
GERD-Eroded Smile Reimagined: A Multidisciplinary Approach to Restoring Function and Esthetic

— Jason Song —

Patient Background

- 27 yo - Hispanic Male
- CC: "I want anterior crowns after my ortho treatment"
- SH: non smoker, EtOH, lives in Pacifica. Spent time in Germany and South in the Army. Korea. Currently working as nurse.



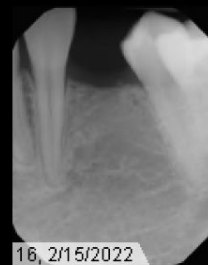
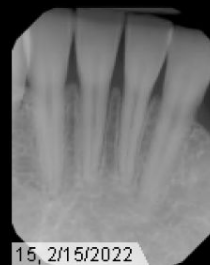
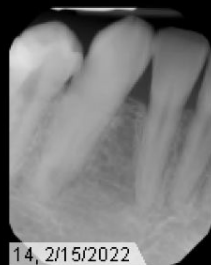
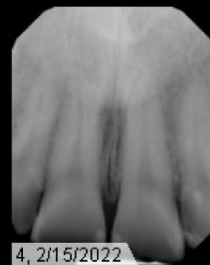
Dental History

- Had ortho tx in 2012 for approximately 2 years. 4 premolars extracted during tx
- #21 extracted due to infection over 10yrs ago
- Slight crossbite prior to orthodontic treatment.
- Highly restored
- Patient of UOP since 04/2022.

Health History

- ASA: II
- Previous history of Gastroesophageal reflux disease (GERD) during time in military
 - Previous treatment of omeprazole
 - Cleared medically – not experiencing any signs or symptom
- NKDA

FMX



Intraoral pictures



Arch pictures



Radiographic and Clinical Findings

- Fracture and lingual erosion of maxillary incisors and canine due to GERD, highly acidic diet, and time in military 2-3 years ago
 - Pt remarks that oral hygiene was not a priority and stress was high
- #7-10 lack appropriate biologic width for restorations
- #30 MOD comp with fractured distal mesial marginal ridge and shadowing under mesial box radiographically

Review of Literature - GERD and Erosive Tooth Wear

- **Gastroesophageal reflux disorder (GERD)** or chronic acid reflux disorder is a condition in which acid-containing contents continuously leak from the stomach and return to the esophagus
 - Hydroxyapatite dissolve at pH < 5.5, gastric reflux < 2
- **Erosive Tooth Wear:** loss of hard tooth substances due to acid exposure to exogenous (food and drink) and endogenous (stomach acid) sources
 - Upper incisors' palatal surfaces first
 - Posterior teeth erode in secondary stage
 - Cupping of teeth
 - Damage multiplied when combined with bruxism
- GERD is one of the leading causes of ETW
 - Recent systematic review involving 17 studies found that median prevalence was 32.5%¹
- GERD patients have significantly lower total protein concentrations in their **acquired enamel pellicle (AEP)**, potentially suggesting that these individuals may have compromised enamel resilience and increased susceptibility to erosion²

¹ Chakraborty A, Anjankar AP. Association of Gastroesophageal Reflux Disease With Dental Erosion. Cureus. 2022 Oct 17;14(10):e30381. doi: 10.7759/cureus.30381. PMID: 36407174; PMCID: PMC9667903.

² Alharthi R, Mutahar M, Bartlett D, Jafari J, Moazzez R. Salivary Proteins in Human Acquired Enamel Pellicle (AEP) on Eroded and Uneroded Teeth in Patients with Gastro-Oesophageal Reflux Disease (GORD). Dentistry Journal. 2024; 12(8):235. <https://doi.org/10.3390/dj12080235>

Intraoral and Extraoral Exam

- Extraoral exam
 - No visible swellings, CLAD, or trismus
- Intraoral exam
 - Bilateral linea alba
 - Tongue piercing
 - Lip, mucosa, FOM, palate otherwise unremarkable
- TMJ
 - asymptomatic

Periodontal Assessment

Dx: gingival health with localized plaque Induced gingivitis

Prognosis: Good

PQI: 0.7

ATP: 1249 (LOW)

CRA: Moderate Caries Risk

pH: 6.6

Oral Hygiene Habits:

