Common Facial Proportions

- Used in many other specialties: plastic surgery, orthodontics
- Average head to body ratio is 1:7
- Desired professional model head to body ratio is 1:8

Rule of Fifths

- Divided into equal fifths
- Each fifth is an eye width

Golden Proportion

- Attributed to Pythagoras
- Explains the beauty in nature to the harmony of mathematics

- Used by da Vinci
Golden Proportion

- Width of Anterior Teeth in Golden Proportion to the Inter-commissural Width

Anterior 6 too wide

Anterior 6 too narrow

House” Proportion

- Central Incisor is 1/16th the Width of Inter-Zygomatic Width

House MM, Loep LJ - Monograph 1937
"Form and Color Harmony in the Dental Art"
- Central Incisor is 1/16th the Length from Ideal Hairline to Chin
  - House MM, Loop JL - Monograph 1937
  - "Form and Color Harmony in the Dental Art"

- Use Trubyte indicator to determine proportions
  - Trubyte Proportion Guide

- Using Inter-pupillary width for width of central incisor

- Central Incisor Width to Height ratio

  Ideal Width to Height ratio = 78%
  - Sterrett et al - J Clin Periodontol 1999

  "Width/length ratios of normal clinical crowns of the maxillary anterior dentition in man"
Width to Height ratio of Central Incisor = 78%

Chu’s Aesthetic Gauges

Golden Proportion (Tooth-to-Tooth Width)

Levin - JPD 1978
"Dental Esthetics and the Golden Proportion"

"The widths of the maxillary central incisors are in golden proportion to the lateral incisors as seen from the frontal"

1.618 X 62% = 1
1 X 62% = 0.618

Golden Mean (Tooth-to-Tooth Width)

Snow - JED 1999
"Esthetic Smile Analysis of Anterior Tooth Width: The Golden Percentage"

“The widths of the maxillary central incisors, lateral incisors, & canines should be 25%, 15%, & 10% of the total frontal view width of the anterior 6 teeth”

CI = 25% ICW
LI = 15% ICW
C = 10% ICW

Repeated Ratio (Tooth-to-Tooth Width)

Lombardi - JPD 1973
"The principles of visual perception and their clinical application to denture esthetics"

“The existing proportion between the width of the maxillary central incisor and lateral incisor should be consistent as you progress distally”

LI = CI * 66%
C = LI * 84%

Preston Proportion (Tooth-to-Tooth Width)

Preston - JED 1993
"The golden proportion revisited"

“The golden proportion was found in the relationship between the perceived width of the maxillary central and lateral incisors in only 17% of observed images”

LI = CI * 66%
C = LI * 84%

Tooth to Tooth Width Proportions

Problem is none relate tooth width proportions with tooth height
The proportion between the successive widths of the teeth as viewed from the frontal should remain constant as you move distally.

Without pre-existing constraints

Sample RED Proportions

Selecting RED Proportions

Purpose of Preliminary Study

...to determine how dentists rate anterior tooth arrangements with different tooth-to-tooth width proportions and whether the best-ranked tooth proportions are affected by inciso-gingival tooth length.
Materials and Methods

Ideal Imaged Retracted Natural Smile

Problem is none relate tooth width proportions with tooth height

Materials and Methods

Survey Set | A          | B          | C          | D          
-----------|------------|------------|------------|------------
Very Tall  | Golden Proportion | 80% RED Proportion | Normal | 70% RED Proportion |
Normal     | Normal | Golden Proportion | 80% RED Proportion | 70% RED Proportion |
Very Short | Normal | 80% RED Proportion | 70% RED Proportion | Golden Proportion |
Short      | 70% RED Proportion | Golden Proportion | 80% RED Proportion | Normal |
Tall       | Golden Proportion | 80% RED Proportion | Normal | 70% RED Proportion |

Materials and Methods

3342 emails sent to dentists in 38 countries

Results

549 dentists responded from 38 countries (470 from US or Canada counted)

Summary Preferred

62% RED Proportion
The majority of dentists surveyed chose central incisors that were as close to 0.75-0.78 width/height ratio as possible.

Preferred RED Proportions

The image shows preferred RED proportions for central incisors.

Width/Length Ratio of Central Incisors

The image compares naturally observed and dentist-preferred width/length ratios of central incisors.

References:
Summary

- The taller the tooth, the smaller the preferred RED Proportion
- The shorter the tooth, the larger the preferred RED Proportion
- The 78% w/h ratio of the central incisor should be maintained
Validity of the RED Proportion

Is the RED Proportion found in nature?
If not is the RED Proportion preferred to Proportions found in nature?

