Transitional Bonding:
Non-Traditional Composite Restorations for Major Occlusal and Esthetic Changes

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Traditional dentistry

is what we were taught in dental school—Class III, Class IV, and Class IV restorations for those dentists practicing the longest, and since the late 1980s or early 1990s, Class I and Class II restorations also.

The evolution of dentistry

Cosmetic dentistry has changed the old stereotype of dentists as tooth drillers and cavity fillers to an improved paradigm of smile enhancers and youth preservers. This cosmetic "r"evolution has added some newer traditions; for example using composite for diastema closure and some full veneers, as well as porcelain veneers and onlays.

Advantages of using composite for cosmetic dentistry

Time saved
- fewer app'ts needed;
- no waiting for lab

Lower cost
- fee should always be *at least* a little less than indirect restorations since no lab fee;
- depending on degree of defect, time to do direct could be *much less* than indirect

Conservation of tooth structure
- more tooth structure saved compared to indirect restorations;
- sometimes little or no prep so treatment may be considered reversible

No lab needed (quality control in dentist's hands)
- easier to match shade since actual teeth are right there (a ceramist's dream);
- composite has an almost magical ability to blend with enamel;
- easier to create high value effect without "graying out" as porcelain can

Ultimate Esthetics

Ultimate esthetics is NOT always necessary.

Many patients are very satisfied with less than ideal esthetics.

These patients can benefit from lower fees and more conservative treatment options.

so this course is NOT about layering!

"Tripod of success"

most "Bonding" courses only teach shade and texture (layering of materials and polish);
this course covers add'l critical information: smile design, tooth topography, and occlusion

Transitional Bonding—definition:

"transition" is the process of changing from one state or condition to another

"transitional bonding" is a composite technique requiring little or no prep to transition a defective dentition to a more restored condition (additional improvements may be needed or desired later)

compared to "ultimate esthetics bonding" or porcelain, Transitional Bonding should be able to achieve 70-90% of the esthetics and virtually 100% of the function

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for major restorative cases, full mouth rehabilitations, and smile makeovers:

- **traditional approach**:

  prepare, temporize, and deliver porcelain restorations

- **non-traditional approach**

  1st: transitional freehand bonding
  - will not provide "Ultimate Esthetics"
  - can expect 70-90% of esthetics
  - should provide virtually 100% of function

  then have following options

  2a. full case preparations for porcelain restorations

  2b. phased preparations

  2c. "upgrade" resin restorations

  2d. monitor and maintain

RATIONALE FOR RESIN

traditional concerns with composite:
- wear
- resistance to fracture
- marginal integrity
- surface staining

wear:

"Many practitioners are fearful of restoring the anterior teeth or anterior guidance in young patients. It is the author's belief that restoration of anterior guidance is probably one of the best things that could be done for young horizontal bruxing patients who present with severe wear."

Spear F. Occlusal considerations for complex restorative therapy. In: McNeill c (ed). Science and Practice of Occlusion. Chicago:Quintessence, 1998:451.

in vivo wear

	wear data	(µm per year)	author/year	source
microhybrids	169 µm / 5 years	(34)	Wassell 2000	J Dent
	264 µm / 17 years	(16)	Wilder, et al 1999	J Esthet Dent
	300-400 µm / 10 yrs	(30)	Mair 1998	Quint Int
	106-149 µm / 3 years	(35-50)	Willems 1993	J Dent
	142 µm / 4 years	(35)	Lundin 1989	Swed Dent J
enamel	30 µm / year		R Christensen 1999	JADA
	16 µm / year (premolars)		Lambrechts 1989	J Dent Res
	28 µm / year (molars)		Lambrechts 1989	J Dent Res

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resistance to fracture:

"Fracture toughness (K_{IC}) represents an intrinsic material property that characterizes a material's resistance to fracture."

Pilliar R, Smith D, Maric B. Fracture toughness of dental composites using the short-rod fracture toughness test. J Dent Res 1986; 65:1308-1314.

fracture toughness

	K_{IC} (MPa $m^{1/2}$)	author/year	source
feldspathic	1.41 ± 0.18	Kvam 1992	Biomaterials
	1.16 - 1.86	Masayuki, et al 1990	Dent Mater
	1.5 - 2.1	Taira, et al 1990	J Oral Rehabil
	0.90 - 1.06	Morena, et al 1986	Dent Mater
reinforced	**Hi-Ceram**		
	2.14 ± 0.14	Kvam 1992	Biomaterials
	Zirconia		
	1.72 - 2.22	Masayuki, et al 1990	Dent Mater
	Aluminous		
	1.48 - 1.56	Morena, et al 1986	Dent Mater

fracture resistance of feldspathic porcelain is essentially the same as for microhybrid composite
both materials have the ability to fracture if overstressed

fracture toughness

	K_{IC} (MPa $m^{1/2}$)	author/year	source
microhybrids	1.16 - 1.27	Knoblock, et al 2000	J Dent
	1.02 - 1.14	Kim & Okuno 2002	J Oral Rehabil
	1.5 -1.8	Ferracane & Condon 2000	Dent Mater
	1.35 - 1.37	Fujishima & Ferracane 1996	Dent Mater
	1.6 - 1.9	Kovarik, et al 1991	Dent Mater
	1.02 - 2.30	Pilliar, et al 1987	J Dent Res
tooth	dentin = 3.08	Mowaffy & Watts 1986	J Dent Res
	enamel = 0.6 - 0.9	Marshall, et al 2001	J Biomed Mater Res

marginal integrity:

long bevel margin on enamel is most resistant of all margin types to secondary decay
minimal prep maintains more enamel for adhesion; tooth is more intact
maintaining more tooth structure and blending composite with tooth shade means most margins are supra-gingival

surface staining:

long bevel margin also makes it practical to contour & polish away most stained margins, so a repair isn't needed (see "polish to rejuvenate" technique)

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MATERIAL REVIEW

basically Hybrid = Microhybrid = Nano
(all are composed of various sized particles—some very tiny and others much larger)

the DIFFERENT composite is MICROFILL
(because all the particles are tiny and uniformly sized)

MICROFILL	HYBRID
fracture susceptible highly polishable highly translucent = FACIAL ENAMEL LAYER	***fracture resistant*** polish fades less translucent = DENTIN & LINGUAL LAYER

for maximum strength and the simplest technique choose hybrid as ***only*** material

3 STEPS TO SUCCESS in Smile Makeover cases:

To successfully treat a Smile Makeover patient, there are 3 phases to consider

1. **Visualization**: smile design (esthetics) then occlusion (function)

"Esthetics drives the case…function finishes the case"

2. **Transitional phase**: transitional bonding or temporaries
(often skipped in direct resin cases or not taken seriously in porcelain cases)

