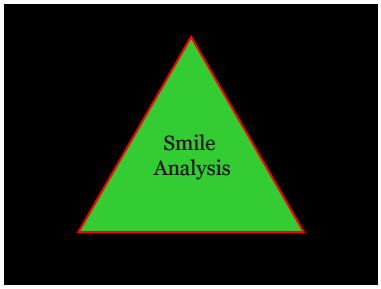
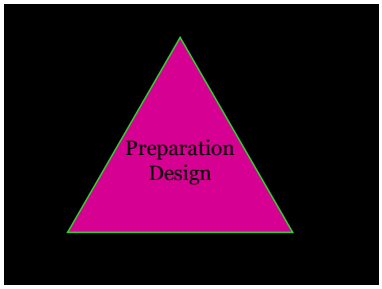
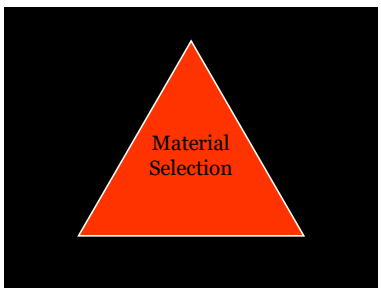
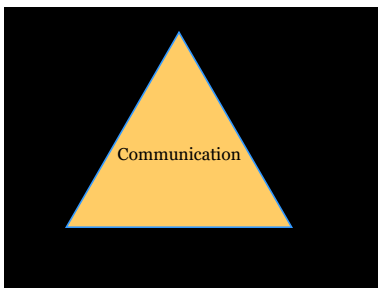
Porcelain Veneers

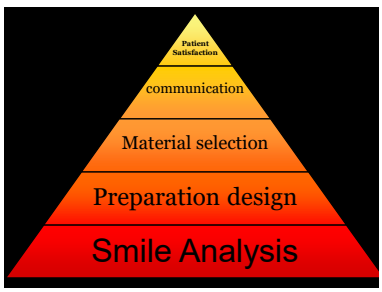
Dino S. Javaheri, D.M.D.





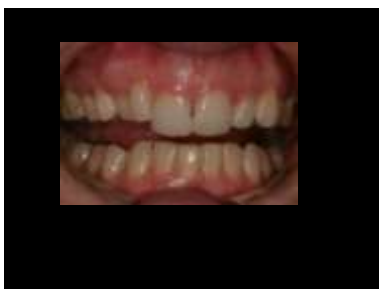






objective vs subjective

- Does midline has to in center for smile to be pleasing?
- Does 75% width to height necessary for smile to be pleasing?
- Do laterals have to be shorter than centrals?



Exam/treatment planning

- Perio – x-rays, probing
- Decay – x-rays, visual exam, charting
- Esthetics –
- Occlusion -

Exam

- Esthetics – photographs
- Occlusion – models
- Decay –
- Perio –

You must be able to visualize the final smile prior to starting

If you cannot then you are hoping to get lucky

Patient Consult Questions

- Chief complaint
  - Review patient goals and objective
  - What are they interested in doing
    - Lengthening teeth
    - Whiten
    - Correct alignment

Next Most Obvious Problem?

- Paint, cabinets, carpets, furniture…

Patient expectations

- What kind of end result
- How white
  - Hollywood look vs. younger smile
  - Old photos
  - Show model of prep and restorations

Questions to ask

- Why are you considering doing the veneers now?
- Is there a time deadline?

Questions to ask yourself

- Can I please this person?
- Is it technically possible?
- Do I want to do this case?

Informed consent

1. Alternatives
2. Advantages
3. Disadvantages
4. Costs
5. Risks
6. What if nothing is done
   1. Elective (required for health)
   2. non-elective (not required for health)

Failures

- Technical
  - I.e. occlusion, material limitation, bonding
- Communication
  - Doctor/lab
  - Doctor/patient
- Psychological
  - Something someone said
  - Just a miserable person

Face

Aging of Face

- Loss of soft tissue volume
- Loss of bone volume
- Eyes becomes deeper and hollow
- Chin and cheeks become smaller and flatter
- Lips become narrow, thin and wrinkled

Facelift

- Does not stop the aging process.
- It "sets back the clock"
- Removes excess fat, tightens underlying muscles, and redraps the skin of the face and neck.
- Can be done alone, or in conjunction with other procedures such as a forehead lift, eyelid surgery, or nose reshaping

Clinical significance of Facelift

- Lifts up the skin about 2mm
- More of maxillary teeth/tissue exposed
- Less of maxillary teeth/tissue exposed

Facial Analysis

- Frontal view
- Lateral view

Facial Analysis

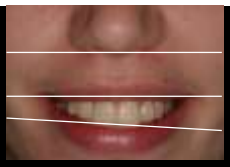
- Should not diagnosis only off of photographs
  - Clinical evaluation very important
- Improper head orientation will to inaccurate diagnosis

Facial Analysis

Horizontal Reference lines

- Interpupillary
- Commissural (lips)
- Ophriac (eyebrows)
- Interalar (nose)

Canted smile after restoration



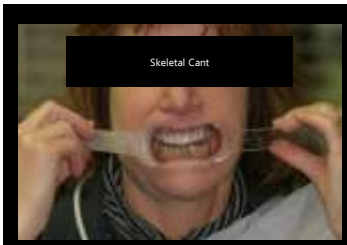
Possible factors

- skeletal - slanted maxilla
- attrition
- Erosion
- Abrasion
- Altered eruption
- Periodontal disease

Pre-op

Preps

temps



skeletal cant

- Both max and mand have cant
- From ramus being longer on one side than the other
- large 8+mm -only option is surgery
- moderate about 4mm- traditional orthodontics
- small 3> mm - ortho or restorative treatment.
  - restorative good option, especially if teeth have wear
  - will need crown lengthening to correct

Facebow

- Only used by 2% of dentists
- Helps with achieving predictable esthetics and function
- Purpose is to properly mount model

Requirement for mounted model

I. Replicate the functional movements of the patient
   - Reduce adjustments
   - Less re-do's

II. Transfer esthetic information that is useful for diagnosis and treatment
   - Incisal plane
   - Occlusal plane

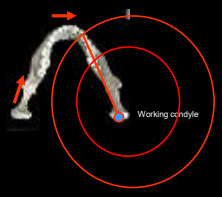
Facebow

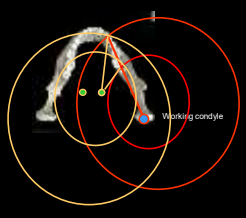
- Facebow allows us to transfer arc of rotation to an articular
  - Uses ear hole due to close proximity to glenoid fossa
  - Not perfect, but close

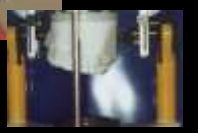
Facebow allows us to transfer this axis of rotation and trajectory to mounted models

Vertical axis of rotation

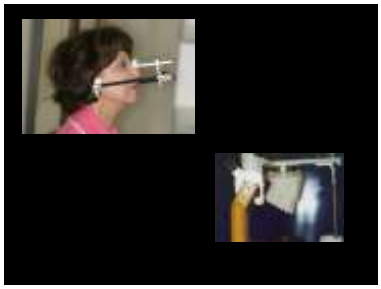
- Critical when opening vertical dimension
  - Restorative or nightguard
- Small articulators will give posterior hitting first

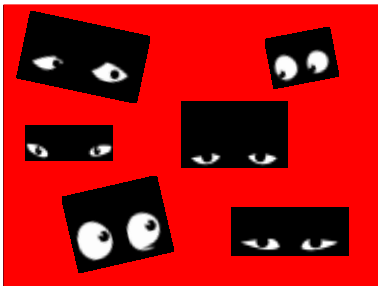






25% of people ear levels are uneven





When to take a stick bite

- wax - up for more than 2 anterior teeth
- final restorations for more than 2 teeth
- Large case -bite stick and facebow

Clinical Application

1. If the interpupillary line is slanted use the horizon instead
2. If interpupillary and commissural line are both slanted, but parallel use that line. Get patient approval in provisionals
3. If interpupillary, commissural, and horizon do not match discuss with patient (mock-up, provisionals)

Rule #1

If the interpupillary line is slanted use the horizon instead

Rule #2

If both interpupillary and commissural line are slanted, but parallel use that line. Get patient approval.

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Rule #3

If interpupillary, commissural, and horizon do not match discuss with patient (Evaluate with mock-up, temporaries)

Vertical Reference line

- Glabella
- Tip of nose
- Philtrum
- Tip of chin

Dental vs. facial midline

- Difference in 30% of people
- Conflicting data on patient perception
  - Easily identified (Johnston)
  - Not identified till 4mm off (Kokich)
  - Important to 80% (Rosenstiel)

Johnston CD et al. The influence of dental to facial midline discrepancies on dental attractiveness ratings. Eur J Orthod 1999;21:517-22.

Kokich VO et al. Comparing the perception of dentists and lay people to altered dental esthetics. J Esthet Dent 1999;11:311-24.

Rosenstiel SF et al. Public preferences for anterior tooth variations. J Esthet Restorative Dent 2002;14:97-106.

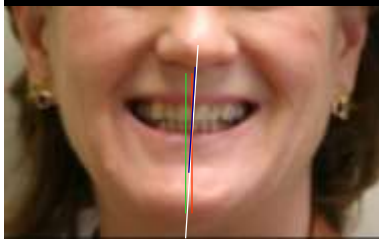
Maxillary vs Mandibular midline

- Only aligned in 25% of population

Johnston CD et al. The influence of dental to facial midline discrepancies on dental attractiveness ratings. Eur J Orthod 1999;21:517-22.

Clinical Application

1. Actual facial midline can be ignored
2. Smile should follow upper lip midline and interincisal line



Ideal location

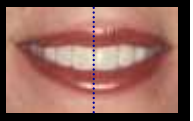
- Papillas between the maxillary central incisors coincides with the mid-line of face

Clinical application

- No action required if discrepancy is limited
  - Unless patient requests
- Ortho only good option
  - Can move clinical crown with restorations
  - Cannot move tissue

Oblique midline

- Very noticeable
- Must be corrected, even if it makes dental midline appear more off

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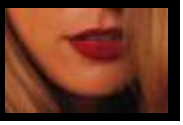
Kokich VO et al. Comparing the perception of dentists and lay people to altered dental esthetics. J Esthet Dent 1999;11:311-24.

Lumineer enamel only prep case
from DenMat website

Lips

- Frames the smile
- Establishes minimum for esthetic treatment
- Guide for teeth position



True full smile

- Conveys emotion: joy, happiness, embarrassment...
- Actual smile involves muscle action of lips and peri-ocular
- Forced smile (as in dental photos) only lip muscles are used.
- Actual smile, shows more teeth.

Doug JK et al. The esthetics of the smile. Int J prosthodont 1999:12(9):9-19.

Consideration and application

1. Evaluate lip movement in friendly and spontaneous conversation.
2. Different levels of max and mand exposure may be observed during smile vs. speech
3. Lips should move in horizontal plane
4. Lip ptosis
   1. Psychological compensation
   2. Muscle tonicity
   3. Neurological disorder

Gibson RM. Smiling and facial exercise. Dent Clin North Am. 1989;33:139-44.

Lip classification

A. Fullness
   A. Thin (A-P 6-10mm)
   B. Medium (A-P 10-12mm)
   C. Thick (A-P 12-20mm)
B. Height
   A. Upper lip half the height of lower

Holdaway RA. A soft-tissue cephalometric analysis and its use in orthodontic treatment planning. Part 1. Am J Orthod 84(1):1-28,1983.
Oliver BM. The influence of lip thickness and strain on upper lip response to incisor retraction. Am J Orthod 82(2):141-149:1982.

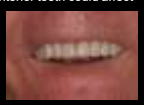
Consideration and Application for Thick lips

- Minimal effect on lips from teeth position
- Teeth appear smaller and darker
  - Make new restorations more dominant


Maritato FR. A positive guide to anterior tooth placement. J Prosthet Dent 1964;14:848.
Pound E. Applying harmony in selecting and arranging teeth. Dent Clin North Am 1962;March:241.

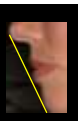
Consideration and Application for thin lips

- Makes teeth appear larger
  - make new restorations less prominent
- Buccal lingual position of anterior teeth could affect lips and facial features.



Maritato FR. A positive guide to anterior tooth placement. J Prosthet Dent 1964;14:848.
Pound E. Applying harmony in selecting and arranging teeth. Dent Clin North Am 1962;March:241

Nose to chin Profile line



- Useful in recording profile
  - Convex – upper lip over 4 mm behind
  - Concave – Upper lip less than 4mm behind
- Variation with gender
- Variation between races

Ricketts RM. Cephalometric analysis and synthesis. Angle Orthod 1961;31:141-156

Ricketts RM. Planning treatment on the basis of the facial pattern and an estimate of its growth. Angle Orthod 1957;27:14-37.

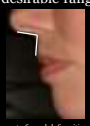
Owens EG et al. A multicenter interracial study of facial appearance. Part 1: A comparison of extraoral parameters. Int J Prosthodont 2002;15:273-282.

Guideline

- Does not take into account cultural variation/perception
- upper lip 4mm behind line, lower lip 2mm behind line for Caucasians
- Full or thin lips will alter e-plane
- behind standard for e-plane: need larger/whiter tooth display
- front of standard for e-plane: need smaller teeth
- ortho/surgery can be used to alter profile or change nose or chin to correct relationship.

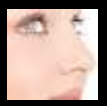
Nasolabial Angle

- Male: 90-95 degrees
- Female: 100-105 degrees
- Cosmetically desirable range 85-105 degrees



Rohrich RJ, Bell WH. Management of nasal deformities: An Update. Modern Practice in Orthognathic and Reconstructive Surgery, Vol. 1. Philadelphia: Saunders 1992:262-283.
Arnett GW, Bergman RT. Facial keys to orthodontic diagnosis and treatment planning. Part 1. Am J Orthod Dentofacial Orthop 103(4):299.312, 1993.
Arnett GW, Bergman RT. Facial keys to orthodontic diagnosis and treatment planning. Part 2. Am J Orthod Dentofacial Orthop 103(5):395-412, 1993.

Nasolabial angle



- thick lips make nasolabial angle number smaller
- thin lips make nasolabial angle number larger
- below 85 (flared out teeth)- teeth appear larger
- above 105 (premolar ext ortho case) - teeth appear smaller

Clinical Application

Protruded maxilla will look better with smaller anterior teeth
- Nasolabial angle below 90
- Teeth to profile line less than 4mm

Retruded maxilla will look better with larger anterior teeth
- Nasolabial angle above 90
- Teeth to profile line above 4mm

Lip support

- 70% of people
  - 1/3 support from incisal area
  - 2/3 from gingival 2/3
- Loss of muscle tone with age
  - Lip position will vary from horizontal to vertical
  - Do not evaluate pts when lying in chair

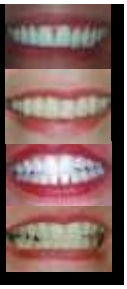
Pound E. Applying harmony in selecting and arranging teeth. Dent Clin North Am 1962;6:241

Burstone CJ. Lip posture and its significance in treatment planning. Am J Orthod 1967;53:262-284.

Lip asymmetry

30% people have lip asymmetry

neurological issues
arch form issues
tooth form



Upper lip asymmetry

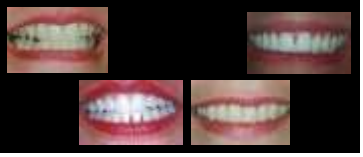
- Main impact is on amount of tissue display
- Creates compromise in final results
  - Inform patient prior to treatment

Lower lip asymmetry

- Can make upper teeth seem shorter or longer
- Can create uneven tooth display of lowers

Clinical application

- Lips (upper and lower) are unreliable for symmetry and change with time

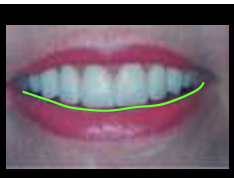


Veneers and crowns 4-13

9 years later

The upper lip line serves as general guideline for:

1. Symmetry
2. The vertical position of the gingival margins



The lower lip line serves as general guideline for:

1. Buccolingual position of the incisal edge of maxillary incisors
2. The curvature of the incisal plane

Lip movement

Allows evaluation of:

1. Smile
2. Speech

Low Smile line
reveal less than 75% of anterior

- 20% of people have low smile line

Average Smile line
reveal 75-100% of anterior

- 70% of people

Smile line level

- Attractive perception – 100% of maxillary teeth plus 1-3mm of gingival tissue.

