaste Abrasion***

⃠ old paradigm - **"Toothbrush Abrasion"**

B. EROSION

1. Regurgitation

a. Wear Pattern

- loss of tooth structure is progressively greater toward the anterior due to action of the projectile vomitus and tongue position
- acid dissolves tooth structure amorphously from the free margin of the gingiva at the lingual surface of the maxillary anterior teeth
- maxillary posterior teeth are worn more than mandibular posterior teeth especially the palatal surface
- mandibular anterior teeth not affected because they are protected by the tongue

b. Type of Person

- bulimic – complex psychological disorder characterized by binge-eating and self-induced vomiting
- patients will rarely admit their eating disorder

c. Additional Facts

- cupping or cratering very common
- elevated silver alloys can be present
- can be in combination with other causes, but never coke-swishing or fruit-mulling because they are time consuming and the binge/vomiting process is rapid

d. Diagnostic Confirmation

- recognition of wear pattern
- worn surfaces of hand-articulated casts do <u>not</u> coincide
- confession by patient
- test silver alloy placed at lingual surface of maxillary anterior teeth to determine activity

B. EROSION continued

2. Coke-Swishing

a. Wear Pattern

- posterior teeth worn greater than anterior teeth due to tongue position
- mandibular 1st molar is worn the most due to gravity and early childhood age this habit begins
- cupping or cratering when present has sharp enamel edges

b. Type of Person

- dislikes sensation of carbonation in throat
- swishes to eliminate carbonation before swallowing for comfort

c. Additional Facts

- person takes a long time to consume one can of soda and therefore not a high volume drinker
- can occur with any carbonated soft drink
- elevated silver alloys can be present
- can be in combination with other causes, but never regurgitation or fruit-mulling because fruit-mullers do not drink soda

d. Diagnostic Confirmation

- recognition of wear pattern
- worn surfaces of hand-articulated casts do not coincide
- patient will freely admit habit

B. EROSION continued

3. Fruit-Mulling

a. Wear Pattern

- Posterior teeth worn greater than anterior teeth due to the position of the pulp of the citrus fruit when mulled
- maxillary and mandibular posterior teeth worn equally
- cupping or cratering when present has abraded enamel edges

b. Type of Person

- health-conscious
- high consumption of fruit with swallowing delay
- often vegetarian

c. Additional Facts

- elevated silver alloys can be present
- can be in combination with other causes but never regurgitation or coke-swishing

d. Diagnostic Confirmation

- recognition of wear pattern
- abraded enamel edges peripheral to cups/craters of hand-articulated casts will match-up
- patient will reluctantly admit habit

ABRASION and EROSION

Miscellaneous

a. Wear Pattern

- will be unique to the habit

b. Type of Person

- anybody

c. Additional Facts

- comprise a very small percentage of the worn dentition patients you will encounter
- can be in combination with the other five major causes

d. Diagnostic Confirmation

- first eliminate the characteristics of the other five major causes of the worn dentition and then discuss oral habits with patient