- Electric toothbrush 2x/day
- Floss 3x/day

	3 2 3	3 2 3		3 2 3	2 1 3	3 2 3	3 2 3	3 2 3	3 2 3	3 2 3	4 2 3		3 2 3	3 2 3		PD
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														B		Bleed
	3 2 3	3 2 3		2 1 2		2 1 2	2 1 2	2 1 2	2 1 2		2 1 2		3 2 3	3 2 3		PD

Odontogram

1	2	3	4	5	P 6	P 7	P 8	P 9	P 10	P 11	12	13	14	P 15	16
M			M									M			M
M			M									M			M
32	31	30	29	28	27	26	25	24	23	22	21	20	P 19	P 18	17

Orthodontic Treatment

- Pt presented with cross bite and required lingual clearance for anterior crowns.
- Treatment to bring lower anteriors lingual and upper anteriors flared buccal to allow enough space for esthetic crowns
- Started treatment in 04/2022. Finished in 04/2024
- Create vertical and anteroposterior clearance for full coverage crowns
 - Necessary or prophylactic RCTs may be necessary
- Will likely need to intrude, retract, and retrocline lower anterior dentition



Review of Literature - Orthodontics Movements

- Developing symmetry of gingival margin

- Orthodontic Movements

- Advantage of orthodontic movements: entire attachment apparatus (osseous, PDL, and soft tissue) move with the teeth
 - Extrusive movements move the free gingival margin coronally at the same distance as the incisal edge moves

- Resective Techniques

- Basic gingivectomy with or without gingivoplasty
 - Full flap procedure incorporating osseous removal for crown lengthening of one or more teeth

Table 1. Methods of developing gingival harmony

Surgery	Orthodontics
Additive gingival techniques	Extrusion
Resective gingival techniques	Intrusion

Ideal Treatment Plan

- Urgent
 - Pt is not in any pain, nor presents with any active infection, no urgent treatment necessary
- Disease Control
 - Prophylaxis, OHI
 - Ideal 4-8 week recall for re-evaluation
 - #3 DOL composite
 - #30 Build up
- Reconstructive
 - #6-11 Lithium Disilicate Crowns
 - #5 and #12 Monolithic Zirconia Crown
 - Appointment 1: Periodontal Consult
 - Appointment 2: Records appointment with Kois Face-bow analyzer and PVS impression
 - Between appointments: Smile design wax-up
 - Appointment 3: Integrity Mockup
 - Appointment 4: #6-11 Surgical Crown Lengthening
 - 3-6 months of healing
 - Appointment 5-7: Prep and Temp #5-12
 - Prep teeth in pairs
 - Appointment 8: Final Impressions
 - Appointment 9: Prosthesis Delivery

Ideal Treatment Plan

- Reconstructive (cont.)
 - #30 crown
 - #22 Implant placement and crown
- Maintenance
 - Occlusal Night Guard
 - OHI review
 - Patient's oral hygiene tends to relapse if not constantly reviewed during maintenance³
 - Important for maintenance for restorations
 - 6 month Recall Examination and propy

³ Segelnick, S. L., & Weinberg, M. A. (2006). Reevaluation of initial therapy: when is the appropriate time?. *Journal of periodontology*, 77(9), 1598–1601. <https://doi.org/10.1902/jop.2006.050358>

Alternate Treatment Plan

- Urgent
 - Pt is not in any pain, nor presents with any active infection, no urgent treatment necessary
- Disease Control
 - Prophylaxis, OHI
 - Ideal 4 - 8 week recall for re-evaluation
 - #3 DOL composite
 - #30 Build up
- Reconstructive
 - #7-10 Lithium Disilicate Crowns
 - #5-6 and #11-12 Porcelain Veneers
 - #30 crown
 - #23 - 21 zirconia bridge
 - Maintenance
 - Occlusal Night Guard
 - OHI review
 - 6 month Recall Examination and prophylaxis

Material Choice

- #6-11: Lithium Disilicate for high aesthetics and to bond with Light Cure NX3 due to short preparations
 - Veneers contraindicated due to retention and exposed lingual dentin
 - Crowns provide functional support in occlusion and protects tooth structure from possible GERD relapse in the future
 - Patient is prone to cold sensitivity
- #5 and #12: Monolithic Zirconia for less reduction of sound tooth structure.
- Preparation Design
 - Minimal lingual preparation to preserve tooth structure