3. **Final treatment**: resin or porcelain

SMILE DESIGN PRINCIPLES—basic approach:

3 most basic characteristics of good smiles

1. Reasonable symmetry
2. Pleasing shade
3. Teeth fill the esthetic zone (some gingiva desirable if in balance and harmony)

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STEP 1: evaluate **esthetic zone (E Z)**

ck. orientation with facial midline and interpupillary line

• **height-to-width ratio of E Z** (see E Z R worksheet for measuring guidelines)

> 30% is the high end of the range: gummy smile, short upper lip, excessive maxillary growth
15-30% is the average/ideal/normal: most smiles fall in this group
< 15% is the low end of the range: many people in this group, potential for longer upper teeth

E Z Ratio #1

height to width ratio of E Z:

measure from inside pink borders of lips,
divide height by width to get %,
almost everyone falls within the 10-30% range

15-30%	> 30%	< 15%
average, ideal, normal	short lip, maxillary excess	potential for longer teeth

STEP 2: evaluate **midline**

STEP 3: evaluate **gingival zenith line** (to set superior horizontal border of upper teeth)

STEP 4: evaluate **incisal edge location** (to set inferior horizontal border of upper teeth)

draw **smile** curve parallel to horizontal axis considering all the following principles

• **width-to-length ratio of centrals (if width is a given)**

E Z Ratio #2

for 80% multiply width by 1.25 to get length
for 75% multiply width by 1.33 to get length
for 70% multiply width by 1.43 to get length

• **tooth show / smile curve / lower lip curve**

STEP 5: evaluate **arch and tooth widths** (to set widths of upper teeth)

• **anterior segment ratio:** width of 6 anteriors compared to width of EZ (average is 66%, range 59-75%)

E Z Ratio #3 measure anterior segment width at widest point of canines

if narrow arch (ratio will be low) determine if can bulk out canines and posterior teeth to appear as if arch is wider (will reduce dark area in buccal vestibule)

• **central dominance ratio:**

E Z Ratio #4 width of 2 centrals compared to width of anterior segment (if in Golden Proportion, would be 50%); 50% should be considered extreme, rather than ideal or average (range is 40-50%)

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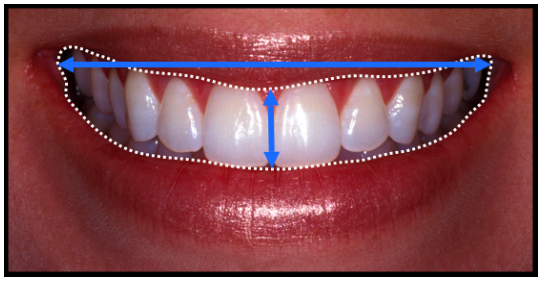
ESTHETIC ZONE RATIOS WORKSHEET
E Z R METHOD of Smile Design by Corky Willhite, DDS

height of E.Z. = _____
width of E.Z. = _____



Esthetic Zone (E Z):

- evaluate 'facial anomalies' and 'E Z symmetry'
- *measure to determine height and width of E Z*

Ratio #1: _____ **=** *height of E Z divided by width of E Z*

15-30%	> 30%	< 15%
average, ideal, normal	short lip, maxillary excess	potential for longer teeth

Midline, gingival contours, incisal edges:

- evaluate 'midline' and 'incisal plane orientation'
- determine if gingiva is appropriate (can't move papillae incisally much)
- position incisal edge based on 4 criteria: (determines "tooth show")

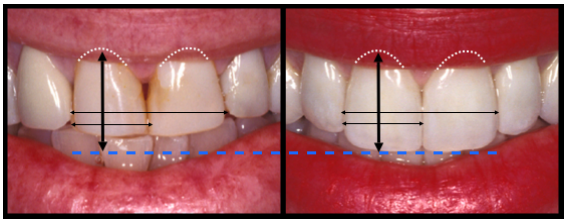
(1) width-to-length ratio of centrals:

width of central = _____ (recommend measuring both centrals and divide by 2)
length of central = _____ (measure from gingival zenith, even if covered by lip)

Ratio #2: _____ = *width of a central divided by length of a central* ***= existing*** *width-to-length ratio*

Using existing width of a central, calculate range of potential lengths using width-to-length proportions:

for 70%: _____ **=** 1.43 *multiplied by width of a central*
for 75%: _____ **=** 1.33 *multiplied by width of a central*
for 80%: _____ **=** 1.25 *multiplied by width of a central*

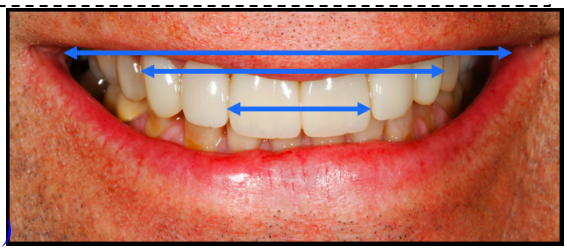


also consider:

(2) smile curve
(3) facial-lingual placement
(4) relaxed lip tooth display

width of anterior segment = _____
(distal of canine to distal of canine)
width of both centrals = _____

Arch & tooth widths:



Ratio #3: _____ = *width of six anterior teeth divided by width of E Z ("anterior segment ratio")*
(avg. 66%, range 59-75%)

Ratio #4: _____ = *width of both centrals divided by width of six anterior teeth ("central dominance ratio")*
(50% would be "Golden Percentage" which is ***maximum****)*
(avg. 46%, range 40-50%; diastema & crowding cases may be out of range)

also consider:

- incisal edge pattern (laterals shorter than tangent from central to canine)
- incisal embrasures/contact areas/papillae (50:40:30 rule)
- axial inclination

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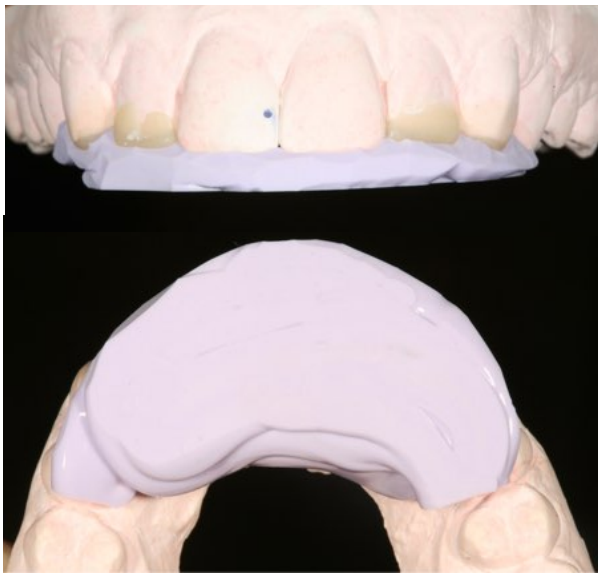
TEMPLATE TECHNIQUE: 10 Steps for Transitional Bonding