Observed Proportions

“The Golden Proportion and Recurring Esthetic Dental (RED) Proportion were not found to exist between the maxillary anterior teeth of the natural dentition.”

(Photos of 376 Jordanian dental students)

Preferred Proportions

“a majority of dentists surveyed considered smiles with a width proportion greater than 69.9% between the maxillary central incisor and lateral incisor, to be esthetically acceptable”

Materials and Methods

Ideal Smile: 78% w/h ratio CI, 70% RED
Materials and Methods

Set | View A | View B
--- | --- | ---
1 | Golden Proportion (same length maxillary anterior teeth as Preston Proportion) | Golden Mean (same length maxillary anterior teeth as Preston Proportion) 
2 | Preston Proportion (78% w/h ratio central incisor) | Golden Proportion (same length maxillary anterior teeth as Preston Proportion)
3 | Golden Proportion (same length maxillary anterior teeth as Preston Proportion) | 70% RED Proportion (78% w/h ratio central incisor)
4 | Preston Proportion (78% w/h ratio central incisor) | 70% RED Proportion (78% w/h ratio central incisor)
5 | Tall Preston Proportion (same length maxillary anterior teeth as Tall Golden Proportion) | Tall Golden Proportion (78% w/h ratio central incisor)

Survey Participants

301 NA dentists from 36 states & provinces across 12 groups throughout US prior to lecture.
Golden Mean
No Statistical Preference

Preston Proportion

Golden Proportion

70% Preference
Golden Proportion

70% RED Proportion

70% RED Proportion

75% Preference
Preston Proportion

70% RED Proportion

70% RED Proportion
57% Preference

Tall

Preston Proportion
Golden (62% RED) Proportion

Golden (62% RED) Proportion
58% Preference

Primary Factor Influencing Decision

Conclusions
Smiles created using the principles of the RED Proportion where preferred by a majority of North American dentists surveyed.

Overall balance was the primary deciding factor
Clinical Significance
The RED Proportion may be useful in creating smiles preferred by North American dentists.

Clinical Significance
75% of NA dentists preferred the RED Proportion when designing smiles with normal length teeth over the GP.

Clinical Significance
Applying the GP universally should be reconsidered since it was found to be the least pleasing and accepted for normal length teeth.

62% RED Proportion used with Tall Teeth

70% RED Proportion used with Normal Teeth

80% RED Proportion used with Short Teeth
**RED Proportion Principles**

- Central Incisor should maintain 78% width/height ratio
- The taller the central incisor the wider it should be
- The taller the central incisor the smaller the RED Proportion used
- The taller the central incisor the more dominant it becomes in the arch
- The wider the central incisor the narrower the resulting lateral incisor and canine

**RED Proportion Principles**

- The shorter the central incisor the narrower it should be
- The shorter the central incisor the larger the RED Proportion used
- The shorter the central incisor the more similar the relative individual tooth widths
- The narrower the central incisor the wider the resulting lateral incisor and canine
- Clinical judgment is paramount

**Average Length Face**

- 70% RED

**Short Length Face**

- 80% RED

**Tall Length Face**

- 62% RED

**Average**

- 70% RED

**Short**

- 80% RED

**Tall**

- 62% RED
Correlation exists between “beauty, nature and mathematics.”

Objective Smile Design must include the analysis of tooth proportions.

Perspective for analysis is frontal view.

FIVE STEPS

STEP one
**Measurement Worksheet**

**STEP two**

**COMPLETE PHOTOGRAPHIC MEASUREMENTS**

**CALCULATE CONVERSION FACTOR**

- Cast Length Central Incisor: 9.0 mm
- Photo Length Central Incisor: 25.0 mm
- Conversion factor = 9/25 = 0.36

**MULTIPLY PHOTO MEASUREMENTS X CONVERSION FACTOR**

Conversions factor = 9/25 = 0.36

Conversion factor X Photograph Widths = "FIVE Widths"

**EFFECTS OF CAMERA ANGLE**
RESULTS:

Central Incisor accurate +/- 15°

Lateral incisors within 5% +/- 10°

Cuspids within 10% +/- 5°

CONCLUSION:

Ideal camera angle within 5° of parallel

CALCULATE W/H RATIO OF CENTRAL INCISORS

7.4 / 8.1 = 0.91 or 91%

CALCULATE RED PROPORTIONS

1.0 / 4.5 = 0.22 or 22%

Completed Measurement Worksheet
**Determine Incisal Edge**

**STEP three**

**DESIR ED INCISAL EDGE POSITION**

- Esthetics
- Phonetics
- Anterior guidance/Occlusion

**Evaluate RED proportions**

**STEP four**

**EVALUATE RED PROPORTIONS**

<table>
<thead>
<tr>
<th>RED Proportion</th>
<th>10%</th>
<th>20%</th>
<th>30%</th>
<th>40%</th>
<th>50%</th>
<th>60%</th>
<th>70%</th>
<th>80%</th>
<th>90%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central incisor to gingival edge</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red proportion</td>
<td>10%</td>
<td>20%</td>
<td>30%</td>
<td>40%</td>
<td>50%</td>
<td>60%</td>
<td>70%</td>
<td>80%</td>
<td>90%</td>
<td>100%</td>
</tr>
</tbody>
</table>

**EVALUATE RED PROPORTIONS**

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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Red proportion</td>
<td>10%</td>
<td>20%</td>
<td>30%</td>
<td>40%</td>
<td>50%</td>
<td>60%</td>
<td>70%</td>
<td>80%</td>
<td>90%</td>
<td>100%</td>
</tr>
</tbody>
</table>

**Treatment & Blueprint**

**STEP five**
Using RED to determine tooth widths

- Total intercuspid width
- \[ \frac{2(1+\text{RED}+\text{RED}^2)}{\text{Width of Central Incisor}} \]

TOO COMPLICATED

Simplified Clinical Application

- Total intercuspid width
- \[ \frac{2(1+\text{RED}+\text{RED}^2)}{\text{Width of Central Incisor}} \]

Substitute values and pre-solve the equation

Simplified RED Proportion Application

METHOD 1
Using ICW and Simple Tooth Height to determine the sizes of the Maxillary Anterior Six Teeth

Use Inter-Canine Width to Determine Ideal Central Incisor

STEP 1: Determine Tooth Height

- TALL
- NORMAL
- SHORT

STEP 2: Measure Inter-Canine Width

www.erskinedental.com
STEP 3a-Divide Inter-Canine Width by factor for CIW

If normal length

Canine-Canine Width

4.4

70% RED

STEP 3b-Multiply CIW* 70% for Lateral Incisor Width

If normal length

Lateral Incisor Width

0.7

70% RED

STEP 3c-Multiply LIW * 70% for CW

If normal length

Canine Width

0.7

70% RED

STEP 3a-Divide Inter-Canine Width by factor

If very tall length

Canine-Canine Width

4.0

62% RED

STEP 3b-Multiply CIW* 62% for Lateral Incisor Width

If very tall length

Lateral Incisor Width

0.62

62% RED

STEP 3c-Multiply LIW* 62% for Canine Width

If very tall length

Canine Width

0.62

62% RED
STEP 3a - Divide Inter-Canine Width by factor

If very short length

Canine-Canine Width

4.8

80% RED

STEP 3b - Multiply CIW * 80% for Lateral Incisor Width

If very short length

Lateral Incisor Width

*0.80

80% RED

STEP 3c - Multiply LIW * 80% for Canine Width

If very short length

Canine Width

*0.80

80% RED

Using RED to determine individual tooth widths

Ward DH. Using the RED Proportion to Engineer the Perfect Smile. Dent Today 2008;27(8):112-117.
## Summary

<table>
<thead>
<tr>
<th>Tooth Height</th>
<th>RED</th>
<th>Central Incisor Width (mm)</th>
<th>Upper Incisor Width</th>
<th>Canine Width</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Tall</td>
<td>65%</td>
<td>7.0</td>
<td>CPW * 2.7</td>
<td>CPW * 2.7</td>
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<tr>
<td>Tall</td>
<td>60%</td>
<td>6.5</td>
<td>CPW * 2.5</td>
<td>CPW * 2.5</td>
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<tr>
<td>Normal</td>
<td>55%</td>
<td>6.0</td>
<td>CPW * 2.3</td>
<td>CPW * 2.3</td>
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<tr>
<td>Short</td>
<td>70%</td>
<td>4.8</td>
<td>CPW * 2.2</td>
<td>CPW * 2.2</td>
</tr>
<tr>
<td>Very Short</td>
<td>80%</td>
<td>4.6</td>
<td>CPW * 2.0</td>
<td>CPW * 2.0</td>
</tr>
</tbody>
</table>

*(with interpolations)*

---

**Hands-On Exercise One**

**Obtain Image**

**Fill Out Full Face Evaluation Form-Page 1**
Incisal Edge Determinants
- Esthetics
- Phonetics
- Anterior guidance / Occlusion