Allen EP. Use of mucogingival surgical procedures to enhance esthetics. Dent Clin North Am 1988;32:307-30.

Clinical application

- Low smile line
  - no need to recontour tissue
  - No subgingival margins
  - Avoid cervical restorations
  - But inform patient, they lift their lip up

High Smile line
reveal 100% of anterior plus tissue

- 10% of people
- 2x more in women than men
- Often from strong labial muscles or short upper lip

Clinical application

- High smile line (gummy smile)
  - Short upper lip
  - Vertical maxillary excess
  - Hyper mobile lip
  - Anterior teeth overeruption
  - Secondary eruption from wear
  - Altered active eruption
  - Altered passive eruption

Coslet JG et al. Diagnosis and classification of delayed passive eruption of the dentogingival junction in the adult. Alpha Omegan 1977;70:24-8.

Itoiz ME, Carranza FA. The gingiva. Clinical Periodontology. 1996:12-29.

Kokich VG, Spear FM et all. Maximizing anterior esthetics. Craniofacial growth series. 2001;38:1-18.

Diagnosis

1. Is there normal tooth length?
   - Short upper lip
   - Vertical maxillary excess
   - Hyper mobile lip
   - Anterior teeth overeruption
   - Secondary eruption from wear
   - Altered active eruption
   - Altered passive eruption

Diagnosis

2. Where is excess tissue (anterior only or ant. & post.)
   - Short upper lip
   - Vertical maxillary excess
   - Hyper mobile lip
   - Anterior teeth overeruption

Diagnosis

3. Do they show teeth at rest
   - Short upper lip
   - Vertical maxillary excess
   - Hyper mobile lip

Diagnosis

- Normal upper lip
  - Female 20-22mm
  - Male 22-24mm
- Vertical maxillary excess
  - Gingival display exceeds 10mm
  - Evaluate facial proportions and cephalometric analysis
  - Surgery will make face look shorter and wider
  - Maxilla goes forward and up

Diagnosis

1. Is there normal tooth length?

- Short upper lip
- Vertical maxillary excess
- Hyper mobile lip
- Anterior teeth overeruption
- Secondary eruption from wear
- Altered active eruption (osseous)
- Altered passive eruption (tissue)

Diagnosis

- Secondary eruption from wear
  - Short teeth with ear on occlusal surfaces
- Altered active eruption
- Altered passive eruption

Diagnosis

When the teeth reach their functional antagonists, the gingival sulcus and junctional eptihelium are still on the enamel, and the clinical crown is approximately 2/3 the anatomical crown.

- Altered active eruption
  - Can't find CEJ in sulcus
  - CEJ vs. osseous level on x-ray
- Altered passive eruption
  - Can find CEJ in sulcus

Altered Active Eruption

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Surgery by periodontist
Dr. Paul Towfighi

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Altered Passive Eruption

Gingivoplasty

- Etiology of gingival asymmetry:
  - Altered passive eruption
  - Different patterns of tooth wear
  - Trauma that modified tooth eruption
  - Tooth positioning in dental arch
  - Parafunctional habits
  - Overzealous tooth brushing
- To correct can use Lasers, electrosurgery, scalpel, diamond bur.

Biological Width

- Average 2mm, varies from .75 to 4.3mm
- Consists of
  - Connective tissue attachment (1.07mm average)
  - Junctional epithelial attachment (.97mm average)
- Allows ginvival fibers to have direct contact with the tooth
- Acts as barrier to the bacteria in the sulcus

Biological width

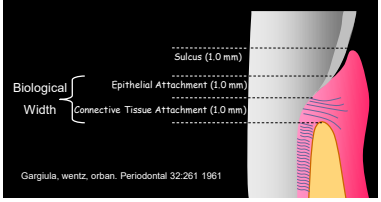
(Epithelial and connective tissue attachment)

Arch position	Average measurement	Range of measurement
Anterior	1.75mm	.75-3.29mm
Premolar	1.97mm	.78-4.33mm
Molar	2.08mm	.84-3.29mm

Biological Width

- Use base of sulcus as reference for maximum amount of tissue that can be removed
- Must have healthy attached gingiva.
- Depth of sulci must exceed the amount of gingiva to be removed.

Facial View

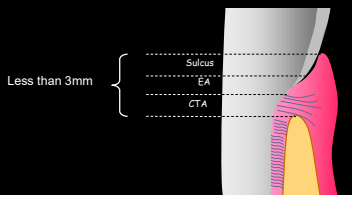


Gargiula, wentz, orban. Periodontal 32:261 1961

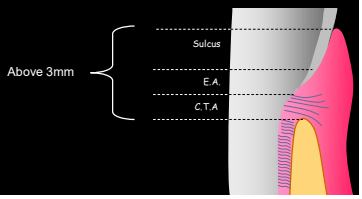
High crest

Minimal room for trimming tissue

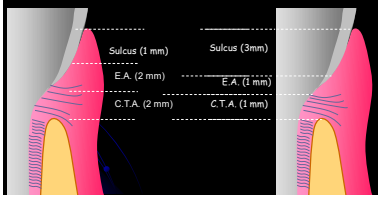
Low risk for recession



Low Crest



Low Crest A & B



Five major causes of inflammatory periodontal disease associated with restorative treatment:

1. Sever damage to tissue during preparation or impression
2. Failure to maintain emergence profile
3. Inadequate finishing or unsealed margins
4. Sensitivity to uncured resin
5. Biological width violation

Examples of biological width violations

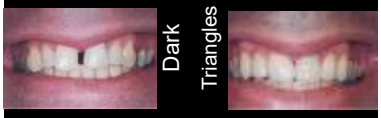
- Persistent inflammation
- Asymmetrical gingival margins
- Recession
- Enlarged gingival embrasures
- Periodontal pocketing

Deep sulcus

- Trim excess tissue
- Go subgingival

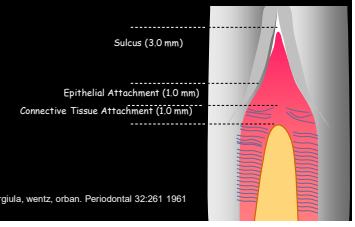
Thickness of periodontium

- Factors
  - Alveolar bone
  - Gingival thickness
  - Width of tooth in facial lingual plane
- Avoid subgingival margin in thin tissue
  - Will recede even under minor chronic irritation



Food impaction Ugly phonetic problems

Interproximal View



Gargiula, wentz, orban. Periodontal 32:261 1961

Morphology of inderdental gingiva

- Factors
  - Position of contact
  - Level of underlying bone
  - Size and shape of roots
  - Angulation of roots

From crest of bone to contact point

- Less than 5mm – 100% intact papilla
- 6mm – 56% intact papilla
- 7mm or more -27% intact papilla

Tarnow DP et al. The effect of the distanced from the contact point of the crest of bone on the presence or absence of the interproximal dental papilla. J Perodontol 1992;63:995-996.

Determinants of Papillary height

- Bone level
  - Perio disease, adjacent teeth, implant next to tooth, implant next to implant, pontic.
- Volume of gingival embrasure
  - Root position, root anglelation, contact point
- Patient biologic width

Predictable options for closing dark triangles

- Lower contact point
- Increase emergence profile
- Move roots closer to each other
- Regeneration of the interpoximal bone

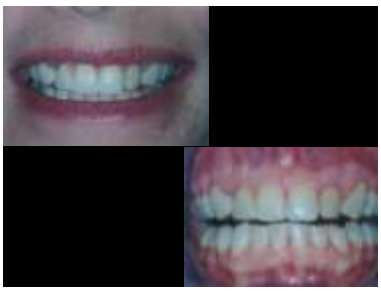
Unpredictable options for closing dark triangles

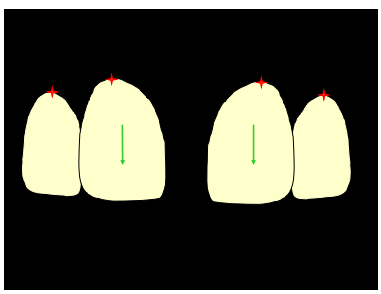
- Soft tissue surgery
  - Anatomic limitations
  - Blood supply problems

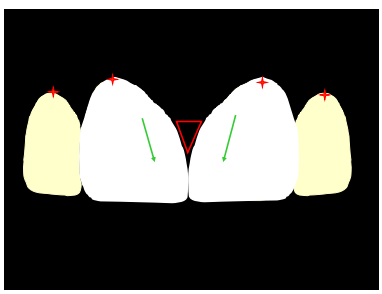
Han TJ et al. Progress in gingival papilla reconstruction. Periodontol 2000 1996;11:65-68.

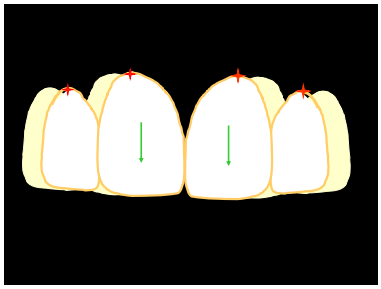
Blatz MB et al. Reconstruction of the lost interproximal papilla. Presentation of surgical and nonsurgical approaches. Int J Perodont Rest Dent 1999;19:395-406.

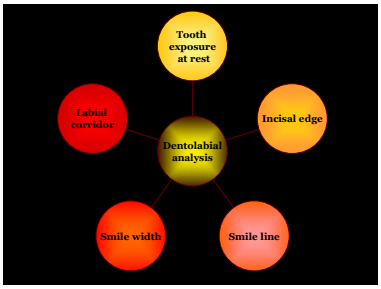
Azzi R et al. Root coverage and papilla reconstruction using autogenous and connective tissue grafts. Int J Perodont Rest Dent 2001;21:141-147.











Length evaluation

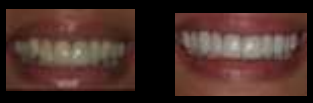
1. Incisal curve

Incisal curve vs lower lip

Convex – attractive young smile
Horizontal –aged, worn, masculine
Reverse – unattractive smile

Incisal curve vs lower lip

Lip is only a guideline. Not reliable.



Incisal plane

- Class 1 – 75-85% convex plane following lower lip
- Class 2 –accentuated convex plane
- Class 3 - typically flat horizontal plane

Tjan AH, Miller GD. Some esthetic factors in a smile. J Prosthet Dent 1984;51:24-8.

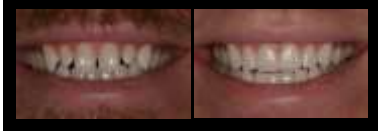
Owens EG et al. A Multicenter interracial study of facial appearance. In J Prosthodont 2002;15:283-8.

Clinical application - Class 2

- Incisal plane appears convex
- Following lip curvature exactly will often make anterior teeth too long

Clinical application – Class 3

- Less incisal curvature
- Horizontal flat plane



Length evaluation

1. Incisal curve
2. Incisal profile

Incisal edge profile

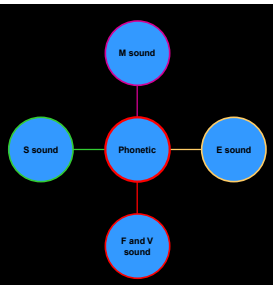
- Anterior posterior position of centrals
- Should be contained within inner border of lower lip
  - If too far forward
    - will make max lip prominent
    - May alter shape of lower lip due to over stimulation

Incisal profile

- Incisal 1/3 profile should be 90° to occlusal plane.

Length evaluation

1. Incisal curve
2. Incisal profile
3. Phonetics



speech problems

- Could take up to one month to adapt
  - Keep them in temps to make sure

“s” sound solution

- Sixty six, Mississippi
- Usually does not change with veneers because the lingual stays the same
- If “s” is a problem, put in articulating paper, have them say “sixty six” and remove contact

“th” sound solution

- Cingulum and tongue
- Reduce cingulum, look at old shape of teeth and match that contour.

“f” and “v” sound solution

- fifty-five, very funny
- length issue, pressing into lower lip

F/V Sounds

- Require correct length and profile of centrals
- Air compression between hard surface (max teeth) and soft surface (lower lip)
- Light contact with lingual border of lower lip

Dawson PE. Restoring upper anterior teeth, In: Dawson PE (ed). Evaluation, Diagnosis, and Treatment of Occlusal Problems, ed 2. St Louis: Mosby, 1989:323-352.
Pound E. Personalized Denture Procedures. Dentist' s Manual. Anaheim; Denar, 1973.
Dawson PE. Determining the determinants of occlusion. Int J Periodontics Restorative Dent 1983;3:8-21.

Clinical consideration

- If incisal edge does not touch lip, can lengthened with mock-up or temps
- Also check
  - Rest exposure (M sound)
  - f/v sound
  - Esthetics
  - Occlusion

Lisp solution

- Common and patients adapt quick
  - Unless you've created an open anterior bite
- Rare that you need to do anything, just wait

M sound – Rest position

Incisal length | Vertical dimension

to get rest position

Tell pt "close down your lips together, then slightly open without smiling"

or have them say "mom" or "Emma" and relax their lips after

True at Rest

- Observed when elevator muscles are completely relaxed. Sleep.
- M sound is "habitual muscular position"

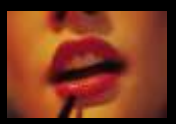
Tooth exposure at rest

- Teeth are not in contact
- Lips are slightly apart
- Maxillary incisal 1-5mm visible
- M sound …mom…mom

Vig RG, Brundo GC. The kinetics of anterior tooth display. J prosthet Dent 1978;39:502–4.

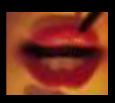
Maxillary tooth display at rest

30 yrs 3.45 mm
40 yrs 1.6 mm
50 yrs .95 mm
60 yrs 0.5 mm
70 yrs 0.2 mm



Mandibular tooth display at rest

30 yrs 0.6 mm
40 yrs 0.8 mm
50 yrs 1.98 mm
60 yrs 2.45 mm
70 yrs 2.8 mm



Freeway space

- Interocclusal space of 2-4mm at rest
- To guarantee success do not increase vertical dimension beyond freeway space
- Not an exact measurement
- Changes all the time
- Patients will almost always re-adapt if VD increased
  - Unless implant or denture

Mansour RM et al. In vivo occlusal forces and moments. J Dent Res 1975;54:114-9.
Pound E. Applying the vertical dimension of speech to restorative procedures. Proceedings of the second international congress. 1979.
Burnett CA. Mandibular incisor position for English consonant sounds. Int J Prostodont 1999;12:263-71.

Length evaluation

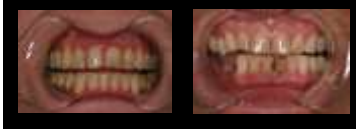
1. Incisal curve
2. Incisal profile
3. Phonetics
4. Function

Reduction in tooth length

i. Attrition
ii. Abrasion
iii. Erosion
iv. Bruxism

Attrition

- The act of wearing or grinding down by friction
- The normal mechanical wear resulting from mastication



Abrasion

- The wearing away of teeth though some unusual mechanical process
- An abnormal wear from causes other than mastication

Erosion

- The progressive loss of tooth substance from chemical process
- Smooth lingual surfaces or wedge shape depressions in facial cervical or occlusal areas
  - Soda
  - Energy drinks
  - Acid reflux

Bruxism

- The parafunctional grinding of teeth
- An oral habit consisting of involuntary rhythmic or spasmodic nonfunctional gnashing, grinding, or clenching of teeth.