1) create template
2) take shade
3) moisture control
4) minimal prep
5) load template
6) etch & adhesive
7) composite sculpt and cure
8) final cure
9) contouring
10) polishing

1) create template:

create template from diagnostic wax-up, use a rigid polyvinylsiloxane impression material to make a template (i.e. putty index) of the lingual and incisal surfaces of the teeth to be restored; should be thick enough to maintain rigidity; some materials may take up to 30 minutes to de-gas

- a "template" may be a putty index, or another type of matrix or stent
- recommended for up to 6 *anterior* teeth only—upper or lower; may be difficult to control if attempt more than 6 at once
- can save time *if* careful to avoid bonding teeth together,
- re-using template to build up teeth one at a time increases risk of it not seating fully



- ✓ Fabricate using a rigid material (ex: Template, Flexitime putty, Regisil Rigid).
- ✓ A trimmed piece of plastic can be used for a flat plane during fabrication.
- ✓ Should be 5 mm thick to maintain rigidity.
- ✓ Trim so facial of tooth is completely exposed while maintaining incisal and lingual surfaces (so trim *exactly* along Facial-Incisal line angle).
- ✓ Trim at same angle as facial surfaces (this example is trimmed well on patient's right side, but is trimmed at an angle on the other side.
- ✓ Should extend 1-2 teeth past last tooth to be treated.

2) take shade:

- determine shade first before dehydration can occur (may occur quickly on some teeth);
- have shade guide arranged by value;
- make "customized shade tab" → use actual composite in closest 2 or 3 shades (small pea-sized ball of composite placed on tooth and flattened with Mylar strip, cure 10 sec.)

3) moisture control: *key is to have a compliant patient with healthy tissue*

- dental dam may be used but if will distort papilla alternatives should be considered;
- bite block and saliva ejector can work very well

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4) minimal prep:

PREP STEP 1 BEVEL FACIAL

- ✓ **only if visible in the esthetic zone**
  a bevel is not required for retention…purpose of bevel is for esthetics only (so there is a "blending zone" between composite and tooth structure)
- ✓ **length should be about the same as length to be added** recent fracture, may need to smooth
  make bevel about as long as composite to be added (ex: if fracture is 3 mm long then bevel should be approximately 3 mm long) but at least 1.5 mm long to assure adequate "blending zone"
- ✓ **should not be deeper than half the thickness of the facial enamel**
  exception: if tooth needs to be brightened overall then prep bevel deeper so is nearly to dentin and increase length of bevel to veneer most or all of facial surface
- ✓ **should gradually become shallower until bevel ends**
  NO chamfer or finish line, the bevel just ends on the **facial** surface

PREP STEP 2 "MICROSCOPICALLY ROUGHEN" worn surfaces with a fine diamond bur:

- ✓ freshen **any** sclerotic dentin to increase bond strength
- ✓ if recent fracture, may need to smooth jagged edges

PREP STEP 3 ROUND OFF SHARP CORNERS

- ✓ goal is to expose the ends of 5-10 enamel rods, so this is a *very slight* rounding off of any sharp corners; adhesion is better to the **ends** of enamel rods rather than to the **sides** of enamel rods

PREP NOTES:

- ✓ prep should be extremely conservative and only *if needed*
- ✓ before etch and adhesion, pumice any unprepped tooth structure so no plaque, stain or pellicle remains, which would reduce bond strength (fine or flour pumice and water on a prophy cup)
- ✓ assure interproximal contacts are light enough for Mylar strip to slide through

5) load template:

- reseat and evaluate template for accuracy and amount of "fill" needed; then place appropriate amount of composite into template (goal is to form entire lingual surface and incisal edge, but kept thin, so don't overfill)
- store loaded template in the dark

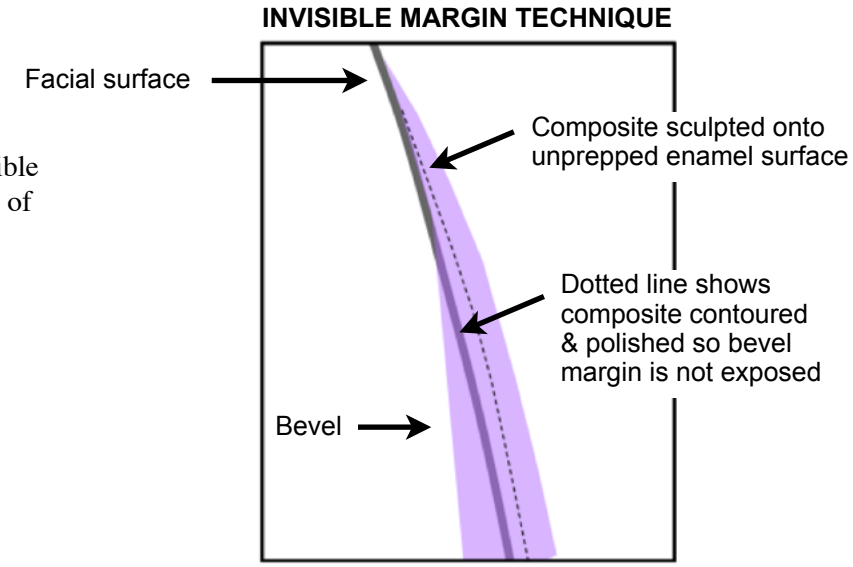
6) etch & adhesive: 3 stage etch then place adhesive

1) unprepped enamel: etch about 60 seconds
2) prepped enamel: etch 15-60 seconds
3) dentin: no more than 15 second etch!!