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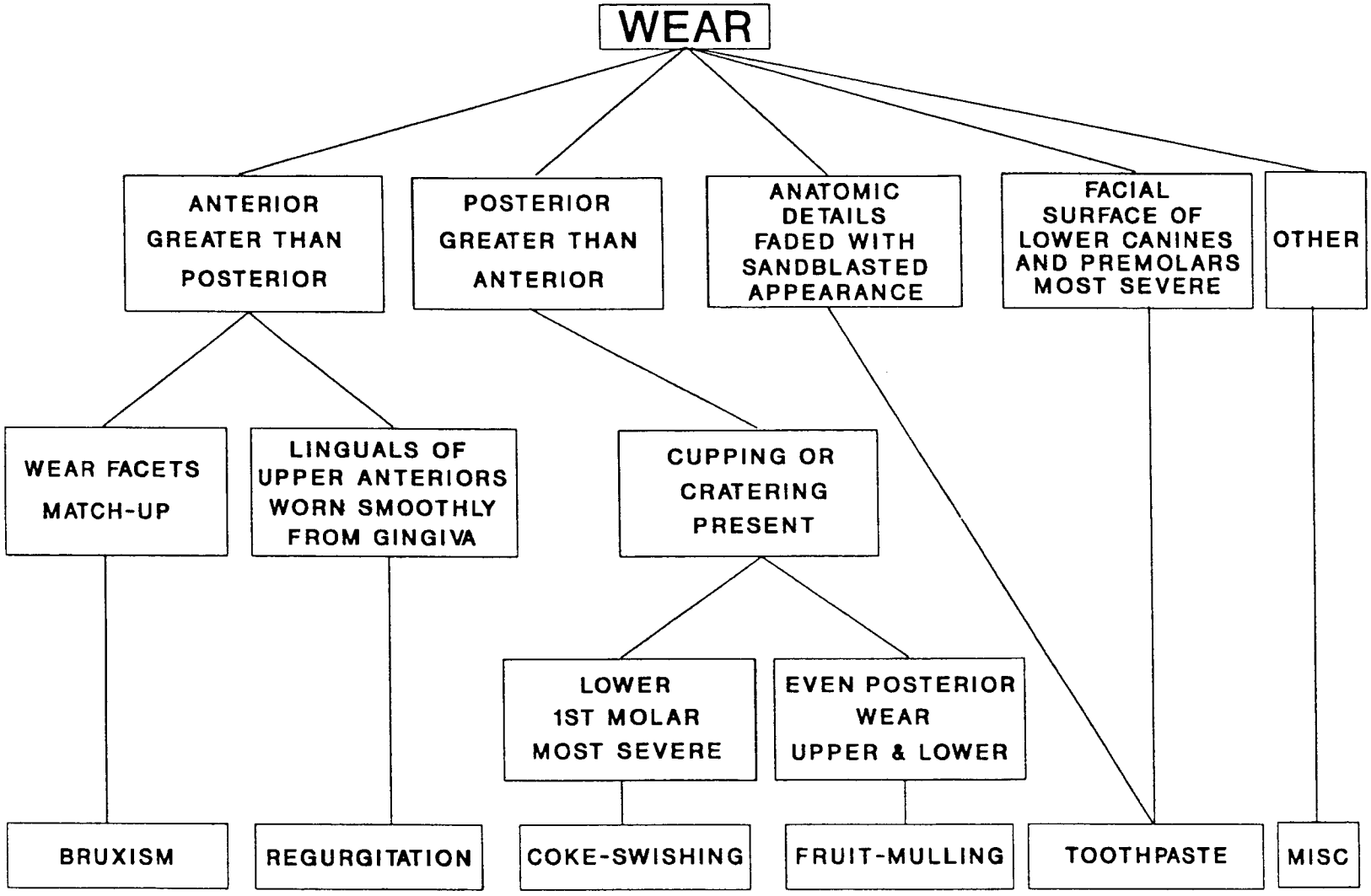

NOTE: 1. CUPPING OR CRATERING MAY BE PRESENT IN ANY CASE.

2. WEAR FACETS FROM BRUXISM WILL BE PRESENT IN ALL CASES.

3. COMBINATIONS OF CAUSE AND CHARACTERISTICS MAY BE PRESENT IN ANY SINGLE CASE.

In Vitro Reproduction of the Non-Carious Cervical Lesion

by

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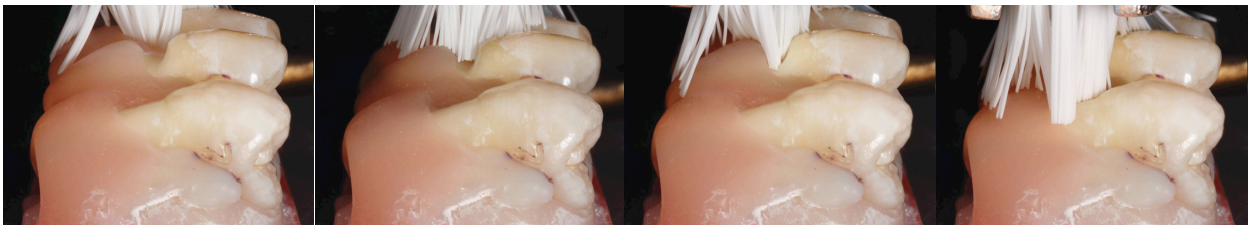

CONCLUSIONS

1. Modern-Day toothpastes carried by the toothbrush create the NCCL
2. Modern-Day toothbrushes without toothpaste do not create the NCCL
3. There is no visually significant correlation between the abrasive index and the size of the NCCL
4. There is no visually significant correlation between firmness of toothbrush and the size of the NCCL
5. The various shapes of the NCCL are due to toothbrush filament deflection
6. The amount and direction of filament deflection is affected by stiffness, juxtaposition of teeth, contours of gingiva and teeth, and pressure
7. Creation of the NCCL occurs with horizontal brushing with toothpaste