Bruxers

- 92% are unaware of nocturnal bruxism
- 75% of spouses are unaware
- Muscle tenderness in less than 10%
- 80% bruxism during light sleep stages
- Does not cause arousal from sleep

Ohayon MM et al. Risk factors for sleep bruxism in the general population. Chest 119:453-461;2002.

Clenching

- Habit that generates constant force exerted from one occlusal surface to the other without any lateral movement.
- Not necessarily in C.O.
- Does not cause wear
- Often not diagnosed

Amount of Tooth contact During Daytime

- Ideal – teeth come together only during swallowing and eating for brief contacts
  - Less than ½ per day
- Bruxism, clenching, or other parafuntional habits may keep teeth in contact several hours per day.

Vertical wear

- Facial/incisal wear on mandibular incisors
- Lingual notch on maxillary incisors
- No loss of vertical dimension
  - Teeth have erupted with wear

Symptoms of intolerable length

- Fractures
- Muscle pain
- Mobility
- Sensitivity

Neutral zone concept

- Concept that teeth, lips, muscle, occlusion all are in a neutral balance state with forces
- Ie. if you build out teeth, lips and muscles will push them back in.
- No scientific evidence of this
- I have not seen this clinically

Length evaluation

1. Incisal curve
2. Incisal profile
3. Phonetics
4. Function
5. Esthetics

Options to create clearance for lengthening

I. Procline maxillary incisors
II. Retract lower incisors
III. Intrude uppers
IV. Intrude lowers

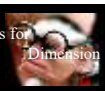
Evaluate

1. Incisal edge position
2. Gingival levels
3. Maxillary incisal inclination
4. Mandibular incisal inclination

Solutions:
Procline maxillary incisors
Retract lower incisors
Intrude uppers
Intrude lowers

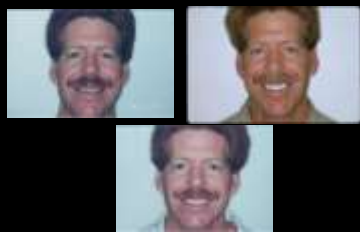
Reverse smile. Change color. Dark triangle.

Techniques for Vertical Dimension



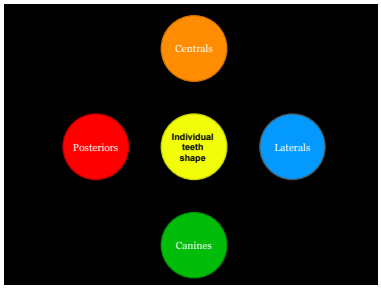
Old records	Wright
Maximum biting force	Boos
Cephalometry	Thompson
Facial measurements	Pleasure
Swallowing	Shanahan
Closest speaking space	Sliverman
Phonetics	Pound
Electromyography	George, Boone
Special gauges	Morikawa et al.
Hydraulic jacks	Morikawa, Kasei

Using temporaries as diagnostic tools



Digital imaging software

- Romexis
- Dentrix
- Vipersoft
- EagleSoft
- Digital Dentist
- Smile-Vision
  - www.smile-vision.net



Individual teeth

1. Biological element
   a. Gingival embrasures
   b. Emergence profile
   c. Cervical contours
2. Functional element
   a. Lingual/occlusal
3. The esthetic element
   a. Outline form
   b. Line angles
   c. Labial surface anatomy

Shape and Color: The Key to Successful Ceramic Restorations Ubassy, Gerald

Smile Design: A Guide for Clinician, Ceramist, and Patient Chiche, Gerard J. and Aoshima, Hitoshi

Smile Guide Dorfman, Bill

The Smile Catalog LVI

Gender and tooth shape

- No correlation
- Only perception

Burchett PJ et al. Estimating age and sex by using color, form, and alignment of anterior teeth. J Prosthet Dent 1988;59:175-9.

Perception

- Rounded form – feminine, kind, flexible
- Sharp edges- masculine, strength, aggressive

Rufenacht CR. Fundamentals of esthetics. 1990;67-134.

Face and tooth form

- In 1914 Williams proposed correlation between shape of face and central incisors
- Other studies show there may be some correlation, but it is not precise or reliable

Williams JL. A new classification of human tooth forms with special reference to a new system of artificial teeth. Dent Cosmos 1914;56:627.

Lavelle CL. The relationship between stature, skull, dental arch and tooth dimensions in different racial groups. Orthodontist 1971;3(1):7-11.

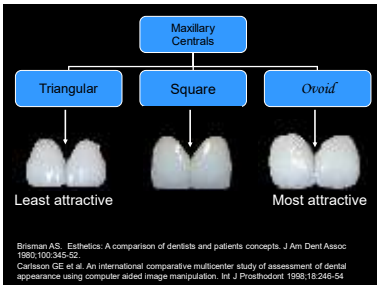
Bell RA. The geometric theory of selection of artificial teeth: is it valid? J Am Dent Assoc 1978;97-637-40.

Seluck LW et al. A biometric comparison of face shape with denture tooth form. J Oral Rehabil 1987;14:139-45.

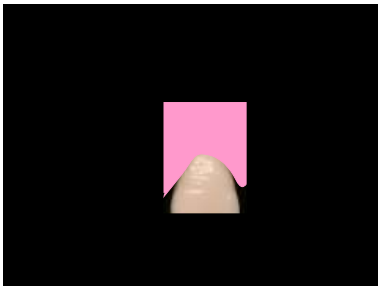
Clinical Application

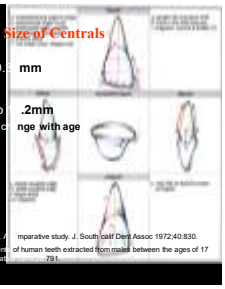
Select tooth shape based on

- Adjacent teeth
- Patient preference/esthetics
- Old photos or models
- Gingival architecture



Brisman AS. Esthetics: A comparison of dentists and patients concepts. J Am Dent Assoc 1980;100:345-52.
Carlsson GE et al. An international comparative multicenter study of assessment of dental appearance using computer aided image manipulation. Int J Prosthodont 1998;18:246-54





Size of Centrals

- Average width 8.3 to 9.[illegible] mm
- Average length 10.4 to [illegible] .2mm
  - Will have considerable c[illegible] nge with age

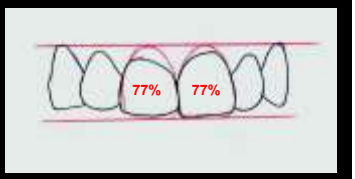
Shillingburg JrHT et al. Tooth dimensions. A[illegible] mparative study. J. South calif Dent Assoc 1972;40:830.
Bjornadal AM et al. Anatomic measurement[illegible] of human teeth extracted from males between the ages of 17 years. Oral Surg Oral Med Oral Pat[illegible] 791.

Central Proportions

- 75% width-length ratio considered "ideal" range
  - 70% narrow tooth
  - 80% wide tooth
- Gender and race factor
  - Men have larger ratio's than females

Garn SM et al. Maximum confidence values for the human mesiodistal crown dimension of human teeth. Arch Oral Biol 1968;13:841-9.
Lavelle CL. Maxillary and mandibular tooth size in different racial groups and in different occlusal categories. Am J Orthod 1972;61:29-37.
Peck S, Peck L. Selected aspects of the art and science of facial esthetics. Semin Orthod 1995;1:105-126.

Width to height ratio



Maxillary Centrals contours

1. Symmetry critical
   1. Width deviation over .3mm is noticeable
   2. Exact symmetry happens 14% of time in nature

Mavroskoufis F, Ritchie GM. Variations in size and form between left and right maxillary central incisor teeth. J Prosthet Dent 1980;43:254-257.
Garn SM, et al. Maximum confidence values for the human mesiodistal crown dimension of human teeth. Arch Oral Biol 1968;13:841-849.

Maxillary Centrals contours

1. 3 lobes, 2 concavities

Maxillary Central Profile

- At junction of middle and incisal 3rd natural thickness ranges from 2.5 to 3.3mm

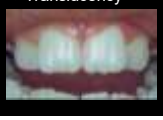
Chiche GJ, Pinault A. Replacement of deficient crowns. In: Chiche GJ, Pinault A (eds). Esthetics of Anterior Fixed Prosthodontics. Chicago: Quintessence, 1994:53-73.

Clinical application

- Limit thickness to 3.5mm as thickness will alter incisal edge position
  - Lip support
  - Phonetics

Young Central Incisors

- Longer (more visible teeth)
- Rectangular
- Irregular incisal edge
- Rounded line angles
- Translucency



Old Central Incisors

- Shorter (less visible teeth)
- Square shape
- Flat incisal edge
- Sharp angular corners

Maxillary Laterals

Considerable natural variation in size and contours

Maxillary Lateral Size

- Average crown length
  - Male-8.7mm
  - Female – 7.8mm
- Average width
  - Male – 6.6mm
  - Female – 6.1mm
- Average length to width ratio
  - Male - .76
  - Female - .79

Clinical application

- "Wild Card" tooth of smile design
  - Insufficient space
    - Alter width of one or both
    - Rotate one or both
  - Masculine or feminine
    - Alter length
    - Alter incisal embrasures
  - Should not compete with centrals for attention

Perception of Feminine Lateral Incisors

- Rounded incisal corners
- Rounded incisal edge
- Narrow gingival width
- Divergent line angles
- Smaller mesial/distal width
- Length shorter than centrals
- Tissue level lower than central

Perception of Masculine Lateral Incisors

- Sharp incisal corners
- Flat incisal edge
- Wide gingival width
- Parallel line angles
- Larger mesial/distal width
- Length equal to centrals
- Tissue level equal to centrals

Golden proportion

- Applied to dentistry in 1973 by Lombardi
- 62% reduction in visible width toward posterior
- Maxillary anterior teeth only
- Use only as guideline, not an absolute
- Only found in 17% of people

Bjorndal AM et al. Anatomic measurements of human teeth extracted from males between the ages of 17 and 21 years. Oral Surg Med Oral Pathol 1974;38:791-803.

Woelfel JB. Dental Anatomy: Its Relevance to Dentistry, ed 4 1994.

Garn SM et al. Maximum confidence values for the human mesiodistal crown dimension of human teeth. Arch Oral Biol 1968;13: 841-849.

Sanin C, Savara BS. An anaylsis of permanent mesiodistal crown size. Am J Orthod 1971;59:488-500.

Golden Proportion

1-X X

$$x/(1-x)=(1-x)/1$$

X = Shorter length = .382

1-X = Longer length = .618

Golden proportion
62% width reduction toward posterior

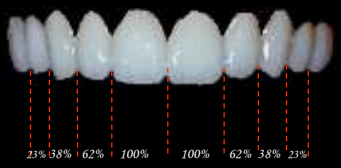
Width of central 1.0

Width of lateral .62

Width of canine .38

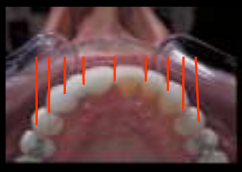
Width of 1st premolar .23

Width of 2nd premolar .14



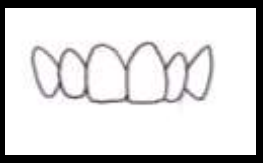
Do not use actual width for Golden proportion

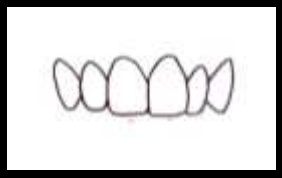
Use perception of tooth size from facial view for Golden proportion

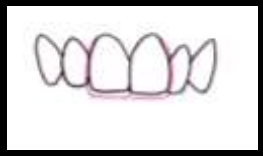


Concerns:

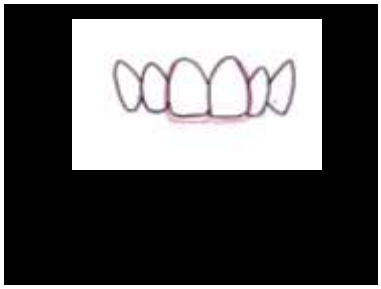
- #10 overlap and lingual tilt
- Slight reverse smile
- #9 and #11 color match

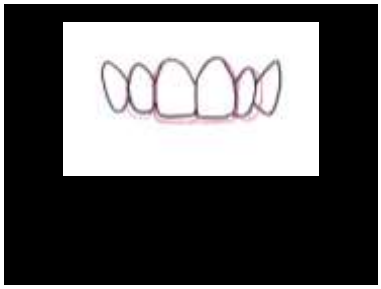


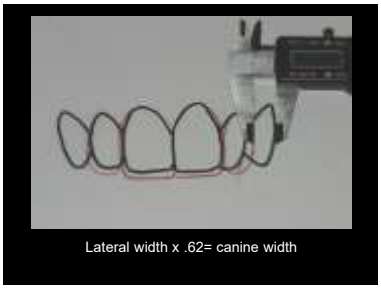




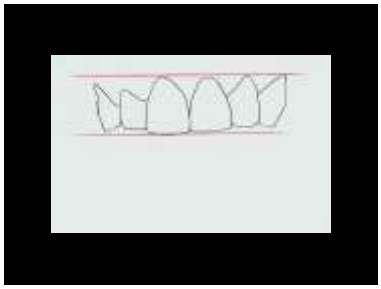
Central width x .62 = lateral width

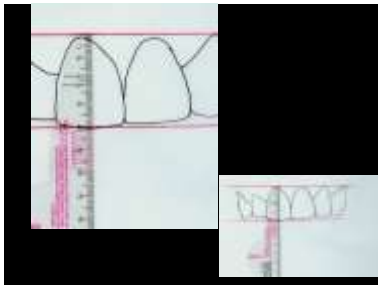


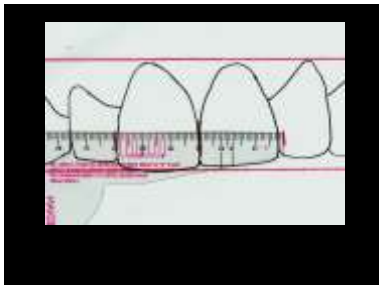


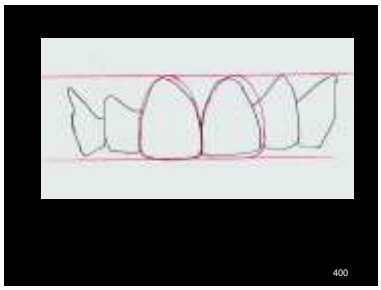


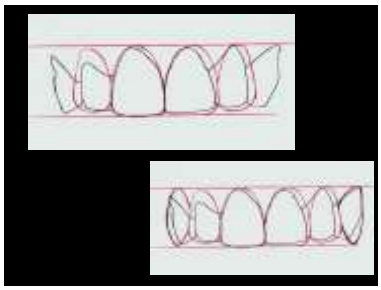
Lateral width x .62= canine width







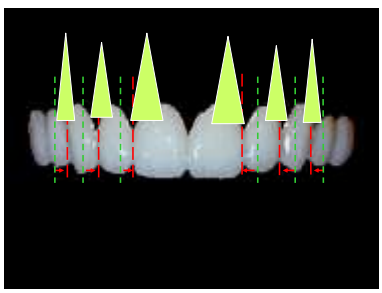




Golden proportion limitations

- Gives dominant centrals
- Only gives width of teeth, not length
- May not be clinically applicable due to arch form or root positions

Lombardi "strict application of Golden Proportions is too limiting for dentistry owing to the differences in the shade of the dental arch"



Arch Shape

- Round
- Square
- Tapered

Round arch

- Gives best proportions and smile width

Square arch

- Incisors have larger viewer area
- Limited profile view of posteriors

Height = 23.78

Width = 17.14

17.14 ÷ 23.78 = 72%

35.87 ÷ 2 = 17.95

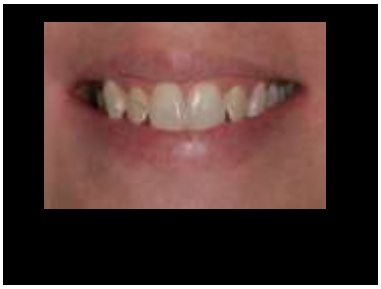
17.95 ÷ 23.78 = 75%

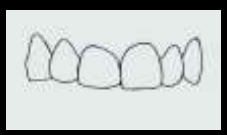
- 17.14 x .62 = 10.62
- 10.62 x .62 = 6.58

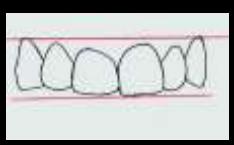
10.62 x .62 = 6.58

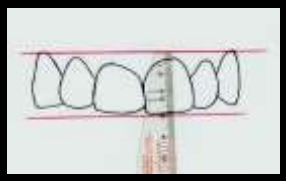
Tapered Arch

- Cannot get ideal proportions
- Narrow smile width

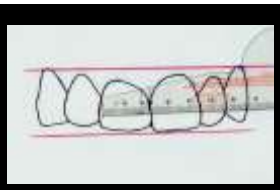






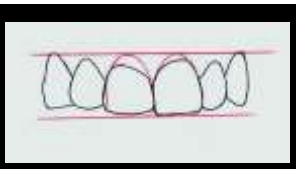


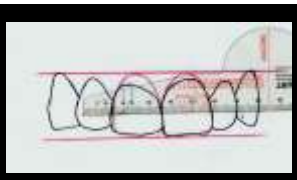
Central length = 30mm



Ideal 75% width to height ratio

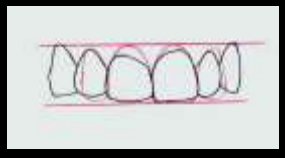
30 x .75= 22.5





Golden proportion .62 reduction in width from central to lateral

22.5 x .62 = 14mm



Ortho?