Review of Literature - Fundamentals of an Aesthetic Smile

- Three Primary Components of Smile Design

- Teeth
- Lip framework
- Gingival scaffold

- Teeth

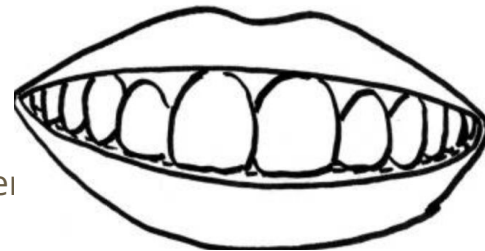
- Color, position, shape of teeth

- Lips

- **Low lip line:** only portion of teeth exposed
- **Medium lip line:** 1 to 3 mm of gingival exposed
- **High lip line:** large expanse of gingiva extending from inferior border free-gingival margin
- Level of the gingival margin **parallel** the form of the upper lip
 - Under ideal conditions, the gingival margin and the lip line should be congruent or there can be a **1–2 mm** display of the gingival tissue
- Fill the vestibule laterally extending to corner of the smile

Table 1. Methods of developing gingival harmony

Surgery	Orthodontics
Additive gingival techniques	Extrusion
Resective gingival techniques	Intrusion



⁴ Garber, D. A., & Salama, M. A. (1996). The aesthetic smile: diagnosis and treatment. *Periodontology* 2000, 11, 18–28.
<https://doi.org/10.1111/j.1600-0757.1996.tb00179.x>

Smile



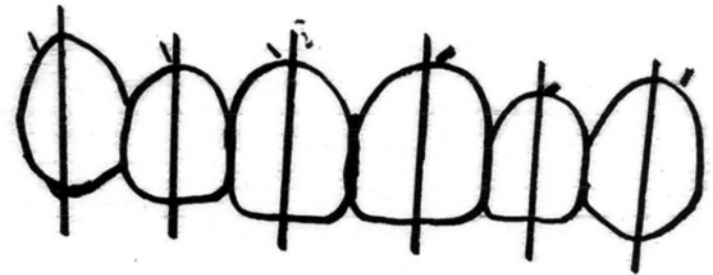
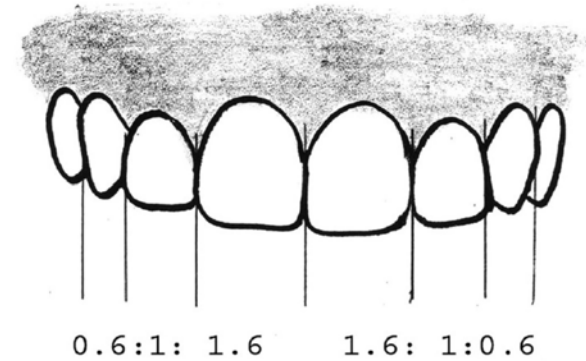
Smile Design

- Pt liked natural style or functional style for form of smile. Pt requests sharp canines similar to the natural style demonstration.



Review of Literature - Fundamentals of an Aesthetic Smile

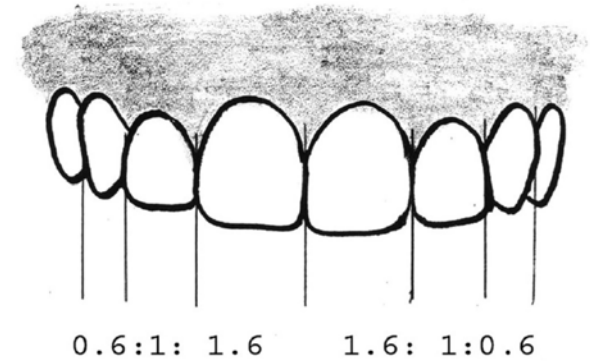
- Gingival Scaffold
 - Harmony/Continuity of form of free gingival margin
 - Bilateral symmetry
 - Symmetrical gingival levels for centrals are key.
 - Centrals' gingival level can align with canines.
 - Lateral incisors should be 0.5–2.0 mm below centrals for natural contour.
- Zenith points: most apical position of the cervical tooth margin where the gingiva is most scalloped
 - Slightly **distal** to the vertical line drawn down the center of the tooth
 - The lateral is an exception as its zenith point may be **centrally** located