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NCCL Literature Summary

1728 – Hunter – *Observation Only*

1906 – Black – *Confirms Miller's Conclusion of Toothpaste*

1907 – Miller – *Laboratory Proof: Etiology is Toothpaste*

1908 – Black – *Closed-mindedly Discounts Simplicity of Toothpaste*

1977 – Abrahamsen – *Pathognomonic Patterns Revealed – Claims Toothpaste*

1979 – McCoy – *Tensile/Flexure Theory*

1983 – McCoy – *Pronounces Black to be Expert on Subject*

1984 – Lee, Eakle – *Tensile/Flexure Schematic Paradigm*

1987 – Grippo – *Ca++ Ion Transfer Theory*

1988 – McCoy - *Dental Compression Syndrome*

1991 – Grippo – *Term "Abfraction" Introduced*

1995 – Grippo – *Claims Acid Corrosion Reproduction*

1996 – Lee, Eakle – *Literature Review of "Abfraction Hypothesis Reveals No Reproduction by Anyone*

2006 – Dzakovich, Abrahamsen – *Laboratory Proof using Modern Materials: Etiology is Toothpaste*

2008 – Dzakovich, Oslak – *In Vitro Reproduction of Noncarious Cervical Lesions*

THE SOPHISTICATED ALGINATE IMPRESSION

To quote one of my mentors, Dr. Ken Rudd, who taught me most of what I know about the alginate impression: "The cast is the direct link between the patient's mouth and the restoration to be fabricated in laboratory."[1]

Accurate casts require accurate impressions. One of the most ill feelings we get in dentistry is when things don't fit. The technical frustration of trying to make things fit is high, and the loss of chairtime is costly. Alginate is our most versatile and universally used impression material. We use it for removable partial dentures, complete dentures, provisionals for crown and bridge, orthodontic appliances, retainers, surgical stents, TMD orthoses, mouthguards, sleep apnea appliances, and perhaps, most importantly, the diagnostic cast. The diagnostic cast is a major component in the determination of our treatment plans, and I try to make my best impressions for this purpose.

In order for alginate to be accurate it requires, just like any other impression material, knowledge of its properties and a precise step by step process to make the impression.[2] The following discusses these properties and gives a step by step process on how to make an accurate alginate impression:

1. Alginate, which is irreversible hydrocolloid, is just as accurate as reversible hydrocolloid.[3] This is not true however for fast-set alginates, which are more grainy and produce a rougher surface.
2. Alginate is a mixture of ingredients which can settle to the bottom. Rotate the container thoroughly to mix the ingredients evenly before dispensing from the can. By weighing the powder, and measuring distilled water rather than the scoop method, your alginate will perform exactly the same for you every time.
3. Change in water temperature does not affect the accuracy of alginate, but will change the setting time. An increase in temperature decreases setting time.[2,4] So if a faster set alginate is desired, use regular-set alginate with warm water.
4. Changes in water/powder ratio affects the viscosity and setting time, but contrary to most dental materials it does not change the dimensional accuracy.[2] It's your call: the thicker the mix, the easier to control, but the shorter the working time. Use whatever water/powder ratio you like. My personal preference is 30gm of JELTRATE Regular to 68cc of H_2O.

   I like to take advantage of this property of alginate, and use it as a free-flowing duplicating material. Spray the cast to be duplicated with PAM.[5] Let it soak in and dry. You need to spray only one time; it will remain indefinitely as a separating medium. Use cold tap water, triple the amount of water, vacuum mix this thin alginate for a full minute, and pour into a duplicating flask. Don't throw away those metal peanut cans and you can make a homemade duplicating flask: Cut out the bottom of the can, put 2 large holes in the reusable plastic lid, buy another can for an additional lid to be used for the bottom and you now have a duplicating flask.
5. Selection of the type of tray is very important. It must be rigid and non-perforated.[6] Disposable trays are fine if they meet these requirements.

6. The size of the tray must be large enough to allow ¼ of an inch (6mm) thickness of alginate.[2] This thickness must be uniform and often requires modification of the tray with compound.[2,6,7] Compound works well because the tray can be extended and still be rigid. A partial impression can be made and then cut back to give us the ¼ inch clearance we need. If a tray is extended with wax it will not be rigid.

7. The alginate must be attached to the tray with an adhesive called Hold [8] (Teledyne/Water Pik) because the rim-locks are not reliable. It can be purchased as a paint-on or a spray.

   Painting it on is somewhat time consuming and spraying it is very messy unless a paper towel is utilized protecting the handle of the tray and the countertop. Tear a slit for the handle in the center of the paper towel and slide the handle underneath. The adhesive must be dry and tacky as with any tray adhesive, otherwise it is a separating medium. Toluene is the solvent to clean Hold. This can be purchased at any paint store.