- will pt need restorations even if ortho is done?
- will it look good without ortho? crowding and diastemma
- will teeth get too weak from preparation? endo? fracture?
- can occlusion be correct without ortho?
- will the apical tissue margin work?
- are tissue levels, including papilla, in the right place?

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Ortho?

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- are tissue levels, including papilla, in the right place?

Centrals – young vs. old

Laterals – masculine vs. feminine

Canines - Personality
Aggressive vs. passive

Maxillary Canine Size

- Average length
  - Male – 10.1mm
  - Female – 8.9mm
- Average width
  - Male - 7.6mm
  - Female - 7.2mm
- Average length to width ratio
  - Male - .77
  - Female - .81

Maxillary Canines

I. Assigned task of discluding teeth in lateral movements
   I. Considerable buccolingual thickness
II. Often not aligned on horizontal planes due to mesial tilt
III. Separate anterior and posterior teeth
IV. Only mesial profile visible in straight on view
V. Larger width in females than males*

*Sterrett JD et al. Width/length ratios of normal clinical crowns of the maxillary anterior dentition in man. J Clin Periodont 1999;26:153-157.

Clinical Application

- Control smile width/buccal corridor
- If too small
  - Lack of exposure (profile view)
  - Large buccal corridor
- If too Large
  - Prominent
  - Narrow buccal corridor

Reduce prominence

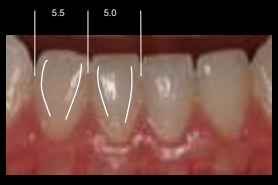
- Shadow effect to cervical, mesial and distal
  - Perceived as depth
  - Reduced length and width

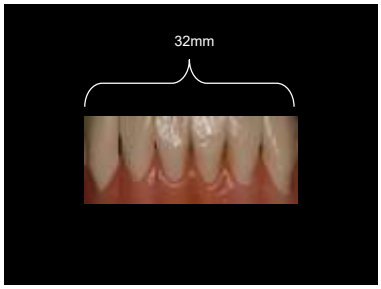
Mandibular Incisor

- Become more visible with age, especially in speech
- Central have similar mesial and distal contours
- Laterals – distal is more convex
- Laterals slightly large than centrals
  - Central width average – 5.0mm
  - Lateral width average – 5.5mm

Loosli LP, Esthetics of single tooth. Esthetic guidelines for Restorative Dentistry. 1982;27-44.

Reynolds JM. Abutment selection for fixed prosthodontics. J Prosthet Dent 1968;19;483-488.





Patient's concerns of teeth shape

- Shape of incisal edges – flat or rounded
- Difference in incisal edges – central vs. lateral
- Size of embrasure spaces

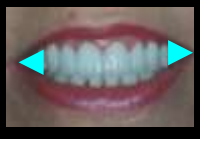
Smile width

- 23% show 8 or less teeth
- 57% show 10 teeth
- 20% show 12 or more teeth

Doug JK et all. The esthetics of the smile. Int J prosthodont 1999;12:9-19

Labial corridor

- Space between buccal wall and maxillary teeth
- Allows natural progression of smile
- Gives illusion of distance and depth



Clinical consideration

- If no labial corridor (teeth build out too much), smile looks artificial

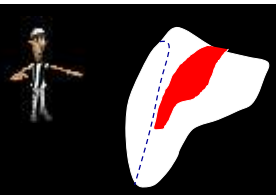
Preparation Styles

- No preparation
- Feathered incisal edge
- Incisal bevel
- Palatal overlap
- Slight incisal overlap
- Common interproximal
- Slice interproximal
- Interproximal ledge
- Subgingival
- supragingival

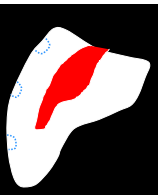
Common preparation

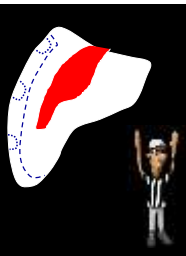
Advantages
- Conservative

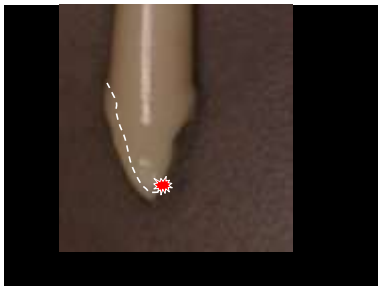
Disadvantages
- Cannot change width
- Veneer fabrication
- Temporary fabrication
  Cementation

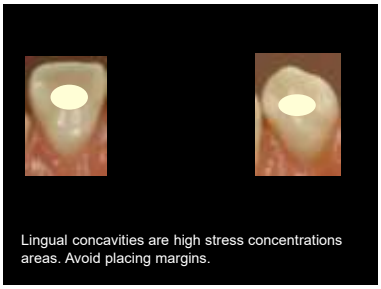


Tooth preparation without respecting facial convexity may result in irreversible pulp damage



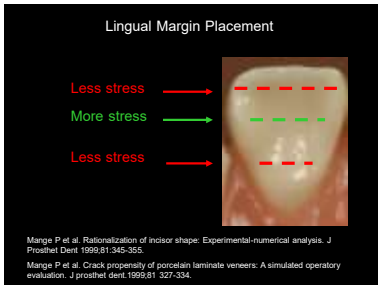






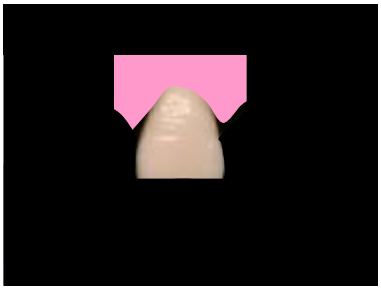
Lingual concavities are high stress concentrations areas. Avoid placing margins.

Lingual Margin Placement



Mange P et al. Rationalization of incisor shape: Experimental-numerical analysis. J Prosthet Dent 1999;81:345-355.

Mange P et al. Crack propensity of porcelain laminate veneers: A simulated operatory evaluation. J prosthet dent.1999;81 327-334.



Ceramic margin?

Chamfer

- Most resilience
- Best color transition
- facilitation scanning devices for CAD/CAM
- Easier preparation

Bichacho N. Cervical contouring concepts: Enhancing the dento-gingival complex. Pract Periodont Aesthet Dent 1996;8:241-245

Slice preparation

Advantages

- Can change width
- Lab fabrication
- Temporary fabrication
- Cementation

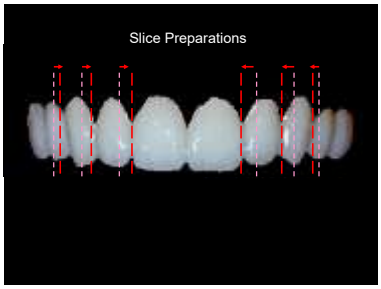
Disadvantages

- Aggressive preparation

Open Contact?

- Decay
- Old restorations
- Create room for width change
- Midline correction
- diastemmas


Traditional Preparations


Slice Preparations

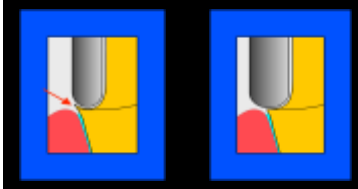
Supra-gingival Margins

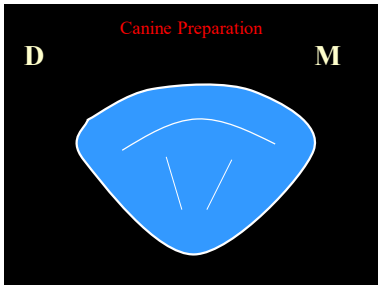
- Reduces injury to gingival tissue
  - Soft tissue model
- Margins more likely to be enamel
- Clear margins on impression
- Easier cementation (adhesion and finishing)
- Easier home care

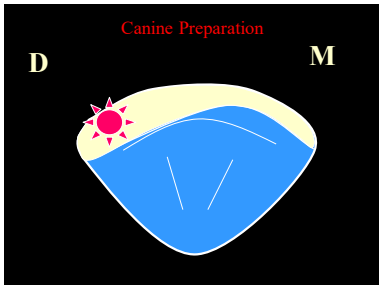
Subgingival Preparation

- Color change
- Cervical contour changes (closing spaces)

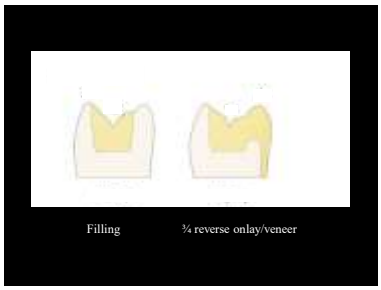
Do not create a lip on the margin




Canine Preparation
D
M


Canine Preparation
D
M


Premolar veneer preparation


Filling
¾ reverse onlay/veneer


n


Can use a variety of preps
depends on indications of case


Preps

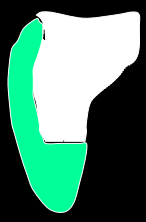
provisionals

Finals

Prep Design for pressed system

- Margin: 0.7mm shoulder
- Axial: 1.5mm
- Occlusal non-functional area: 1.5mm
- Occlusal functional area: 2.0mm
- Rounded line angles

Preparation Design











Step 1. Line up teeth with arch form

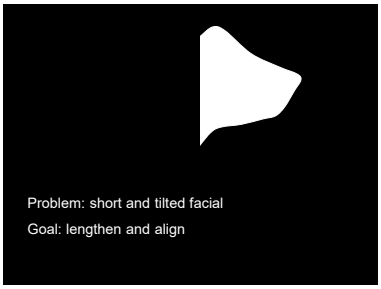
Step 2: put in depth cuts

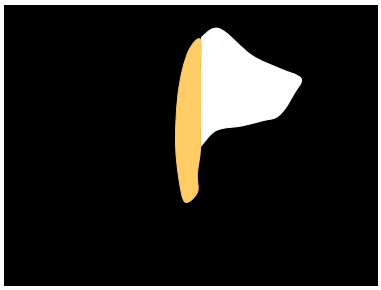
Step 3: connect the dots

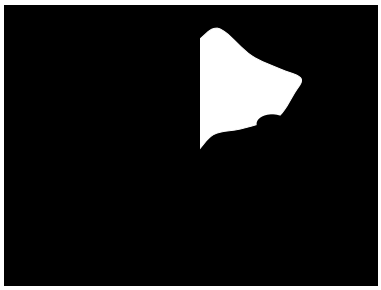
Step 4: Check with prep guide

Step 5: Smoothen preps


Concerns:
Discolored #9
Slight reverse smile
8 and 9 distal flare
#7 lingual tilt
Color
Diastemma


Problem: short and tilted facial
Goal: lengthen and align





Provisional Restorations

Acrylics
(Snap, Trim)

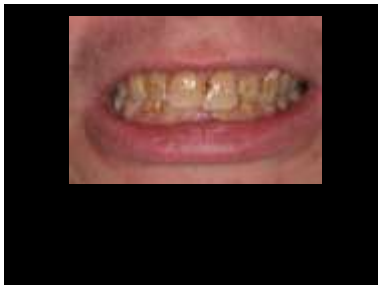
Advantages	Disadvantages
• Cheap	• Discolor
• Many shades	• Smell
• strong	• Shrinkage (10-17%)

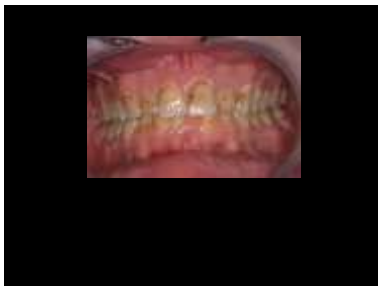
Bis-acryl composite

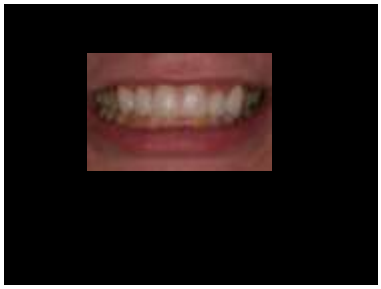
Advantages	Disadvantages
• Wear resistant	• Shades
• Color stable	• Brittle
• Minimal shrinkage	
• Good short term polish	
• No heat	
• Easy dispense	

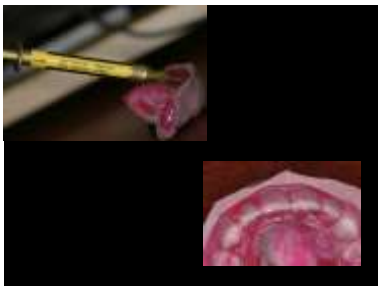
Telio CS C&B (Ivoclar)

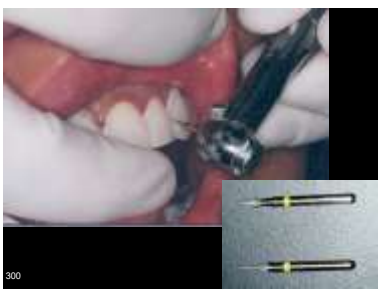
- **Advantages**
- High fracture strength
- Accurate & tension-free results
- Easy handling









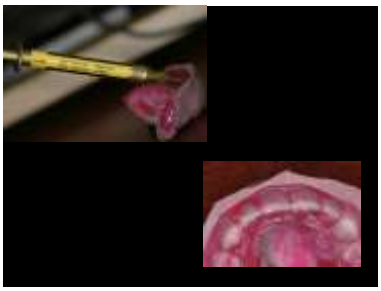

300

Resin Glaze

- Almost zero air inhibited layer
- Glaze lasts about 2 weeks
- May not cure with LED

Resin Glaze

- Bis-Cover (Bisco)
- Fuji Coat LC (GC)
- TempART GloassCoate (Sultan)
- Tempglaze (Clinician's Choice)
- LuxaGlaze (DMG/Zenith)



Stains

- Kolor+Plus (KERR)
- Tetric Color (Ivoclar)
- Creative Tints (Cosmedent)

Measure length and take model of provisional for lab communication

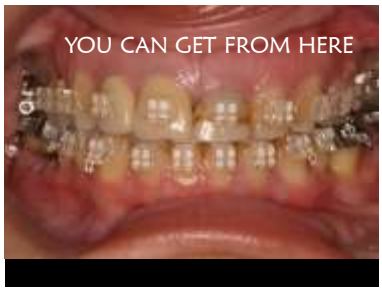
Leakage

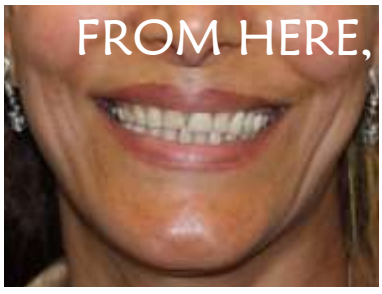
How to avoid: apply desensitizer or antibacterial prior to making temporary