7) composite sculpt and cure:

- if amount of tooth structure to be replaced is large, to reduce effect of polymerization shrinkage, directly place a minimal 1st increment to cover worn incisal edge and any hard-to-reach areas of the tooth; then light cure 10 sec (be sure this increment will not interfere with fully seating the template)
- seat template with uncured composite; smooth composite and sculpt to allow space for subsequent increments; use very thin bladed instrument to clear contact areas so teeth don't bond together
- light cure each tooth 20 sec (twice as long as for other increments since may be curing through tooth structure)
- remove template; examine lingual margins and smooth any uncured composite that may have pulled away, and add to any gaps or rough surfaces (unfilled resin, gentle air to thin, use small increments of composite or flowable)
- add enough composite to reinforce any very thin areas to minimize risk of accidental fracture; cure
- build up teeth to full contour (individually or every-other-tooth), sculpt so facial is slightly overcontoured (so have some composite to remove when contouring)
  - ✓ use layers as needed for Ultimate Esthetics or increments as needed for Transitional Bonding;
  - ✓ contour and polish *proximal* surfaces prior to completing adjacent teeth (so can use Mylar Pull to create contacts without having composite bond to the next restoration)
  - ✓ Mylar Pull forms the proximal surfaces including the contact (uncured composite is in contact with adjacent proximal surface)

✓ sculpt composite onto unprepped enamel for most predictably invisible margins (even when in the middle of the facial surface)



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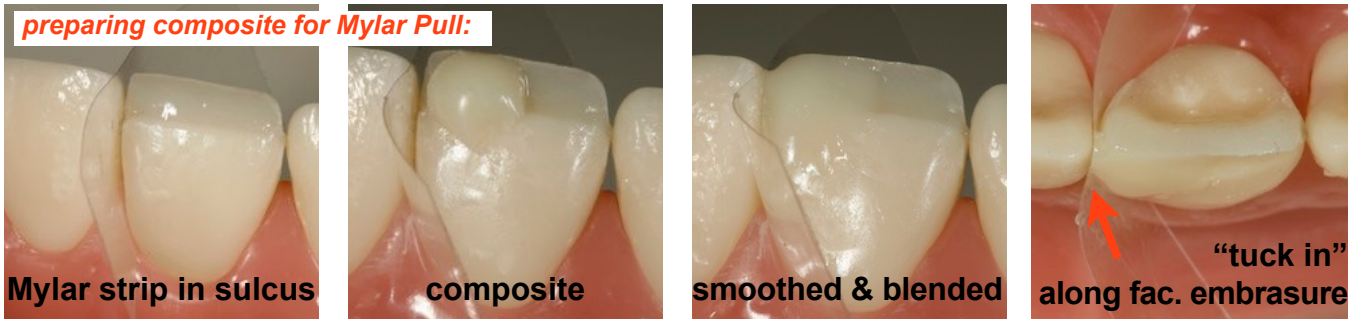
MYLAR PULL is using a Mylar strip as an *instrument* rather than as a *matrix*

Advantages:

- allows convex contour from gingival to incisal on proximal surfaces
- helps adaptation of uncured composite to underlying cured composite or tooth structure, so as to avoid voids or gaps
- improves ability to fine-tune sculpting since no Mylar strip is in the way

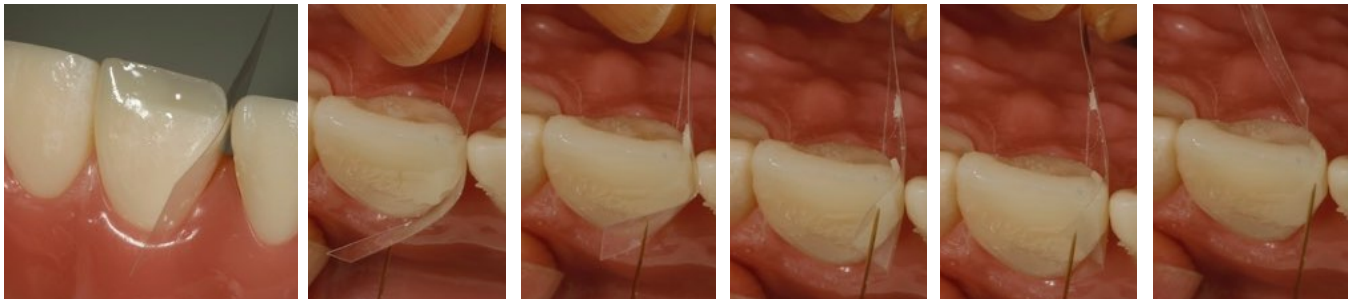
Example of Mylar Pull on model (here showing mesial first, then distal second): Place clean Mylar strip into sulcus on mesial, then place composite to form the facial layer and cover bevel, sculpt so mesial half is slightly overcontoured but "tuck in" where touching Mylar strip, smooth and blend facial composite, now you are ready for the Mylar Pull.



Mylar Pull TQ: use instrument to *gently* push Mylar strip towards middle of tooth; this forms the facial embrasure as you pull the strip straight to the lingual while moving instrument from gingival to incisal

The Mylar strip is pulled to the lingual as the instrument moves gingival to incisal
(it takes practice...like patting your head and rubbing your stomach!)

After Mylar strip is pulled through, refine sculpting, then light cure 10 sec. Repeat steps above on distal starting with placing Mylar strip into sulcus, sculpt composite, do Mylar Pull, refine sculpting, cure



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Watch 3-4 minute videos of the Mylar Pull Technique:
- http://www.youtube.com/watch?v=rAjlZJevzeM (or search "Mylar Pull" at youtube.com)
- http://www.youtube.com/watch?v=zKMNEXr5Vus

NOTE: the lingual layer must be cured PRIOR to adding the facial composite and doing the Mylar Pull!!

Troubleshooting the Mylar Pull:

PROBLEM: too much or all of the uncured composite pulls lingually leaving inadequate bulk to complete the facial and proximal layer
SOLUTION: lingual layer must be *cured* composite or tooth structure…there must be lingual support for the Mylar Pull to work
PROBLEM: there isn't enough composite in the cervical area to complete the facial and proximal layer
SOLUTION: pull the Mylar strip directly lingual, don't allow it to drift incisally (it should not drift out of the sulcus)
PROBLEM: moisture infiltration—bleeding or sulcular fluid
SOLUTION: slip unwaxed floss into sulcus (preferably of adjacent tooth) to wick away a slight amount of moisture

CREATING AN IDEAL CONTACT: after the Mylar Pull, if the uncured composite is in contact with the adjacent tooth, this is a great method of creating an ideal contact between them

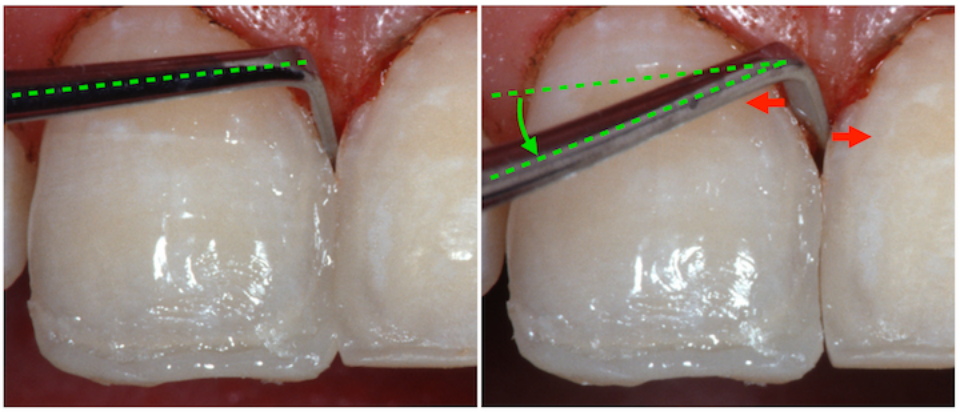
NOTE: to avoid bonding the uncured composite to the adjacent tooth or restoration, the adjacent surface should be:

1) enamel that is not prepped or etched,
OR
2) composite that is polished

} because composite can't bond to either of these surfaces

If the adjacent surface isn't one of these two, the Mylar Pull can still be used but stop pulling just before the Mylar strip comes out. Leaving just 1mm of the strip between the teeth will still allow most of the advantages of the Mylar Pull while assuring that no bonding at the contact occurs.