8. Vacuum mixing the alginate for 15 seconds will produce smooth, virtually bubble-free mixes that are superior to hand mixes with a green bowl to reduce SUBsurface air bubbles.[2] Vacuum mixing does not prevent surface bubbles in your impression, but more importantly prevents subsurface bubbles that can sag from the weight of the stone when the cast is poured creating a distortion.

9. Surface bubbles can be reduced and more detail achieved if the alginate is syringed or painted on the teeth with your finger. A 60cc disposable syringe is loaded by you while your assistant loads the tray.

   Painting can be achieved best by using your palm as a palette and placing the alginate systematically on all the surfaces of the teeth. For the buccal surface, of the maxillary right teeth, use the back of your forefinger. Reverse for lefties.

10. Care must be taken not to touch the teeth when painting, because if the pellicle is removed the alginate will stick. Pellicle is also absent from teeth that have been pumiced or recently cleaned with toothpaste. If teeth need to be cleaned, do so, but wait 24 hours for new pellicle to form before an alginate impression is attempted.

11. The patient should be positioned to allow the best visibility for the dentist and where it is least likely for the alginate to enter the throat. That would be completely supine for the maxillary impressions and upright for the mandibular impressions.

    Typically we seat the patient in an upright position when making the maxillary impression in case the patient gags so we can quickly lean them forward. However, in this position we cannot see very well and because of gravity, any posterior excess will likely enter the throat, which is straight down. If instead we lay the patent all the way back, excess material can still go down, but not in the direction of the throat, which is now 90° to the upright position. We can also see much better and direct the alginate where we want it to go. The upright position for mandibular impressions works best.

12. Using a mouth mirror to enter the mouth instead of a finger gives at least an additional ½ inch or more room for a larger tray and it is a more comfortable stretch of the lips for the patient.

13. A sample of alginate can be placed on the bracket table to determine when the alginate is set. Set a timer for two minutes after it has lost it's tackiness.[2]

14. After the two minutes, make one attempt to remove the impression with a quick snap by holding the handle. If this fails, do not struggle with it or leverage yourself against the mandible to remove the impression. Instead, place your forefinger in the posterior buccal space with the mouth as closed as possible and break the seal.
15. Once removed, the impression is taken into the laboratory where prevention of distortion is paramount. Do not allow excess alginate to touch the countertop. Either trim the excess or suspend the tray. To make an accurate cast from this accurate alginate impression it must be poured in less than ten minutes.[2,8,9] There is no option. After 10 minutes, alginate can lose water through syneresis causing the material to shrink as well as gain water through imbibition causing it to swell.[8,9] The typical routine of making an upper and lower impression, wrapping them in a wet paper towel, and then taking them to the lab to be poured does not help and will likely cause distortion. It is bad technique.
16. The surface of the alginate requires some preparation before it can be poured with stone. Spray with a disinfectant and suspend in baggies for the appropriate amount of time.
17. Rinse with tap water, sprinkle with stone to absorb fluids, especially thick, ropy saliva, and gently brush stone mix into hard to get at places. Spray the impression clean with a hand sprayer (it works better than a faucet) and then gently blow off excess water with compressed air.

    You now have an accurate alginate impression ready to pour with a compatible stone.

Alginates must pass the ANSI/ADA specification no. 18 for surface detail and gypsum compatibility, but this test is not discriminatory; it's just pass or fail. Some combinations of alginate and stone are more compatible than others.[10-13] Unfortunately, the combinations are endless and there are not enough studies to test all of them, but the standards by which others seemed to be compared are Jeltrate and Die-Keen. For a Type III lab stone I use COE-cal.

The disinfection of the alginate impression presents a new unwanted problem in regard to alginate and stone compatibility. Many disinfection agents adversely affect the accuracy and compatibility. Most agents require 10 minutes to be effective which is in conflict with the requirement to pour the alginate impression in less than 10 minutes. There have been several studies published on the subject since 1985, but the results are conflicting and confusing.[14-18]

To give some clarity to all of this, the chlorine based products seem to be the best. A 1:10 diluted solution of household bleach can be used, but requires 10 minutes to be fully effective, or Alcide LD, a chlorine dioxide, works well if immersed for 3 minutes, but it is expensive and using it as a spray is ineffective. However, the solution to the solution is the results of a study by Dr. Richard Schwartz, et al.[19,20] They found that lowering the pH of NaOCl (household bleach) to 10 requires only 3 minutes to be effective, can be sprayed, and does not affect the accuracy nor the alginate/stone compatibility.

To simplify our clinical lives and maintain accuracy in our casts, it is important to note that we may be wasting our time and intellect on disinfection altogether and step #16 can be eliminated.[21]

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