Removal of Temporary

LABORATORY COMMUNICATION

FEATURING: MICHAEL DOLE
COSMETIC CERAMIST





SUGGESTED PROTOCOL FOR COSMETIC CASES

-- COMMUNICATION
-- PHOTOS
-- A GOOD BITE AND IMPRESSION
-- CLEAR, FULL ARCH IMPRESSION
-- TEMPORARY MODELS
-- PREP SHADES
-- DIGNOSTIC WAX-UP
-- STICK BITE(WITH PHOTO!!)
-- SMILE DESIGN DESIRED
-- MATERIAL SELECTION

COMMUNICATE

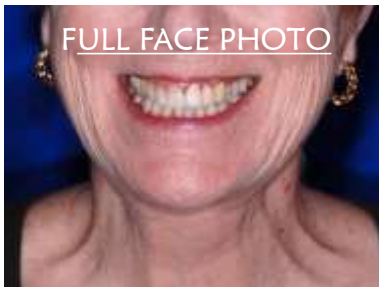
- WITH THE LAB ON ALL ASPECTS OF YOUR CASE: SMILE DESIGN TO COST, TO DELIVERY TIMES
- PICK THE RIGHT LAB/CERAMIST
- ARE YOU GIVING THE LAB ALL THE RIGHT TOOLS FOR SUCCESS?
- RX, EMAIL, OR LETTER,CALL:
  THEY ALL WORK
- REDUCE THE AMOUNT OF GUESSING
- GUEST ARTIST OF THE DAY
- PREDICTABLE RESULTS

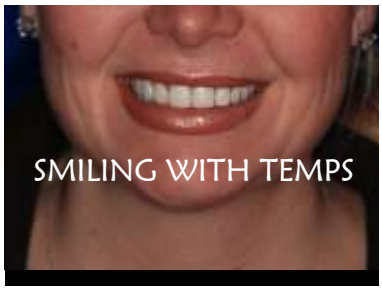
PHOTOS

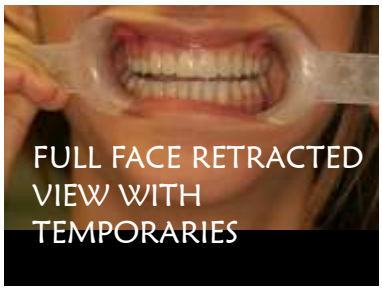
PHOTOS

FINDING THE HORIZONTAL PLANE AND MORE

- FULL FACE PHOTO
- FULL FACE WITH STICK BITE
- PREPS
- TEMPORARIES:(SMILING AND RETRACTED VIEW)
- ANY PHOTOS TO CAPTURE TRANSLUCENCY, TEXTURE, DESIRED CHROMA

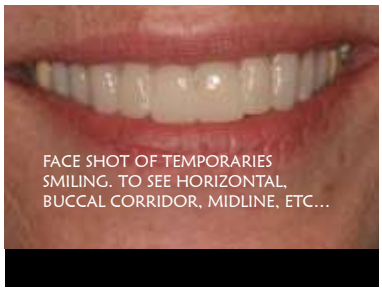






PREP SHADES

PREP SHADES


FACE SHOT OF TEMPORARIES
SMILING. TO SEE HORIZONTAL,
BUCCAL CORRIDOR, MIDLINE, ETC…

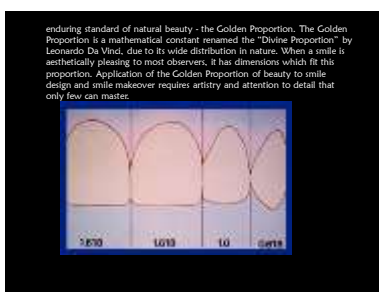

GREAT PHOTO, OF EVERYTHING, DO BLACK TRIANGLES MATTER,
IS THE SMILE UP LINE LOWER THAN GINGIVAL INTERPROXIMALS?
TELL THE CERAMIST/LAB IF IT DOES NOT MATTER

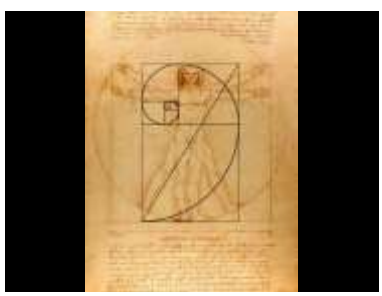

SHADE GUIDE REFERENCE
020
030

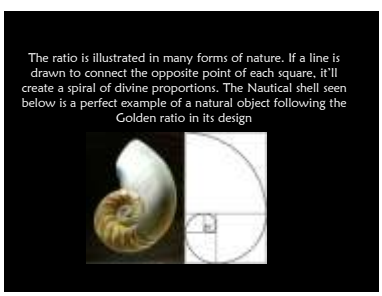

DIAGNOSTIC WAX-UP
SMILE DESIGN DESIRED
GOLDEN PROPORTIONS


DIAGNOSTIC WAX-UP


GOLDEN
PROPORTIONS


enduring standard of natural beauty - the Golden Proportion. The Golden Proportion is a mathematical constant renamed the "Divine Proportion" by Leonardo Da Vinci, due to its wide distribution in nature. When a smile is aesthetically pleasing to most observers, it has dimensions which fit this proportion. Application of the Golden Proportion of beauty to smile design and smile makeover requires artistry and attention to detail that only few can master.




The ratio is illustrated in many forms of nature. If a line is drawn to connect the opposite point of each square, it'll create a spiral of divine proportions. The Nautical shell seen below is a perfect example of a natural object following the Golden ratio in its design

GOOD IMPRESSION, OF COURSE

OPPOSSING ARCH AS WELL

- ISSUES THE LAB MUST GET CORRECT:

-FINDING THE HORIZONTAL PLANE

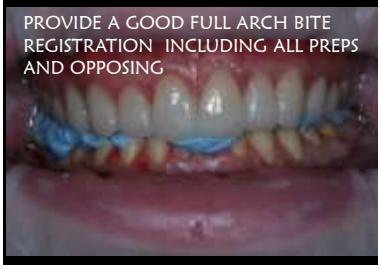
-GETTING THE BITE/MOUNTING CORRECT

SUPPLY LAB WITH GOOD BITE

GETTING THE BITE/MOUNTING CORRECT IS ESSENTIAL

- MAKE SURE BITE IS CLEAR, NOT DISTORTED
- MAKE SURE PATIENT IS IN CLOSED BITE
- INCLUDE ALL PREPS AND OPPOSING
- TAKE MORE THAN ONE, IF APPLICABLE
- NOTE BITE OPENING, IF OPENING BITE
- IF PREPPING POSTERIORS , TAKE POSTERIOR BITES, PREP TO OPPOSING

PROVIDE A GOOD FULL ARCH BITE REGISTRATION INCLUDING ALL PREPS AND OPPOSING



SEND A BITE, AND INCLUDE A STICK BITE AS WELL

STICK-BITE(WITH PHOTO)

ADDITIONAL TOOLS

- PRE-OP MODELS
- LENGTH OF CENTRALS
- SHIMBASHI MEASUREMENT
- GENDER AND AGE
- INCISAL EDGE POSITION/ BITE REGISTRATION
- ARTICULATOR PREFERENCE

TEMPORARIES/PRE-OP MODELS

TAKE A GOOD IMPRESSION OF TEMPORARIES

PRE-OP MODEL

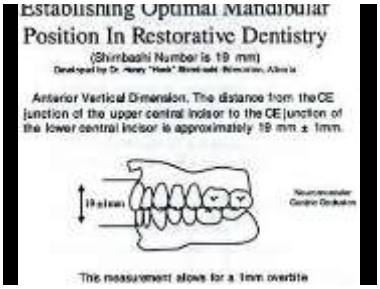
A PRE-OP MODEL GIVES CERAMIST EXTRA INFORMATION TO UTILIZE

ADDITIONAL TOOLS

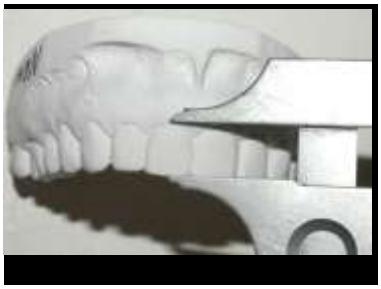
- PRE-OP MODELS
- LENGTH OF CENTRALS
- SHIMBASHI MEASUREMENT
- GENDER AND AGE
- INCISAL EDGE POSITION/ BITE REGISTRATION
- ARTICULATOR PREFERENCE

SHIMBAHSHI MEASUREMENT

- Measurement from cej to cej of oppossing tooth
- useful tool to measure the closed bite between maxillary and mandible



LINGUAL PUTTY MATRIX



INCISAL EDGE POSITION

MAKE SURE YOU PREP ENOUGH AT INCISAL TO ALLOW CERAMIST TO DESIGN PROPER INCISAL INCLINATION. ROLL IN AT INCISAL.

THESE PROTOCOLS APPLY TO SINGLE UNIT ANTERIOR RESTORATIONS AS WELL

GOOD PHOTOS, DETAILED RX, AND A COLOR MAP FOR RESTORATION ALL WORKS TOGETHER

MATERIAL SELECTION ANTERIORS

*FOR STRAIGHTFORWARD ANTERIOR COSMETIC CASES:

EMAX OR EMPRESS ARE 1ST CHIOCE

* FOR BRIDGES LARGER THAN THREE UNITS, OR LARGE FRAMEWORK CASES ZIRCONIA, AND PFM ARE STILL VIABLE OPTIONS

MATERIAL SELECTION FOR POSTERIORS

- ALL CERAMIC(EMAX)
- ZIRCONIA(NONLAYERD)
- PFM
- GOLD

THINGS TO AVOID

DO NOT TEMP CEMENT FINAL RESTORATIONS

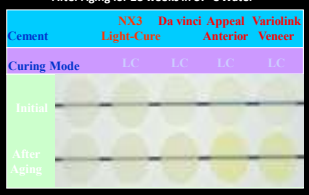
USE THE CORRECT ADHESIVE!

USE THE CORRECT ADHESIVE

- YOU WILL SEE A SHADE SHIFT WITH DUAL CURE CEMENTS(DUAL OR SELF CURE WILL WORK IN MOST POSTERIOR SITUATIONS)
- USE LIGHT CURE BASE CEMENT ONLY, WITH NO CATALYST, FOR BEST RESULTS IN ANTERIOR

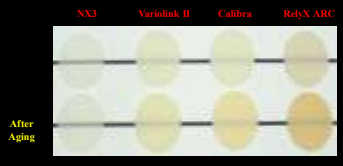
Light cured comparison of cements

After Aging for 28 weeks in 37°C Water



Comparison of dual-cure resin cements – clear shade

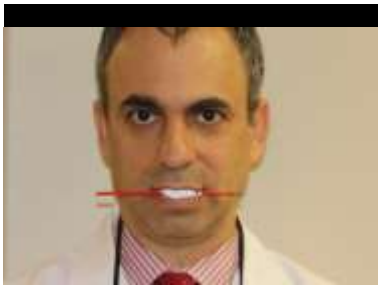
After Aging for 28 weeks in 37°C Water



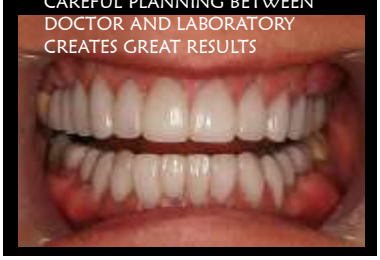
MAKE SURE YOU GET THE HORIZONTAL PLANE MIDLINE CORRECT

MANAGE PREP SHOW-THROUGH


FINISHED CASES



CAREFUL PLANNING BETWEEN DOCTOR AND LABORATORY CREATES GREAT RESULTS



YOU WON'T GET THIS KIND OF ARTISTRY/AESTHETICS WITH CAD CAM..... YET. BUT IT'S GETTING REAL CLOSE.

ANY QUESTIONS?

- MICHAEL DOLE
- 916-261-0848
- michaeldole@att.net

Intra-Oral Photography

Why Take Pictures?

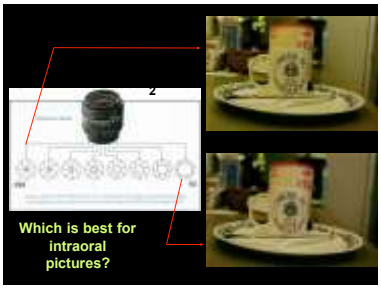
1. Diagnosis
2. Patient education
3. Legal documentation
4. Communication with lab and specialists
5. Self evaluation

Quality of photo

1. Depth of field
2. Flash
3. Resolution
4. Correct angles

Depth of field (how much is in focus)?

- The "f-stop" (Aperture) = how much the iris opens
- Big opening = Small "f-stop"
- Small "f-stop" = Small focal range



Which is best for intraoral pictures?

Depth of field

Turn off auto focus. Focus between lateral and canine

Ring vs. Point flash

- Ring flash = No shadows. Recommended for most intra-oral applications.
- Point flash = Shadows. Recommended when showing depth and size (gingival contours, thickness of restoration, etc)

Print Resolution

- 5x7 print = 2MP looks great
- 5x7 print = 3MP looks perfect
- Higher than 3MP for
  - Publication
  - Large prints

Screen resolution

- iPhone 5 0.7MP
- HD TV or monitor 2MP
- iPad Retina Display 3MP
- 4K TV 8MP

Dental photography resources

- Photomed Photomed.net 800 998-7765
- Lester Dine dinecorp.com 800 624-9103

12 Standard Shots For Cosmetic Cases

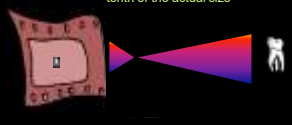
1. Portrait
2. Full smile
3. Right side smiling
4. Left side smiling
5. Retracted full smile
6. Retracted Right
7. Retracted Left
8. Close up #8 & #9
9. Close up #7
10. Close up #10
11. Upper occlusal
12. Lower occlusal

Lens Magnification

(Portrait Shots)

1:10

Image on film is a tenth of the actual size



Portrait

- Point flash
- Auto settings
- Auto focus
- 1:10 Magnification
- Make sure head is level

Lens Magnification

(Occlusal, full smile and side shots)

1:2

Image on film is half life-size

Full Smile

- Point or ring flash
- 1:2 Magnification
- Patient seated completely horizontal

Full Retracted

- 1:2 Magnification
- Slightly open – shows translucency and incisal edge

Wrong angles

Upper/Lower Occlusal

Magnification at 1:2
Keep mirror out of picture
(may have to go a little less than 1:2)
Auto focus off, point or ring flash
Patient should be laying horizonally

Upper

Lower

Defog mirrors

- warm them up in hot water
- Blow air
- defog solutions

Lens Magnification (Close up shots)

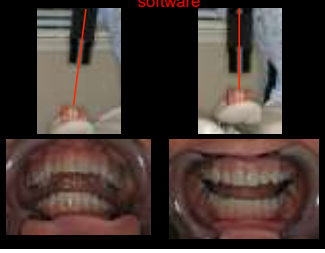
1:1

Image on film is actual size

Close up of Teeth #8 & #9

- 1:1 Magnification
- Patient is lying completely horizontal

Cannot correct pour angulation with software



Can correct tilt with software

END

Color

Science Vs. Art

Science

- Physics
- Lighting
- Background
- Individual definition

Art

Reason for sending case back to lab

- 1. color off
  - too light
  - too dark
  - "slightly more yellow than A2"
  - 2. open margins
  - 3. open contact

Individual color definitions

Green
Grassy green
Pale green
Emerald green
Sage green
Dark green
Light green

predictable results

- Using only Vita shade guide: 17% of anterior restorations need require shade modification
  - significant wasted chair time
  - pt confidence

- Hassel AJ, Koke U, et al. Clinical effects of different shade guide systems on the tooth shades of ceramic veneered restorations. INt J prosthodont 2005;18(5):422-6.