MOPPER POP is used to separate teeth that are not bonded, but only "stuck" together. The Mopper Pop is used if floss won't slide through the contact after light curing. If you are certain that the surface adjacent to the newly cured composite is either enamel (that isn't prepped or etched) or polished composite (see *NOTE* above) then take an 8A instrument and insert it into the gingival embrasure. Push the edge of the blade against the contact and barely torque the instrument between the teeth. Warn the patient that they will feel a little pressure and hear a pop, otherwise they will think you've broken something.



8) final cure:

glycerin gel used over entire restoration to block oxygen from inhibiting the cure
(goal is to eliminate the oxygen inhibition layer); cure all areas of restoration at least 60 sec

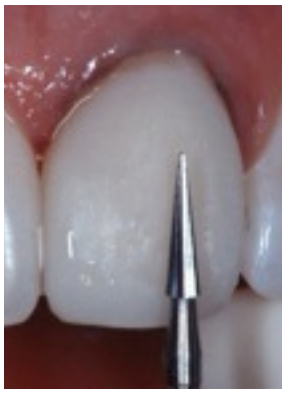
it is OK to do the final cure later, if more convenient, as long as it is done before the final polish

9) contouring

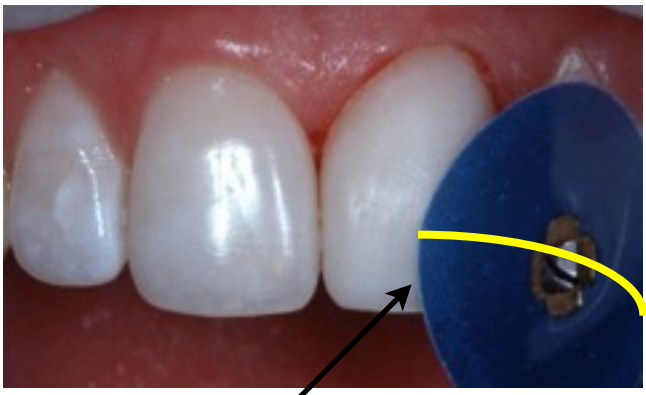
- understanding tooth topography is invaluable when contouring restorations
- contouring is the process of adjusting the contours, it's NOT polishing
  ALL contouring should be complete prior to ANY polishing
- focus on 1° anatomy first (1° anatomy = outline form from facial, incisal, and profile views)
  start contouring with ET and OS burs (Brasseler) or FlexiDiscs (coarse or extra-coarse; Cosmedent)
  complete contouring with medium grit FlexiDiscs (NO surface defects should be evident)
  proximal surfaces can also be contoured with coarse/medium grit FlexiStrips (Cosmedent)
- 2° anatomy should be contoured after 1° anatomy is complete and is exactly as desired
  ask yourself if you *love* the contours before proceeding to the next step
- repair surface defects after contouring 2° anatomy
  (see composite repair section)
- when using FlexiStrips supragingivally, hold in an "S" shape rather than a "C" shape to preserve the contact (see photo below)

CONTOURING WITH BURS, DISKS, AND STRIPS

ET bur

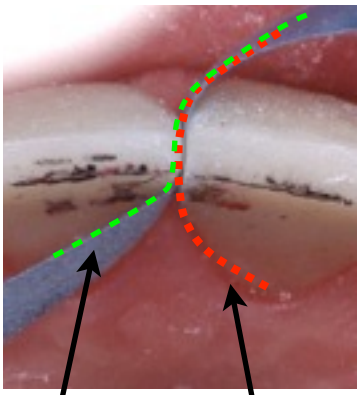


coarse then medium FlexiDisks



MEDIUM-GRIT DISK (finishes contouring)
no surface defects should be visible after completing medium-grit disk
(repair defects prior to using any finer polishing disks or cups)

FlexiStrips



"S" shape is correct for supragingival contouring

"C" shape is more likely to open contact, but is correct for SUBgingival contouring

PEARL: "Contour *intentionally*" means don't touch the tooth with a bur or disk without having a *specific* purpose or goal (such as: flattening the facial surface, opening an incisal embrasure, softening a line angle, etc). Contouring only because you know "the contours aren't correct" is as likely to worsen the tooth topography as to improve it!

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Finishing = Contouring + Polishing ***2 SEPARATE STEPS!***

better not to think of last step as "finishing" but as two steps, since they have very different goals

10) polishing:

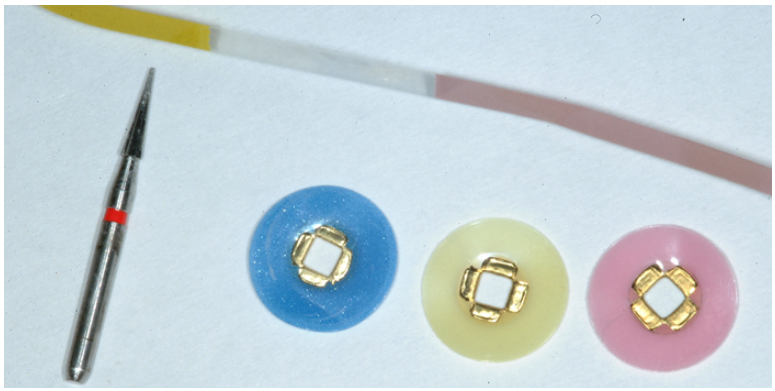
- polishing should be much quicker than contouring;
  if surface defects are present, polishing will make them MORE evident
- start with fine grit FlexiDiscs (yellow), then super-fine (pink);
  proximal surfaces should be polished with fine/super-fine grit FlexiStrips;
  if desire more surface texture, one option is to skip the fine and super-fine disks
- complete with Enamelize (aluminum oxide paste) on a FlexiBuff felt disk;
  use unwaxed floss (quadrupled) before rinsing off polishing paste to complete proximal polish