³ Garber, D. A., & Salama, M. A. (1996). The aesthetic smile: diagnosis and treatment. *Periodontology* 2000, 11, 18–28. <https://doi.org/10.1111/j.1600-0757.1996.tb00179.x>

Review of Literature - Fundamentals of an Aesthetic Smile

- Golden Ratio
 - When viewed from the facial, the width of each anterior tooth is 60% of the width of the adjacent tooth
 - Measured intercanine-distance to approximate width and subsequently height of teeth ($0.8L = W$)
- Incisal lengths
 - Ideal degree of tooth display = 3.5mm
 - Phonetics
 - F and V sounds: Fricative sounds are produced by the interaction of the maxillary incisal edge with the inner edge of the lower lips' vermillion border



⁵ Bhuvaneswaran M. (2010). Principles of smile design. *Journal of conservative dentistry: JCD*, 13(4), 225–232. <https://doi.org/10.4103/0972-0707.73387>

Aesthetic Wax-up



Integrity Mock up



Integrity Mock up cont.



Incisal show at rest during integrity mock up



Current Biologic Width

Attached gingiva determined via bone sounding - PD

6 3 5	4 3 3	5 3 4	4 3 4	5 3 4	4 3 3
2 2 3	3 2 3	3 2 3	3 2 3	3 2 3	3 2 3
P 6	P 7	P 8	P 9	P 10	P 11



Biologic width = insufficient

2 1 3	3 2 3	3 2 3	3 2 3	3 2 3	3 2 3
2 0 3	3 0 3	3 0 3	3 0 3	3 0 3	3 0 3
0 1 0	0 2 0	0 2 0	0 2 0	0 2 0	0 2 0
6	7	8	9	10	11
2 1 2	2 2 2	2 1 2	2 2 2	2 2 2	2 2 2
	B B		B	B	
2 0 2	2 0 3	3 0 2	2 0 2	2 0 2	2 0 2
0 1 0	0 2 -1	-1 1 0	0 2 0	0 2 0	0 2 0

Review of Literature - Crown Lengthening

- Biologic Width

- Length of dentogingival junction: 2.04 mm (1.07 mm of CT attachment and 0.97 mm of epithelial attachment)
- **3 mm optimally**
 - Separating osseous crest from plaque associated with crown margins
 - Reduce risk of periodontal attachment loss
 - Too close to bone = chronic inflammation
- In a study of 10 jaws of cadavers, 15% of the restorations violated these dimensions with biological widths **less than 2.04 mm**, and the restoration margin was less than 2 mm from the osseous crest ⁷

- Gingival Biotype

- Thick versus Thin
- Perio probe visible in sulcus?

⁷Vacek, J. S., Gher, M. E., Assad, D. A., Richardson, A. C., & Giambarrresi, L. I. (1994). The dimensions of the human dentogingival junction. *The International journal of periodontics & restorative dentistry*, 14(2), 154–165.

Crown Lengthening Surgery

- Used 15 blade to create a full thickness scalloped incision extending from tooth #5 to #12 on buccal and palatal mucosa.
- Reflected FTMP flap to expose bone using Molt 9 periosteal elevator
- Removed bone surrounding #7, 8, 9, 10 to create 4mm biologic with using end-cutting burs, surgical handpiece, and copious sterile saline irrigation
- Sutured using 4-0 chromic gut to create vertical mattress on each papilla involved in flap.
- Primary closure achieved and hemostasis observed.

Surgery pictures



Press-down splint used for precise finish line of gingival margin

Review of Literature - Crown Lengthening

- **Crown-lengthening** is a surgical procedure to expose more of the tooth structure by removing gum tissue, and sometimes bone, for restorative or aesthetic purposes.
- **Indications:** insufficient tooth structure to support restoration, correct gummy smiles, improve contours for dental health
 - More cleansable gingival embrasure areas adjacent to full-coverage crowns.
- Functional versus Aesthetic
 - **Functional:** Performed to expose more tooth structure when a restoration (like a crown) is required.
 - **Aesthetic:** Done to improve smile appearance by reshaping gum and bone.