Light factors

- too bright or too dark is a problem
- Intensity
  - Affects pupils diameter
  - fovea
    - Accurate color matching only at center of retina
    - High concentration of cone cells
  - 1600 to 2100 LUX (150 to 200 foot candles)

Color correct light

- Clear bright day = 5,500 K
- D_{50} illuminating light
- Can use color temperature meter to check

Name	CRI	Temp	Intensity	Cost
Chroma 50 (GE)	92	5000K	1930	5.95
Daylight Deluxe (Westinghouse)	84	6500K	1990	3.80
Industrial Vision (Western)	91	5500K	1900	15.90

Demetron Shade Light (sds/KERR)

- 6500K
- Cordless light
- Hold 2 inches from patient
- Wait 30 seconds prior to use
- $525

Shade selection considerations
(in this order)

1. Size
2. Position
3. Value
4. Hue
5. Chroma

Size

The larger the object, the whiter the object appears
- More surface area
- More reflection

The smaller the object, the darker the object appears
- Less surface area
- Less reflection

Position

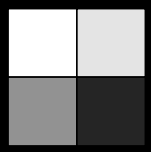
- More forward, appears larger and whiter
- Further back, appears smaller and darker

Color

- Hue – color
  - Eg. yellow, brown, green
- Chroma – saturation level
  - Eg. light yellow, dark yellow
- Value – Quantity of gray present: brightness
  - Eg. High, low

Value

- Value is affected by surrounding contrast
  - Darker surrounding, brighter appearing object
  - Lighter surrounding, darker appearing object



Clinical significance

- Error toward value of surrounding teeth and tissue
  - Low value if dentition is dark
  - High value if dentition is light

Hue consideration

- objects take on color complementary to background
  - Blue background, orange appearing object
  - Yellow background, violet appearing object
  - Red background, green appearing object

Clinical Use

- Use neutral gray (18%) background card
  - Reduces background colors
  - Improves perception
  - hue and chroma easier to distinguish
  - less afterimage effect

Chroma

- Low chroma surrounding, more intense object
- High chroma surrounding, less intense object

Opalescence

- Object appears blue in reflected light
- Object appears red-orange in transmitted light

Fluorescence

- Emit visible light when exposed to ultraviolet light
- Dentin is fluorescent
- Adds to natural appearance of restorations
  - Reduces metamerism

Metamerism

- Object appearing different color under different light (fluorescent vs. color correct)
- Examples
  - Pants and jacket
  - Teeth and crown
  - Zirconium vs. pressed porcelain

Gloss

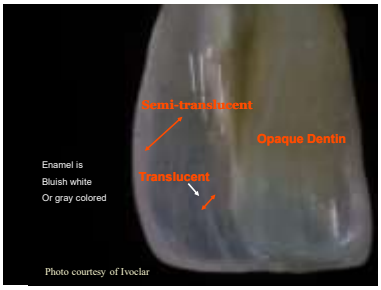
- Level of shine

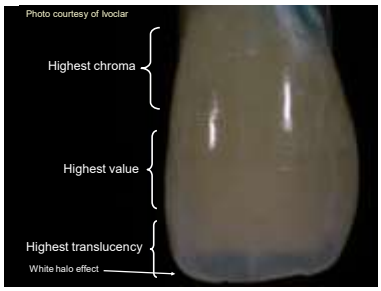
Translucency

amount of translucency vs opacity.

- Factors
  - Thickness of enamel
  - Saturation of dentin

  - areas of high translucency.
    - Incisal edge
      - Over-bleached teeth





Young teeth

- Increased translucency
- High value
  - Light colored dentin
  - thickness of enamel

Aged teeth

- Incisal and facial thinning of enamel
- Reduction in tooth volume
- Increased hue and chroma, lower value

Color

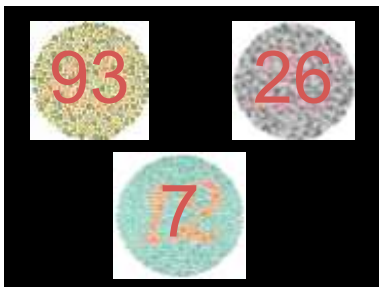
- Maxillary teeth lighter than mandibular
- Incisors lightest in arch
- Laterals have less hue than centrals
  - Centrals appear as lightest tooth
- Canine have increased chroma

Viewer associated effects

- Color blindness
- Age
- Fatigue
- Nutrition
- Emotions
- Medications
- Binocular differences

Color blindness

- Trouble seeing red, blue or green
- 10% of males
- 0.3% of females
- Due to lack of pigments in cones



Nutrition

- High intake of saturated fats causes degeneration of center of retina
- Health of eye increased by
  - Fresh fruits
  - Dark green, leafy vegetables
  - Vitamin C
  - Vitamin E
  - Zinc
  - Lutein

Fatigue

- Most common cause of incorrect shade matching
- Eye, body, or mental
- Best hue and chroma in first 7 seconds of evaluation

After image from fatigue

- Positive afterimage
  - Same color as original image
  - After short viewing of color
- Negative afterimage
  - Opposite or complementary to original image
  - After prolonged viewing of color
  - Due to depletion of neurotransmitter in cones

Age

- Vision becomes yellowed with age
- Starts at age 30
- Clinical noticeable after age 50
- Above age 60 perception of blue and purple decreases

Alcohol

- Red/orange/yellow appear lighter
- Blue/green/purple appear darker

Caffeine

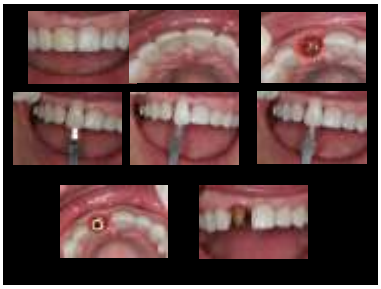
- Red/orange/yellow appear darker
- Blue/green/purple appear lighter

Medications

- Can causes a blue tint
- Can make it difficult to distinguish blue and green

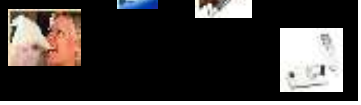
Protocol

1. Take shade at beginning of appointment.
2. Clean teeth. Polish with pumice if necessary
3. Use new and correct shade guide for material
4. Correct light
5. Remove lipstick and makeup, place neutral color bib
6. Evaluate translucency/opacity
7. View 7 second at a time to minimize eye fatigue
8. Value
9. Chroma
10. Hue
11. Take photographs with correct shade tabs
12. Use same restorative material

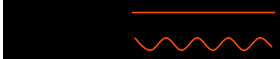


Electronic shade matching

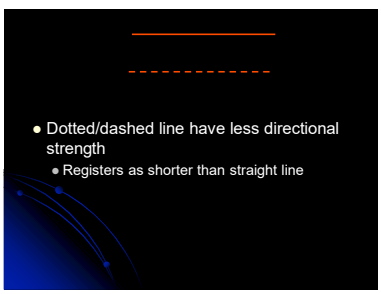
- Hit or miss per case
- Good for body shades



- Horizontal straight lines require simple movement of the eye.
  - Eye rapidly registers
  - Eye does not focus



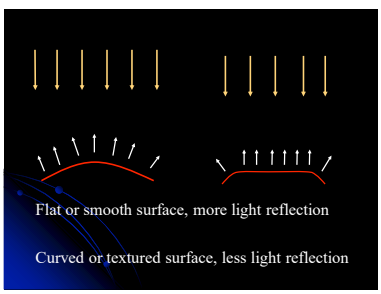
- Undulated line requires eye to move up and down
  - Eye must focuses
  - Takes time to evaluate characteristics
  - Generates esthetic appeal



- Dotted/dashed line have less directional strength
  - Registers as shorter than straight line

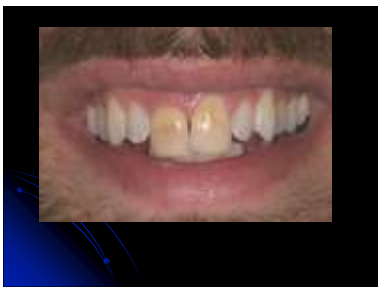
Line Angles

- Reflective - light come back
- Deflective - light goes away
- Larger reflective area - tooth appears larger
- Smaller reflective area - tooth appears smaller
- Distal incisal line angles should turn inward



Flat or smooth surface, more light reflection

Curved or textured surface, less light reflection



Altering perception – Widening

- Move line angles out
- Decrease embrasures (sharpens tooth)
- Move proximal contacts facial
- Flatten facial surface
- Horizontal lines and ridges
- Whiter than other teeth

Altering perception - Narrowing

- Move line angles toward middle
- increase facial embrasures
- Move proximal contacts lingually
- Textured surface
- Vertical lines and texture

Altering perception - Lengthening

- Flatten cervical convexity (height of contour)
- No facial planes
- Vertical texture and lines
- make tooth whither than other teeth

Altering perception - Shortening

- Prominent cervical convexity
- Horizontal texture and lines
- Convexity of cervical third
- Lingual tilt of incisal third
- Define 3 facial surfaces

Surface texture

- More - teeth appear smaller
- Less - teeth appear larger

Porcelain Systems

Ceramic Fundamentals

- Union of metallic and non-metallic element
- Most are oxides with metals and semi-metal (eg. Aluminum, silicon, magnesium)
- Have high melting points (1100 to 1700 C)
- Low thermal and electrical conductivity
- Concrete, glass, crystals, and gypsum are all ceramics

Ceramic Fundamentals

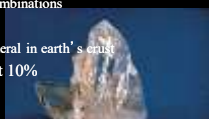
- Structure may be crystalline or non crystalline
  - Crystalline
    - regular arrangement of atoms in lattice pattern
    - Light and brittle
    - Eg. Quartz
  - Non crystalline
    - Amorphous in structure
    - Stronger and denser
    - Eg. Granite

Porcelain Fundamentals

- Is a type of ceramic
- Appears luminous and internally lit
- First discovered by T' ang Dynasty (618-907A.D.)
- Rediscovered by German alchemist Bottger in 1710
- First used in dentures by Fauchard in 1723
- First PFM in 1885 by Logan
- Widespread use of PFM by 1958
- All Porcelain restoration popularized by McLean in 1960' s

Porcelain Composition

- Feldspar about 65%
  - Rock forming minerals
  - Constitute 60% of earths crust
  - Has aluminum, sodium, potassium, iron calcium, barium combinations
- Quartz about 25%
  - Most abundant mineral in earth' s crust
- Metal Oxides about 10%



Added components

- Sodium oxide and alkaline earth oxides
  - Increase translucency
- Fluxing agents
  - Lower melting temperatures
- Potassium oxide
  - Improves thermal expansion
- Leucite
  - Increases fracture strength

Synthetic porcelains

- No impurities
- Homogenous consistency
- Fluorescence, opalescence and translucency nearly identical to natural dentition
- Smooth surface
- Low firing temperature about 870C
- Can be cooled faster
- Color does not alter with multiple firing

Bonding

- Use of micromechanical adhesion for retention, resistance, and strengthening of crown.
- Minimum 2mm of circumferential tooth structure.
- Better esthetics

Bonded Systems

- Feldspathic
- Leucite reinforced pressed
- Lithium disilicate

Luting

- Use of macromechanical geometric forms for retention and resistance.
- Strength is inherent to crown
- Minimum 3.5mm of circumferential tooth structure and 10% taper.
- Better color masking

Luted systems

- Gold
- PFM
- Zirconium (ie. LAVA)
- Lithium disilicate (ie. E.max)

Traditional Feldspathic

- Layered technique
- Minimum thickness .3mm
- 1mm bar strength of 55Mpa

Traditional Feldspathic

Advantages
- Color masking
- Esthetics
- Easy to fabricate
- Technician familiarity
- Can have opaque or translucent area
- Cervical reduction .3

Disadvantages
- Relatively weak
- Must be bonded
- Strength at 2mm

Feldspathic porcelains

- Creation (Jensen)
- Duceram Plus (Degussa)
- Omega 900 (Vident)
- HeraCeram (Kulzer)
- IPS D. Sign (Ivoclar)
- Ceramco 2 (Dentsply)
- Cerinate (DenMat)

HeraCeram (Kulzer)

- Can be applied to metals
- Fully synthetic
- Can be applied to pressed core
- Can be used alone
- Excellent for combination cases
  - Veneers, crowns, bridges.

Omega 900 (Vita)

- Low wear of opposing teeth
- Easily polished chairside
- Matches vita shade system
- Indications
  - PFM crown and bridge
  - Veneer, inlay, onlay, anterior crown
  - Cannot be placed over ceramic core

Creation (Jensen)

- Best esthetics of any porcelain system
- Dentin has high chorma
  - Maintain value, increase vitality and depth
- Indications
  - PFM' s
  - Veneers, inlay, onlay, anterior crown
- Does not match vita shade system

Finesse (Dentsply/Ceramco)

- Inlay/onlay, crowns, veneers
- Low fusing porcelain

IPS d.Sign (Ivoclar)

- Excellent translucency
- Low wear of opposing
- Indications
  - PFM's
  - Veneers, inlay, onlay, anterior crowns
- Technique sensitive fabrication.

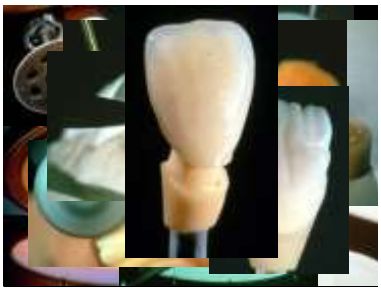
Leucite reinforced Pressed feldspathic

- Leucite reinforced
- Reduction minimum .5mm
- Moderate masking capability
- Strong up to 4mm
- 1mm bar strength 125-155Mpa

Pressed

Advantages
- Excellent esthetics
- Excellent fit
- Wear
- Some can to pressed to metal

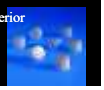
Disadvantages
- Fabrication technique
- Color masking
- Must be bonded
- One homogenous layer of opacity
- Cervical reduction .5
- Over-preparation



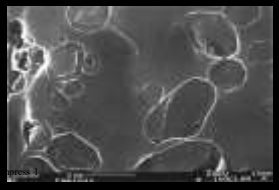
Core strength

Empress (Ivoclar)

- Inlay, onlay, anterior crowns, veneers
- Created in 1983 at Univeristy of Zurich
- Pressed ceramic, Leucite reinforced
- The standard for esthetics
- 15 year track record
- 2 new ingots allow .5mm veneers
- 11 ingots
- 98.92% success rate at 11 years for anterior crowns



Fradeani M, Redemagni M. An 11-year clinical evaluation of leucite-reinforced glass-ceramic crowns: a retrospective study. Quintessence Int. 2002;33:503–10.



OPC (Jeneric Pentron)

- Optimal Pressed Ceramic
- Inlay, onlay, crowns, veneers
- Pressed ceramic with leucite crystals
- Stronger than Empress
- Kind to opposing

Authentic (Microstar)

- The "do it all" pressable
  - *Stained veneer, layered veneer, inlay, onlay, full crown,*
  - *pressed to metal for crown or bridge, inlay bridges, maryland bridges*
  - *'Encapsulate/embed' metal*
- Can be used as PFM
- Large ingot selection - 56!