Polish to rejuvenate

The "polish to rejuvenate" technique is recommended to improve stained margins on old composite with beveled margins (butt joint margins would need a repair)

before

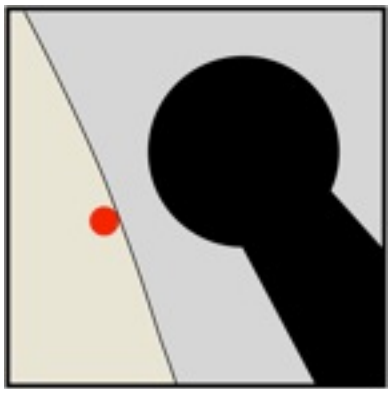
stain removed



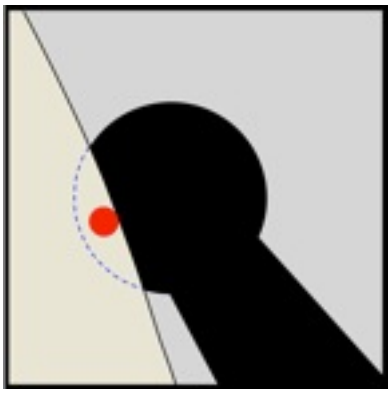
E.T. 6 bur, FlexiDiscs and FlexiStrips

This procedure should only be needed in a small percentage of patients. Composite margins can be smoothed and polished to be very resistant to stains—similar to porcelain or enamel. If the composite was ended slightly over onto unprepped tooth structure (see Invisible Margins section), just a little contouring should remove the stain, smooth the restoration, and make the area more resistant to staining in the future. Since this is above and beyond what normal restorations need, there is a separate fee of $35-85 per tooth for this.

COMPOSITE REPAIR during initial placement of restoration—should be done prior to polishing



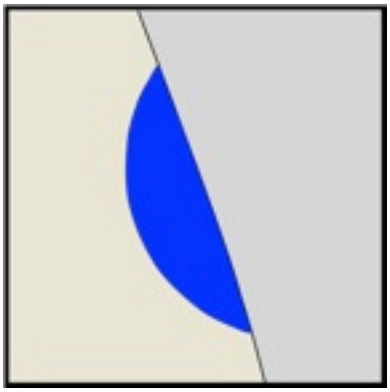
Use large, round, fine-grit diamond bur (Brasseler 8801-018)



Bur should engage only deep enough to make a saucer-shaped prep, a beveled margin is desired, *not* a butt joint

Then etch (to clean), apply a thin layer of unfilled resin (but do not light cure)

Place and sculpt the composite without overbulking it much, light cure



contour the repair, then polish the restoration

If surface has already been polished before repair, added composite will *not* bond to polished surface, so either roughen surface around repair or contour past the previous polished surface

if after restoration completed:

For microhybrid or nanofill repairs that are more than one day old, same as above except also sandblast (micro-etch) prepped area prior to acid etching

For microfill repairs, do *not* sandblast, because microfill particles are so small and uniform that sandblasting will DECREASE retention. Retention when repairing microfill is purely mechanical from the small bur marks.

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POSTERIOR TEETH transitional bonding TECHNIQUE:

mandibular position should be "set" on anterior teeth so when pt bites down the mandible is in the desired position to build posterior centric stops

in Centric Relation this usually requires no manipulation by this time (once anterior teeth are built, the anterior stops create a tripod effect with the condyles that should allow for a predictable closing position) but it is important to check that the pt does close into the desired mandibular position before adding composite to the cusps

lower teeth:

if both arches involved, add to buccal cusps of *lower* teeth (functional cusps) before uppers to achieve centric stops

1. microscopically roughen if needed
2. pumice buccal & occlusal surfaces
3. etch (60 seconds if unprepped) & adhesive
4. place microhybrid to build up buccal cusp
5. have pt. occlude into uncured resin and hold
   (asst. suctions first to eliminate excessive saliva)
6. light cure from buccal while pt. is biting
7. pt. opens then cure again with glycerin gel
8. contour to remove excess (maintain centric stop, check for interferences in excursions)
9. polish

once lower Buccal cusps have been built for function, add to B cusps of *upper* teeth (non-functional cusps) to blend length with anteriors for desired smile curve

upper teeth:

1 – 9 same steps as for lower buccal cusps

check for interferences in excursions, adjust *slopes* of new cusps only (not cusp tips) to avoid losing centric stops

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ADVANTAGES OF TRANSITIONAL BONDING:

- virtually no prep = reversible
- completion possible in one appointment
- diagnostic, even major changes can be tested
- lower introductory cost to high-quality treatment
- wear rate more similar to enamel
- easy to adjust and repair
- improves ability for inter-disciplinary treatment
- allows for phased treatment
- good for improving skills at freehand bonding

PRECAUTIONS:

excessive forces must be controlled

- night-time appliance
- "don't use teeth as tools"
- recommend patient use a low abrasive toothpaste
- Al_2O_2 polishing paste (Enamelize) for prophylaxis

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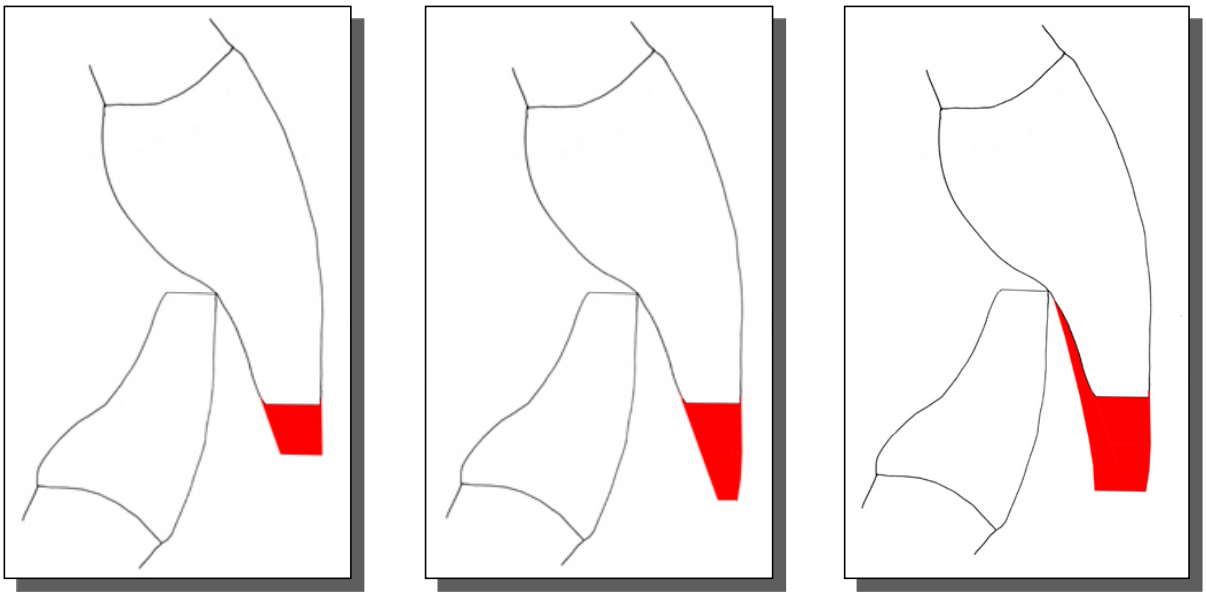
Occlusal Considerations

building anterior guidance (lengthening anterior teeth):