⁶ Hempton, T. J., & Dominici, J. T. (2010). Contemporary crown-lengthening therapy: a review. *Journal of the American Dental Association* (1939), 141(6), 647–655. <https://doi.org/10.14219/jada.archive.2010.0252>

Review of Literature - Crown Lengthening

- **Ferrule:** allows forces of occlusion to be dispersed onto the PDL → reduces likelihood of failure
 - Ideal amount 1.5 mm⁸
 - Greatest amount of retention and resistance to dislodgment of restoration occurs at the **apical one-third** of prep
- **Contraindications:** increasing ferrule length will reduce root length invested in bone and possibly make crown-root ratio unfavorable
 - Pt's crown-root ratio 1:3
- Lengthening the crown of a tooth with minimal supragingival tooth structure may involve additional surgical removal of tissue.

⁸ Libman, W. J., & Nicholls, J. I. (1995). Load fatigue of teeth restored with cast posts and cores and complete crowns. *The International journal of prosthodontics*, 8(2), 155–161.

Review of Literature - Crown Lengthening

- Osseous Resection versus Laser
 - Concerns
 - Quantity and quality of residual gingival tissue
 - Height of gingiva present on F and L aspect of the involved teeth
 - 3 mm of attached gingiva¹⁰
 - Gingivectomy can completely remove attached gingival tissue
 - Laser
 - Minimal to no bleeding
 - Place restoration immediately
 - Surgical
 - Apically placed flap can preserve amount of gingiva while also **increasing** the width of the attached gingiva after healing
 - Tissue is the issue, but the bone sets the tone⁹
 - In an esthetic crown-lengthening procedure, bone removal plays an important role in the final location of the free gingival margin after healing.
 - Methods:
 - High-speed rotary, piezoelectric cutting device, hand chisel

⁹ Garber DA, Salama H, Salama MA. *Multidisciplinary cases: lessons learned*. Paper presented at: 24th Annual Meeting of the American Academy of Esthetic Dentistry; Whistler, British Columbia, Canada; Aug. 6, 1999

¹⁰ Maynard, J. G., Jr, & Wilson, R. D. (1979). Physiologic dimensions of the periodontium significant to the restorative dentist. *Journal of periodontology*, 50(4), 170–174. <https://doi.org/10.1902/jop.1979.50.4.170>

2 Week Post-op



2 Week Post-op



Review of Literature - Healing after Crown Lengthening

- Between immediate postsurgery and follow-up, gingival margin may rebound, largely during the first three postoperative month ¹²
 - At 3 months, FGM position on treated teeth was on average 0.58 mm and 0.63 mm coronal to its immediate postoperative position
 - Final position determined primarily by **technical factors** like (flap margin position relative to osseous crest, amount of osseous resection, tooth root preparation) and secondarily on **anatomical factors** (periodontal biotype)¹¹
 - Rebound = thick biotypes
 - Recession = thin biotypes
- The final position of the free gingival margin can occur at **three** months after surgery but may occur as long as **six** months after surgery.
 - No further significant changes in the vertical position of the free gingival margin were apparent after 6 months.
 - Periodontal tissues stable with minimal changes ¹³
- Restorative Tx generally initiated 6 weeks after CLP, final delivery after 3 months

¹¹ Pilalas I, Tsalikis L, Tatakis DN. Pre-restorative crown lengthening surgery outcomes: a systematic review. J Clin Periodontol 2016; 43: 1094–1108. doi: 10.1111/jcpe.12617.

¹² Pontoriero R, Carnevale G. Surgical crown lengthening: a 12- month clinical wound healing study. J Periodontol 2001;72(7):841-848.

¹³ Brägger U, Lauchenauer D, Lang NP. Surgical lengthening of the clinical crown. J Clin Periodontol 1992;19(1):58-63

6 Week Post-op



Review of Literature - Healing after Crown Lengthening

- Between immediate postsurgery and follow-up, gingival margin may rebound, largely during the first three postoperative month ¹²
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Prep and Temp #7-10



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Thank You

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