Moderate strength porcelains

- IPS e.max (Ivoclar)
- In-ceram Spinell (vita/vident)
- OPC 3G (Pentron)

IPS e.max CAD/CAM (Ivoclar)

- Monolithic Lithium disilicate
- Good esthetics with stain/glaze technique
- Indications
  - 3 unit anterior bridge
  - crowns
  - Inlays, onlays
  - veneers

IPS e.max Press (Ivoclar)

- Lithium disilicate substructure or monolithic
- Great esthetics if multi-ingot used without staining
- Excellent esthtics with layered technique
- • Better fit than CAD/CAM version
- 10% stronger than CAD/CAM
- Indications
  - Crowns
  - Anterior 3 unit bridge
  - Single implant
  - Veneers –Inlay/onlays

In-Ceram Spinell (Vita/Vident)

- Magnesium oxide and alumina core
- Translucent
- Anterior crown and bridge
- Must be bonded

OPC 3G (Pentron)

- Interlocking lithium disilicate
- 3 times strenght of OPC
- Indications
  - Veneers, inlay, onlay, anterior crown and bridge (1 pontic)
- Can be luted, best to bond

High strength ceramics

- Zirconia based
  - Improved light transmission
  - Still have high value
  - High fracture rates if layered for esthetics
  - Mainly used a monolithic restoration

Monolithic Zirconium

- Very strong
- Acceptable esthetics for posterior restorations
- Preps can be minimal .5-.75mm, similar to cast metal.
- Low wear of opposing
- Can be used for bridge
- Difficult to adjust and polish
- Difficult to remove

Bruxzir (Glidewell lab)

- Can be shaded and translucent
- Full arch

Hammer Time

Lava plus (3M)

- Very strong
- 18 vita shades and 8 effects stains
- Relatively translucent

Katana (Kuraray)

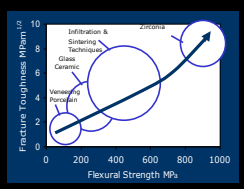
- Up to 98mm diameter disc
- Pre-colored
- Translucency

Other zirconium systems

- Procera (nobel)
- Prettau (Zircozahn)
- Cercon (dentsply)
- Everest (Kavo)
- IPS zir cad (ivoclar)

Monolithic Zirconium Summary

Strength – very high
Esthetics – good
Cementation – any
Longevity – good
Units –single or bridges
Removal - difficult



Masking ability

Translucent

Opaque

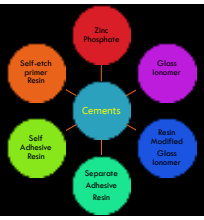
Feldspathic (fired)
Feldspathic (pressed)
Lithium disilicate
Zirconium
PFM

My Preferences for all ceramic in order

Second Molar	First molar	Premolars	Anteriors
All Zirconium	e.max	e.max	e.max
e.max	All zirconium	empress	empress
	Layered zirconium	Layered zirconium	Layered zirconium

CEMENTS

Dino S. Javaheri DDS



Zinc Phosphate

Advantages	Disadvantages
Low Cost	No Adhesion Post-op sensitivity Soluble

Zinc Phosphate indications

- Metal posts with adequate retention
  - Can be easily removed with cavitron

Glass Ionomer

- Polyalkenoic acid and a glass component
- Acid base reaction
- Self etching weak bond
- Fluoride release

Glass Ionomer

Advantages	Disadvantages
Adhesion High retention rate Moderate strength Fluoride release Easy to use	Brittle Soluble Expansion Post-operative sensitivity

Glass Ionomer Indications

- Gold
- PFM
- Zirconium (ie. Lava, Procera Z)

Resin Modified Glass Ionomer

- 20% resin, 80% glass ionomer
- Acid base reaction with self or dual cure resin
- Self etching moderate bond
- Limited fluoride release
- Most used cement (60%)

Resin Modified Glass Ionomer

Advantages	Disadvantages
Very low Solubility Adhesion High retention rate Moderate to high strength Some fluoride release Easy to use Cost $6 per crown	Expansion ~ 5% Color change Desensitizers lower bond strength

GC FujiCEM 2 (GC America)

- Automix
- Film thickness – 19 microns
- Low compressive strength (89)
- 4.5 minute set time

Nexus RMGI (KERR)

- Tack cure: 2-3 seconds
- Easy cleanup. Gel state is achieved when cement reaches rubbery consistency
- Set time, self cure: 4.5 minutes
- Working time: 1.5 minutes

RelyX Luting Plus Cement (3M)

- Film thickness – 31 microns
- Hand mix or auto mix
- Low compressive strength (121)

Resin Modified Glass Ionomer Indications

- Gold
- PFM
- Zirconium (Lava, Procera Z)

Resin Cements

Separate Adhesive	Self etch included	Self-adhesive
• Use total etch or self etch adhesive • Basically a flowable composite	• Has own separate self etching primer to be applied prior to cement	• Cement matrix itself is self-etching. • No adhesive needed



Self Adhesive Resin Cements

Advantages	Disadvantages
• High strength • Adhesion • Easy to use • Self or dual cure • No solubility	• Color change • Weak bond to dentin • High cost ($8-12 per crown) • No fluoride release

Rely X Uni-Cem 2 (3M/ESPE)

- 3 shades
- 6 month self life out of pouch
- Self cure mode very slow - 10 min from mix
- No longer requires refrigeration
- Most popular of group – used by 34%

Maxcem Elite Chroma (KERR)

- Dual cure
- 5 shades
- Color cleanup indicator
- Easy clean up

Panavia SA Cement Plus (Kuraray)

- 3 colors
- On stronger side for bond to dentin

To increase bond with self adhesive

- Use a dual cure adhesive with cement
- Retentive preps with pits and slots
- Light cure cement

Other Self Adhesive Resin Cements

- Breeze (Pentron)
- Embrace WetBond (Pulpdent)
- G-Cem (GC America)
- Monocem (Shofu)
- Multilink Sprint (Ivoclar)

Self Adhesive Resin Indications

- Zirconium (Lava, Procera Z)
- Alumina (Wol-ceram, Procera)
- Posterior pressed crowns
- Porcelain inlay or onlay

Included self-Etch Primer Resin Cements

Advantages	Disadvantages
High strength	High cost ($11-15 per crown)
Best adhesion to dentin	Some technique sensitivity
Low chance of post-op sensitivity	Most change color
Self and dual cure	No fluoride release
No solubility	

- dual-cure
- color-stable
- fluoride-releasing
- single-bottle universal restoration primer.
- Very strong bond
- Limited working time. Sets up fast
- Clean up difficult
- Has try-in paste

PANAVIA V5

Multilink Automix Next Generation (Ivoclar)

- 5 shades (white and medium translucency is new)
- Dual cure
- Requires refrigeration
- Easier clean up than before
- Must light cure after clean-up
- Color change

Rely-x Ultimate (3M)

- Similar to uni-cem 2
- Dual cure
- Easy to use
- Uses scotchbond universal adhesive

Nexus XTR (KERR)

- Two great products in one package
- 5 shades

Other included self-etch resin cements

- C&B Meta bond (Parkell)
- Duo-link SE (Bisco)
- Bistitie 2 DC (Tokuyama)

Included self-Etch Resin cement Indications

- Zirconium (Lava, Procera Z)
- Alumina (Wol-ceram, Procera)
- Posterior pressed crowns
- Porcelain inlay or onlay

Separate total-etch Adhesive Resin Cements

Advantages	Disadvantages
High strength	Technique sensitivity
Strong adhesion	High chance of post-op sensitivity
Light and dual cure	
No solubility	

Separate Self-Etch Adhesive Resin Cements

Advantages	Disadvantages
High strength	Adhesive specific
Low chance of post-op sensitivity	May have weaker bond to enamel
Light and dual cure	
No solubility	

Variolink esthetic (Ivoclar)

- Heavy bodied
- Seven shades
- Value based
- Try in paste match and hand

Accolade PV (Danville Materials)

- Good handling
- Try-in paste is composite without initiator
- 6 shades

Da Vinci (Cosmedent)

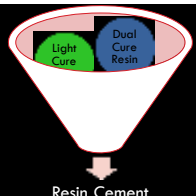
- 4 shades
  - Bright, brighter, brightest, ludicrous bright
- Good for the very white cases
- Value based system

Rely-X Veneer Cement (3M/ESPE)

- Light cure only
- Great handling of cement
- Heavy bodied try-in paste

NX3 Nexus Third Generation (KERR)

- Dual-cure & light-cure cements both color stable
- One set of try-in gels



Self Cure Resin Cements

- Minimal working time
- Not color stable
- Post, crown, inlay, onlay, Zirconium, metal
  - Panavia 21 (Kuraray)
  - C&B Meta bond (Parkell)
  - C&B Cement Luting (Bisco)

Dual Cure Resin Cements

- Cures by both light and chemical activation
- Limited working time
- Most not color stable
- crown, inlay, onlay, Zirconium, metal
  - Panavia F (Kuraray)
  - Uni-cem (3M/ESPE)
  - Variolink 2(Ivoclar)
  - Calibra (Denstply)
  - NX3 (KERR)
  - Duo-Link (Bisco)
  - Cement-it (Pentron)
  - Clearfil Esthetic cement (Kuraray)

Light Cure Resin Cements

- Most color stable
- Most working time
- Need powerful light
  - Rely-x veneer
  - Variolink
  - NX3
  - Da vinci
  - Or some flowable composites

Adhesive

Objectives of Adhesion

- Reduction in preparation size
- Protection from microbial leakage
- Elimination of post-operative sensitivity
- Provide a mechanism for restoratitive material to bond to the tooth.

Bonding Protocols

- Total etch and bonding
- Self-etching bonding

Total Etch (etch and rinse) and Bonding

- All enamel and dentin etched with phosphoric acid
- All enamel and dentin bonded
- Most common technique
- Most predictable bond to enamel.
  - Perifiral seal is key to lifespan of restoration
- Can be used for all procedures

Total Etch

- Etch enamel and dentin
- De-mineralizes surface
- Remove smear layer
- 30-40% phosphoric acid
  - 10% too weak for enamel
- 15-30 seconds Enamel, 10 seconds Dentin

Enamel

- 95% inorganic material by weight (86% by volume)
- 4% water by weight (12% by volume)
- 1% organic matrix by weight (2% by volume)
- High fluoride concentration in superficial 50μm
- 1 ½ to 2mm thick

Enamel

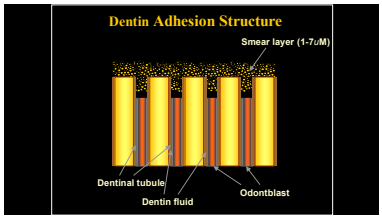
- Will get better bond if surface 50μm is removed
  - Fluoroapatite is more resistant to etch
  - Biofilm consisting of glycopolysccharides from salvia

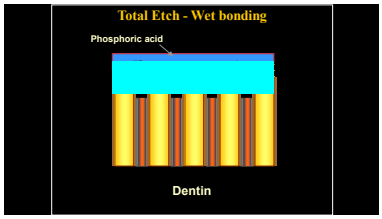
Dentin

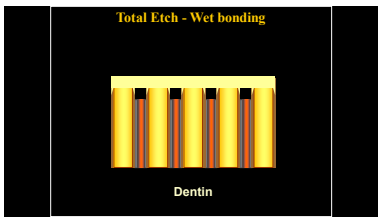
- 70 % inorganic material by weight (45% by volume)
- 10 % water by weight (25% by volume)
- 20% organic matrix by weight (30% by volume)
- Pulpal pressure of 30cm H_2O pushes fluid out of tubuli

Cementum

- 61% inorganic material by weight (33% by volume)
- 12% water by weight (36% by volume)
- 27% organic matrix by weight (31% by volume)



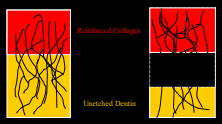


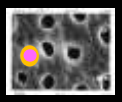


Loss of smear Layer

- Opens microchannels
- Bacteria, adhesives, by-products go down dentinal tubuli

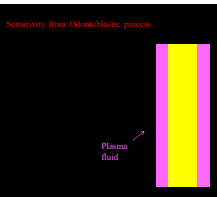
Etching with Phosphoric acid





Peritubular dentin –highly mineralized.

Dentinal tubules – contain plasma fluid and odontoblastic process.



Sodium Hypochlorite

- Dissolves collapsed collagen fibrils that prevent primer infiltration
- Conflicting data on how bond strengths are effected

Etchants

Selection criteria should be consistency/handling you feel comfortable

Two etchants have antibacterial included

Etchant

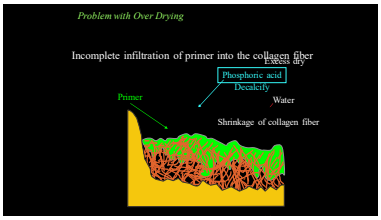
- Ultra Etch (ultradent)
- Uni-etch (bisco)
- Gel Etchant (KERR)
- Etching gel mini tip (3M)
- Scotchbond etchant (3M)
- Enamel Etch (cosmedent)
- Etch 37 (bisco)

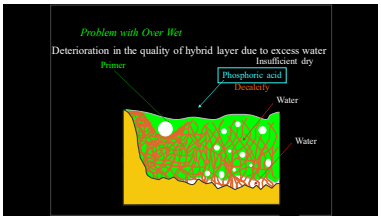
Ultra-etch (ultradent)

- Best handling/viscosity
- Easy to rinse
- Great visibility
- Has anti-bactrial option

Uni-Etch (Bisco)

- No silica, rinses cleaner
- Has anti-bacterial option

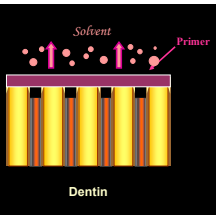




Preparation surface

Primer

- Wetting agent
  - HEMA, PENTA, BPDM
- Hydrophilic resin in a solvent
  - Acetone, ethanol, or water
- Seek moisture
- Seal tubules
- Micro-mechanical bond to hybrid zone



Acetone Vs. Alcohol Solvent

Acetone	Alcohol
More technique sensitive	Less technique sensitive
Seeks moister quicker	Seeks moister slower
Evaporates quicker	Evaporates slower
1 day if left uncapped	7 days if left uncapped
About 1 min working time	About 3 min working time

Primer

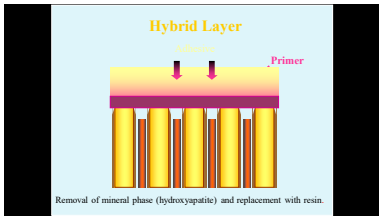
- Shake bottle, stir uni-dose
- Date bottle
- Multiple layers
- 20 seconds/layer
- Agitate
- Air dry

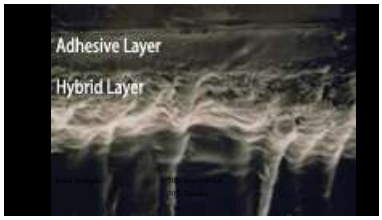
Photo courtesy of 3M/ESPE

Air Dry options

Dentin Bonding Resin

- Unfilled or lightly filled
  - 2/3 BIS-GMA or other methacrylate, 1/3 Primer
- Hydrophobic
- One thin layer

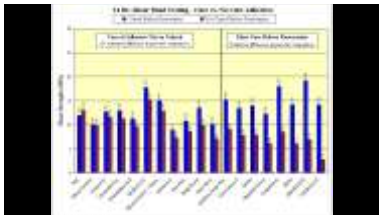




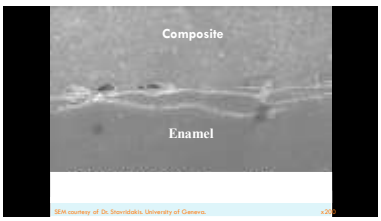
Curing bonding agent prior to restoration

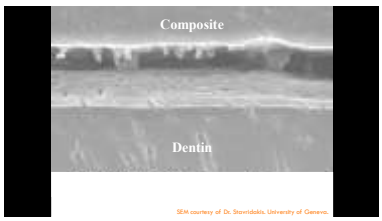
Direct restorations - Yes

Indirect restorations - ?



How strong is our bond?