- guidance path may be lengthened without *occlusal* restrictions (esthetics and phonetics do restrict)
- steeper guidance path requires a transitional phase
- develop two-point contact in protrusive (can eliminate deviation if develop with pt watching in mirror)
- posterior disclusion desired (may need to equilibrate posterior teeth to eliminate interferences, but less with add'l anterior length)

ultimately must control excessive forces to expect longevity, even when occlusion is perfect

building anterior guidance while *maintaining* V.D. in a Class I patient:



guidance path not steepened steepened path

incisal edges should always be at least 1 mm thick (if thinner, are susceptible to fracture)

NOTE: Incisal edges should always be *at least* 1 mm thick, otherwise the material may fracture even under normal function. This applies to composite, porcelain, and ENAMEL.

(middle diagram above is misleading because the restored incisal edge appears thinner than 1 mm—and it should NEVER be that thin)

Other considerations of anterior guidance:

- No posterior interferences in lateral and protrusive movements
- Movements should be smooth with no fremitis (and less pressure on the laterals)
- Plateaus on the edges for a resting place
- Smooth crossover both directions

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increasing Vertical Dimension

Patients can adapt to a wide range of Vertical Dimension

3 reasons to open VD:

1. modify overjet and/or overbite after smile design
2. gain space to obtain better anatomy of posterior teeth
3. improve facial esthetics (generally subtle effect)

regarding muscle lengthening: (from Dr. Frank Spear's handout)

"If the condyle is left in a fixed position and the anterior is opened, for each 3 mm of opening (measured on anterior teeth) there is approximately 1mm increase in masseter length."

"If the anteriors are left fixed and the condyle is seated, for each 1mm of condylar seating there is approximately 0.7 mm of muscle shortening."

"KEY: determine the amount of condylar seating from MIP to CR. For each 1mm of seating, the anterior can be opened 2mm without any change in contracted muscle length."

stability: (from Dr. Frank Spear's handout)

"Will teeth intrude? Possible but no way to predict it. Studies show 20-50% of pt's will intrude (but never all the way, and maximum intrusion is reached by 6 mo's)"

Is a removable appliance needed to test a change in VDO?

"An occlusal appliance…is not an effective method of assessing vertical dimension alterations. When an acrylic occlusal appliance is placed in a patient's mouth, vertical dimension is just one of the many variables the appliance is changing; other variables include the ICP contact points, the angle of tooth contact, the excursive contact points, and whether the patient can tolerate a large piece of acrylic in the mouth for an extended period of time. The use of provisional restorations, be they composite bonded on teeth or acrylic provisional restorations on prepared teeth, is a much better method of assessing the occlusal changes in vertical dimension and speech."

Spear F. Fundamental occlusal therapy considerations. In: McNeill C (ed). Science and Practice of Occlusion. Chicago:Quintessence, 1997:432.

Only one centric stop per tooth is needed for stability:

"A SIMPLIFIED OCCLUSAL SCHEME: CLINICAL GUIDELINES
…The buccal cusps of the mandibular posterior teeth occlude in the central fossa of the maxillary posterior teeth. There must be at least one occlusal contact per tooth to ensure axial stability by neutralizing the eruptive forces of the periodontium."

Wiskott H, Belser U. A rationale for a simplified occlusal design in restorative dentistry: Historical review and clinical guidelines. J Prosthet Dent 1995;73:169-183.

Mounted models:

It is recommended that all cases that would include significant occlusal changes—including increasing VDO—should have models mounted on an articulator for evaluation, treatment planning, and a diagnostic wax-up. Since I follow the centric relation philosophy of occlusion, my preference is to mount the models using a facebow and bite registration to position the models to reflect the mandibular position in CR.

Diagnostic wax-up:

1) determine whether and how much to open VDO: there is no magic formula for determining this; if the upper anterior teeth are to be lengthened resulting in more overbite, decide if that amount of overbite would be acceptable or you should compensate for at least some of the add'l overbite by increasing VDO (so it is helpful to have already calculated how much the upper anterior teeth will be lengthened, and whether the lower incisors will be lengthened, prior to deciding this) *Remember that humans can adapt to a wide range of VDO, so increase as needed to maximize the function and esthetic outcome*

2) adjust the pin on the articulator to allow for the desired overbite once anterior teeth are lengthened; at that new VDO you should also consider:

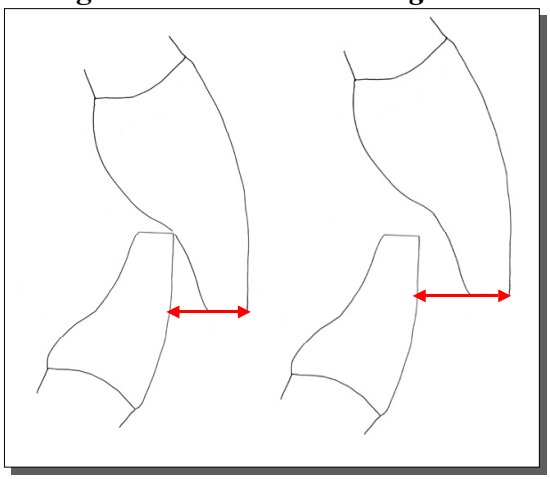
   • if the overjet is acceptable
   • if there is an appropriate amount of space to restore posterior teeth (if there is very little space, opening the bite may allow for much more ideal preps and restorations; if the space is such that the lower buccal cusp tips would have to be very long and pointed to achieve contact with the upper occlusal surfaces, it would be necessary to reduce the VDO to a more manageable increase *or* to build up the entire occlusal surface of the upper teeth)

3) send the mounted models for the wax-up with detailed instructions; tell the lab "don't prep the model" prior to applying wax—this is an additive procedure and prepping tooth structure on the model can lead to difficulty seating a template made from the wax-up; have the lab use a contrasting color wax so it is easy to tell where wax has been added to the model (duplicate the wax-up in white stone to have a more attractive model to show patients)