Total etch/wet bonding concerns

Dentin varies person to person, tooth to tooth. in each area of teeth

One Vs Two bottle systems

One Bottle	Two Bottle
Simple to use	Less technique sensitive
Cannot bond to self cure	Hydrophilic primer can penetrate dentin better
	Hydrophobic resin overcoat

Uni-dose vs. bottle

Uni-dose	Bottle
Simple to use	Cheaper
Correct chemistry each application	Dual cure

Two Bottle total etch adhesives

Primer and adhesive in separate bottle

OptiBond FL (Kerr)

- Ethanol based two bottle
- Dry or moist – works well
- Lowest reported post-operative sensitivity
- Fluoride
- Has a dual cure option
- Self-cure questionable
- Does not bond to metal

All bond 3 (Bisco)

- Ethanol based two bottle
- Low sensitivity for total etch system
- Dual cure and self option
- Thick bonding resin
- Primer needs to mixed and cured
- Recommend cure at 500mW/cm2
- No unidose

Adper Scotchbond Multi-purpose plus (3M)

- Ethanol based
- Usually on low end of enamel bond strengths
- Moist and dry works well
- Dual and self cure option

Optibond Solo Plus (Kerr)

- Ethanol based
- Thick, need to air thin for indirects.
- Bottle and single dose
- Least post-operative sensitivity?
- Dual/self cure option give poor results
- Best selling bond agent of 2013

PermaQuick (Ultradent)

- Ethanol based
- Easiest bonding agent to use due to syringes
- No dual/self cure option
- No uni-dose

One Bottle total etch adhesives

Primer and adhesive in one bottle

Prime & Bond NT (Dentsply)

- Acetone based
- High nano-filler
- Light cure is single bottle
- Long tract record
- Excellent results
- Dual and self-cure require activator

XP Bond (dentsply)

- Tertiary-Butanol solvent
- No or minimal post-op sensitivity
- Low film thickness
- Effective even when dentin over dried for 10 seconds
- 15 minutes of activity when stored in cliXdish

One Step Plus (Bisco)

- Acetone based
- Only single bottle that definitely bonds to self cure
- High pH
- Sensitive to over dry
- Unit dose available
- Shake very well prior to use

Gluma comfort bond and desensitizer (Kulzer)

- Bond and desensitize in one step
- Tooth moisture level not critical
- Ethanol based
- Desensitize and bond in one step
- Lower bond strengths with LED
- 3 or more layers required
- Bond strengths on low end of adhesives
- Cost on high end of adhesives

i-Bond Total etch (Kulzer)

- high bond strengths
- Has glutaraldehyde
- Apply 15 seconds, cure 20 seconds

Single bond plus (3M ESPE)

- Ethanol
- Nanofill version of original
- Light and dual cure
- High bond strenghts
- Bursting the bubble for unidose is not precise

Why are self etching adhesives so popular?

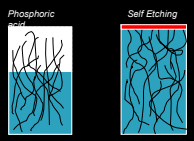
1. Easy to use
2. Has its own water
3. Low sensitivity with little effort

Sensitivity Issues

- 2002 – Total etch had double the sensitivity issues over SE
- 2012 – Total etch had 10% more sensitivity
  - Better technique
  - desensitizers

No difference in controlled clinical studies on post-op sensitivity levels between total and self etch adhesives.

Problems with total etch - depth



Smear Layer

The smear layer reduces dentin permeability and fluid flow by 86%

Pashley DH et al. Regional resistances to fluid movement in human dentintion. Archs Oraal Biol

Self etching primers

- Combine etch and prime process
- Bonding agent may be separate or included

SE Bond Components

I. Weak acid i.e. polycarboxylate acid
II. Wetting agent i.e. HEMA
III. Resin i.e. BIS-GMA

Problem with total etch- rinsing

- Rinsing creates fluid movement and exchange
- Dentin fluid flow is affected

Problems with total etch

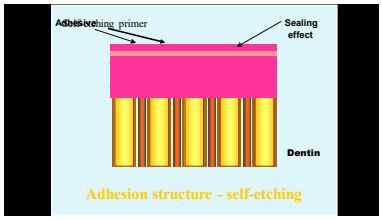
1. Etch depth
2. Rinsing
3. Exposed collagen
4. Wet/dry primer surface

Self-etching Advantages

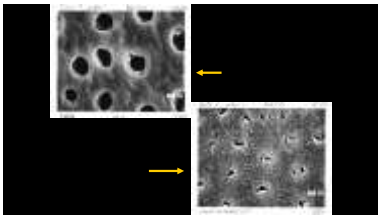
- Easy to get consistent results
- Less technique sensitive
- Faster
- One layer
- No sensitivity from bonding
- Bond strength increase over time
- Moisture contamination not critical
- No wet/damp/dry issues

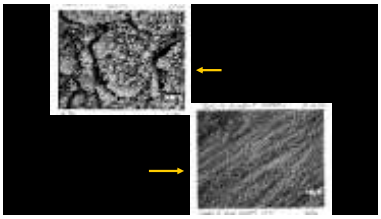
Self-etching Disadvantages

- Thick
- Not as effective on uncut tooth structure
- Brands vary in effectiveness
- Enamel bond strength inadequate in some studies
  - Staining of margins over time
- No laser cutting (smear layer)



Adhesion structure - self-etching





SE Primer

- Dissolves/liquefies smear layer
- Leaves smear plug in place
- Immediately seals dentin surface
- The primer pH becomes neutralized.

Technique

- Surface may be moist or dry
- Agitate bottle
- Apply primer for specified time
- Air evaporate solvent
- Apply one coat of adhesive
- Air thin
- Cure

Contraindications with Self-Etching

- Disinfectants/Antibacterial on some brands
- Eugenol based materials
- Dycal
- Astringedent

Clearfil SE bond (Kuraray)

- Excellent clinical and research results
- MDP monomer
- The standard for SE direct systems
- Light cure only
- Direct restorations only
  - 40 microns thick
  - Most are 10 microns
- Does not bond to self cure
- Not radiopaque

Clearfil Protect Bond (Kuraray)

- Very similar to original SE Bond
- Antibacterial and fluoride included

ALL-bond SE/ACE all-bond SE (Bisco)

- Mix two components till pink then apply
- Optional "liner" layer which is thick adhesive
- Ace is a dual barrel syringe delivery system for all bond SE
- Works well for direct, indirect, self cure
- Enamel bond strengths on lower end, unless you pre-etch with phosphoric acid.
- Recommended cure at 500mW

Prelude (Danville Materials)

- Has both total etch and self etch option
- No difference in total and self etch bond strengths
- Water/ethanol based
- 10 second application per
- For self-cure add "link" con
- Cheapest of all self-etch

Universal adhesives

- Universal application
  - direct and indirect, total or self etch.
  - Bonds to zirconium, lithium disilicate, metal
    - No additional primers needed
- Silane included in adhesive

Adhese Universal (Ivoclar)

- Easy application
- Minimal waste
- Has benefits of uni-dose
- Direct/indirect
- Use Monobond Plus on restroration

OptiBond XTR (KERR)

- Universal application
  - direct and indirect
  - Bonds to zirconium, lithium disilicate, metal
    - No additional primers needed
- High bond strengths
  - Enamel 43MPa
  - Dentin 52MPa
- Easy to use.

Scotch bond Universal (3M)

- Universal application
  - direct and indirect, total or self etch.
  - Bonds to zirconium, lithium disilicate, metal
    - No additional primers needed
- Bond strengths
  - Enamel 28MPa
  - Dentin 52MPa
- Easy to use.
- Dual cure option

Peak Universal (Ultradent)

- Unique syringe mixing
  - Once mixed stays active for 30 days
- Bonds to metal, zirconium, lithium disilcate
- Has chlorhexdine
- Strong unpleasant smell
- Excellent bond strengths
  - Dentin – 60 MPa
  - Enamel – 42 Mpa
- Does not bond to self cure

All bond Universal (Bisco)

- Universal application
  - direct and indirect, total or self etch
  - Bonds to zirconium, lithium disilicate, metal
    - Additional primers needed
- SE bond strengths
  - Enamel 19 MPa
  - Dentin 39 MPa
- Easy to use.

Veneer cementation Technique

Hydrofluoric Acid

- Etchs surface of porcelain
- Gives micromechanical retention
- Standard to be done at lab

Not sure … place drop of water

Checking Margins

- Interproximal cervical margin has 2-4x larger opening than other areas
- Shrinkage of porcelain toward middle bulk

Sorensen JA, et al. Marginal fidelity and microleakage of porcelain veneers made by two techniques. J prosthet Dent 1992;67:16-22.

Sim C-K et al. Comparison of fit of porcelain veneers fabricated using different techniques. Int J Prosthodont 1993;6:36-42.

Altering color with stains

Advantages	Disadvantages
I. Adjust value	I. Extra coats of die spacer
II. Adjust chroma	II. Weakens adhesion
III. Adjust opacity	III. Cement shrinkage stress

Ceramic Preparation

- 10 second etch with phosphoric acid
- Removes debris of:
  - Die stone
  - Latex glove powder
  - Saliva
  - Fit checker
  - Try-in paste
- Rinse

Ivoclean (Ivoclar)

- Universal cleaning agent for ceramics and metals
- Removes phosphates from saliva
  - Important in bonding to zirconium
- Much better than using phosphoric acid

Silane Ceramic primer

- Increases "wettability"
- Prevents surface contamination
- Increases bond strength

Ceramic Preparation

- Two coats
  - Prior to try-in (not damaged by etch or ivoclean)
    - Do not sandblast
  - After try-in
- Leave each coat for 1 min

Kalavacharla VK et al, Influence of etching and silane on bond. Operative dentistry. 2015;40(4):372-8

Clearfil Ceramic Primer (Kuraray)

- Silane coupler with MDP
- Enhances bonds to porcelain, Zirconia, Alumina, Lucite, Lithium Silicate and composites
- Can skip hydrofluoric acid
- Can skip adhesive step according to manufacturer
  - Multiple layers
- 5 second application

Monobond Plus (Ivoclar)

- Primer for all ceramics and metal
- Apply for 60 seconds
- No need for adhesive layer per manufacturer

Other good silanes

- Silane Primer (KERR)
- Silane (Ultradent)
- Bis-silane (Bisco)
- Rely-x resin (3M)
- Sinlane enhancer (pulpdent)

Monobond Etch & Prime (Ivoclar)

- Etchant and primer in one
- Reduces potential of over etch e.max

Ceramic Preparation

- Apply adhesive
- Air thin. Do not cure.

Ceramic Preparation

- 10 second etch with phosphoric acid
- Rinse
- Apply silane
- Air dry after one minute
- Apply adhesive
- Air thin. Do not cure.
- Apply cement

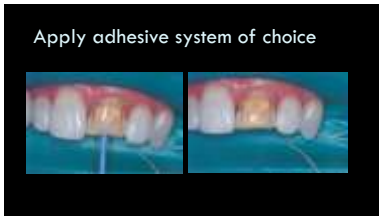
Necessary cement characteristics for large veneer case

- Long working time
- Color stable
- Strong bond

Replacing veneer on #9

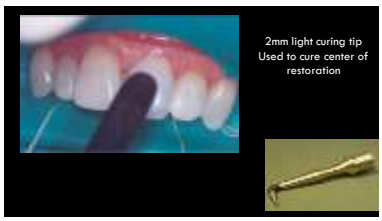
Prep


Isolation


Apply adhesive system of choice


Restoration placed with cement


Clean off Cement


2mm light curing tip
Used to cure center of restoration


Floss


Full cure with big tip


Flash removal with #12 blade

Preparations

Restorations back from lab

Try-in restorations one by one. Adjust prep if needed.

Try in two at a time to check contacts

If too tight, use articulating paper to mark spot

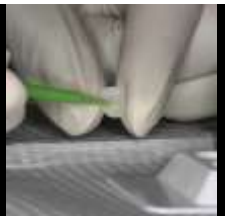
Adjust with fine diamond bur and lots of water

Try in anterior restorations, make sure nothing moves around when pressed

Rinse off try-in paste

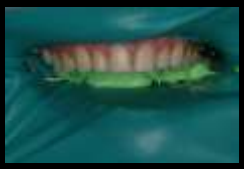
Clean debris with phosphoric etch

Apply silane and adhesive to restoration. Do not cure.



Apply cement and place restorations light protective cover

Isolation

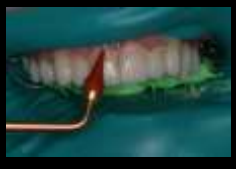


Option 1: total etch and adhesive

Option 2: self etch system

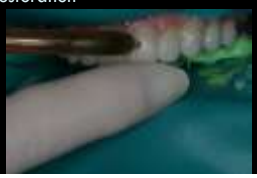
Place in all restorations. Make sure all are in right place.

Clean off cement



After initial removal of cement

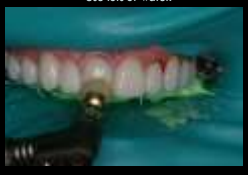
2mm light tip to cure center of restoration



Remove excess cement and floss

Cure cure cure

Get back shine with composite polishers
Use lots of water.



ContacEZ or FitStrip (garrison)

Adjust occlusion with fine diamond bur. Porcelain polishers for adjusted areas.
Lots of water.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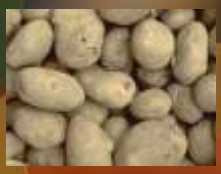
Marketing

Cosmetic cases don't just happen
You have to make it happen.



A successful business must have 2 of 3
- Low price
- Good service
- Good product
- ie. Costco, Nordstrom, Best Western

Cosmetic Cases

- Pt want beautiful smile….. product
- Pt want to be taken care of….. Service
- Pt expect higher fees….. price

Magic phrase to "sell"

Step 1

- Advance cosmetic skills and knowledge
  - less stress
  - faster dentistry
  - less failures

Step 2

- Think of every current patient as a potential candidate for cosmetic dentistry
  - Bruce

Don't spend big money on advertising till your existing patients accept your recommendations

New cosmetic procedures patients in my practice

Poor results

- Online advertising
- Yellow pages
- newspapers
- Coupon books

Good results

- Patient referrals
- Regular patients
- Orthodontists
- Web site

Step 3

Change culture/image of practice

- Takes time
- Get staff educated
- Get staff involved, excited, motivated
- Everyone must believe
  - cardiologist

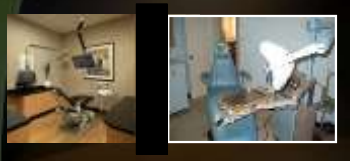
Change culture/image of practice

This is what patients judge your office on

1. Physical appearance of office
2. Level of customer service
3. Level of technology

Patients judge dentists by

1. Physical appearance of office



Where would you go for treatment?

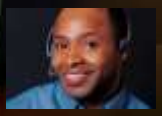
Patients judge dentist by:

Entertainment

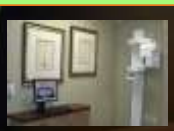
- Cd's
- Movies
- Magazines

Patients judge dentists by

Level of customer service



Technology



Patients judge dentist by

- Not clinical dentistry, so we have to educate the patient
- Do not "sell" or pressure…..educate

Educating patients

- Explain the problem
- Use an evaluation form or checklist at first
- Show "before and after"
- Re-appoint for esthetic exam if necessary

Esthetic exam

- Make patient aware of problems
- Explain what problem mean
  - Visual aids, photos, tracing

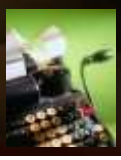
- Give yourself time
- Expectation vs. Reality
- Deliver results or don't start the case

Esthetic exam

- Present option
  - What would you like to do?
  - Do not hand patient treatment plan sheet

Is it worth doing esthetic cases?

- Increased cost
- Can your area support fees to cover costs?
- Profit margin?



Cost of cosmetic procedures

- CE
  - Tuition
  - Cost of closing office

Your Cost

- Procedure time
  - Minimum 5 appointments
  - Learning/speed curve

Your Cost

- Laboratory costs
  - Specialty work, specialty fee
    - Wax-up $30-50 per tooth
    - Restoration $250-350 per tooth

Your Cost

- Staff
  - Increased technical skills
  - Presentation
  - Customer service

Your Cost

- Warranty
  - Remake cost
  - Lab communication - Will your lab tell you if the work could be better

The bottom line: charge enough for it to be worth doing the case.

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