4) when the wax-up is complete, be sure the occlusion works as desired and the esthetics are appropriate

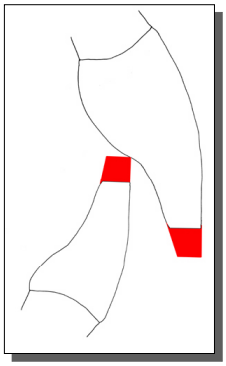
5) make a template from the wax-up—or from a duplicate model to avoid damaging the wax-up—to use as a guide for building the lingual surfaces and incisal edges of the anterior teeth (details on fabrication are below in "Template Technique.")

building anterior guidance while *increasing* V.D. in a Class I pt:



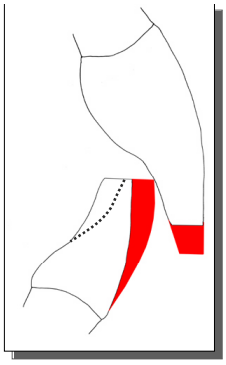
increasing V.D. also increases overjet
if mandible is in Centric Relation

there are 3 basic options to gain anterior centric stops when increasing V.D.:

1. 

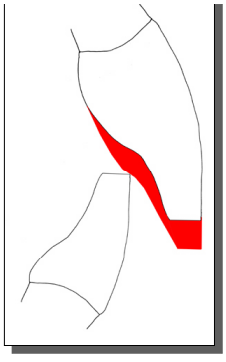
this option may seem simplest, but will cause lower incisal edges to appear longer than occlusal plane

least used option

2. 

this option can also be used to improve alignment of lower incisors

consider reducing linguals of lowers to avoid thick incisal edges

3. 

this option avoids need to treat lower incisors

guidance path will actually be made less steep
(which is advantageous with bruxers)

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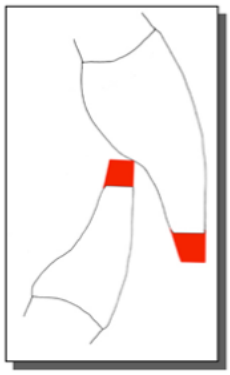
building anterior guidance while *maintaining* V.D. in a Class II patient:

same as Class I

building anterior guidance while *increasing* V.D. in a Class II pt:

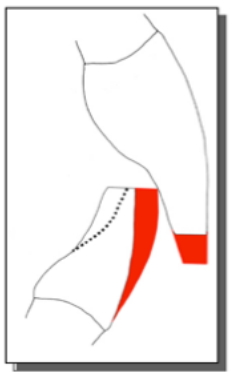
increasing V.D. also increases overjet so Class II pt's become *more* Class II

there are 3 basic options to gain anterior centric stops when increasing V.D.:

1. 

same as Class I

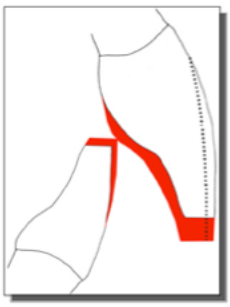
least used option since will often cause lower incisal edges to appear longer than occlusal plane

2. 

same as Class I

this option can also be used to improve alignment of lower incisors

consider reducing linguals of lowers to avoid thick incisal edges

3. 

difficult to accomplish centric stops on Class II pt's by only adding to linguals of upper anteriors

consider contouring enamel on facial of uppers to reduce protrusion (only able to gain slight improvement)

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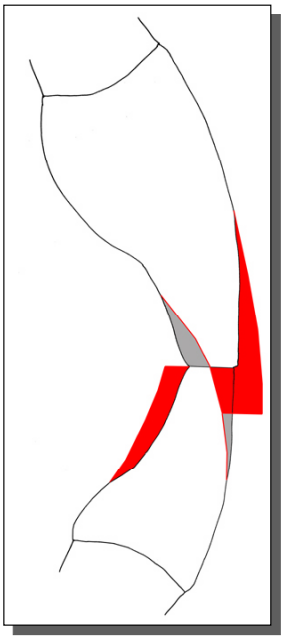
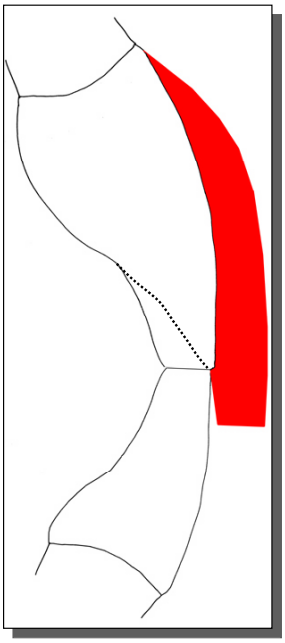
building anterior guidance while maintaining V.D. in a Class III pt:

if end-to-end occlusion with no anterior guidance, may be able to create guidance

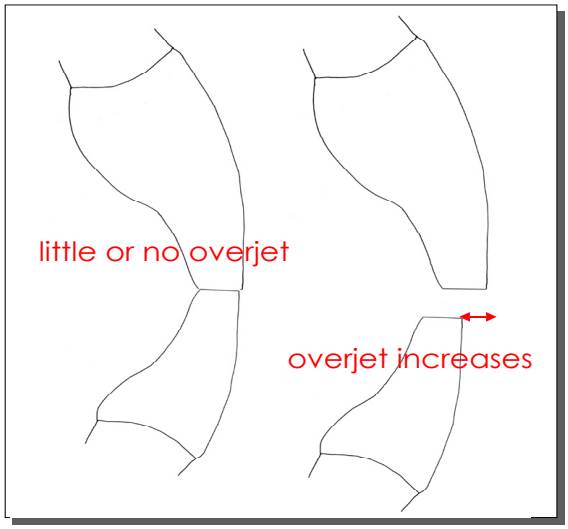
consider building out facial of uppers for more lip support, also reducing lingual for smoother lingual contour

consider reducing facial of lowers to decrease protrusion, also adding to linguals so incisal edge doesn't appear too thin



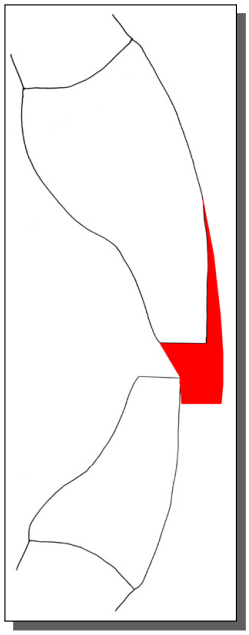


building anterior guidance while increasing V.D. in a Class III patient:



increasing V.D. also increases overjet; so can potentially turn a Class III pt into a Class I

most common option to gain anterior centric stops when increasing V.D. for Class III patients



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