Measurement Worksheet

Imaging

Lengthen incisal edge #9 - 0.5mm

Imaged with Perio Surgery
After Post Perio Surgery

Using Inter-Cuspid Width & Central Incisor Height for RED

- Total intercuspid width
- \( \frac{2(1+RED+RED^2)}{\text{Width of Central Incisor}} \)

(solve for RED substituting desired 78% w/h ratio of central incisor)

Determining RED for 78%w/h ratio central incisor

\[ \text{ICW} \times \sqrt{3 - 0.5} = \text{RED} \]

TOO COMPLICATED

Using Inter-Cuspid Width & Central Incisor Height for RED

- Total intercuspid width
- \( \frac{2(1+RED+RED^2)}{\text{Width of Central Incisor}} \)

(solve for RED substituting desired 78% w/h ratio of central incisor)

Simplified RED Proportion Application

METHOD 2

Using ICW and Central Incisor Tooth Height to determine the sizes of the Maxillary Anterior Six Teeth
Simplified use of RED to determine individual tooth widths

- Measure Frontal View Inter-Canine Width

- Divide Inter-Canine Width by Central Incisor Height to give Quotient

- Lookup Quotient in Chart for RED & Tooth Sizes

- Central Incisor = ICW/4.38
- Lateral Incisor = ICW/8.26
- canine = ICW/8.94

Ward DH. Using the RED Proportion to Engineer the Perfect Smile. Dent Today 2008;27(8):112-117.
Using relative central incisor length to determine RED proportion and central incisor length and width

• Measure
  Frontal View
  Inter-Canine Width


Using relative central incisor length to determine RED proportion and central incisor length and width

• Choose desired relative Central Incisor Height

Using relative central incisor length to determine RED proportion and central incisor length and width

<table>
<thead>
<tr>
<th>Tooth Height</th>
<th>Desired RED proportion</th>
<th>CIW</th>
<th>CIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Tall</td>
<td>62% RED</td>
<td>ICW/4</td>
<td>ICW/1.1</td>
</tr>
<tr>
<td>Tall</td>
<td>66% RED</td>
<td>ICW/4.2</td>
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<td>Normal</td>
<td>70% RED</td>
<td>ICW/4.4</td>
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<tr>
<td>Short</td>
<td>75% RED</td>
<td>ICW/4.6</td>
<td>ICW/1.4</td>
</tr>
<tr>
<td>Very Short</td>
<td>80% RED</td>
<td>ICW/4.8</td>
<td>ICW/1.48</td>
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</tbody>
</table>

Lookup associated quotient and divisors

Using relative central incisor length to determine RED proportion and central incisor length and width

<table>
<thead>
<tr>
<th>Tooth Height</th>
<th>Desired RED proportion</th>
<th>CIW</th>
<th>CIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>70% RED</td>
<td>ICW/4.4</td>
<td>ICW/1.4</td>
</tr>
</tbody>
</table>

Using desired central incisor length to determine RED proportion and central incisor length and width

- Measure
  - Frontal View
  - Inter-Canine Width

Using desired central incisor length to determine RED proportion and central incisor length and width

- Choose desired
  - Central Incisor Height (DCIH)
  - 7-13mm

Simplified RED Proportion Application

**METHOD 4**

Using ICW and Desired Tooth Height to determine the width and height of the Maxillary Central Incisor

- Measure
  - Frontal View
  - Inter-Canine Width

- Choose desired
  - Central Incisor Height (DCIH)
  - 7-13mm
Using desired central incisor length to determine RED proportion and central incisor length and width

- Divide ICW by DCIH to give quotient

Using desired central incisor length to determine RED proportion and central incisor length and width

- Lookup Quotient for RED & Divisors

<table>
<thead>
<tr>
<th>Quotient</th>
<th>Tooth Height</th>
<th>RED Proportion</th>
<th>Central Incisor Width</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.3</td>
<td>Very Tall</td>
<td>62% RED</td>
<td>ICW/3.3</td>
</tr>
<tr>
<td>3.25</td>
<td>Tall</td>
<td>66% RED</td>
<td>ICW/3.25</td>
</tr>
<tr>
<td>3.4</td>
<td>Average</td>
<td>70% RED</td>
<td>ICW/3.4</td>
</tr>
<tr>
<td>3.5</td>
<td>Short</td>
<td>76% RED</td>
<td>ICW/3.5</td>
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<tr>
<td>3.8</td>
<td>Very Short</td>
<td>80% RED</td>
<td>ICW/3.8</td>
</tr>
</tbody>
</table>

Using desired central incisor length to determine RED proportion and central incisor length and width

- Divide ICW by divisors for CIW and CIL

Never underestimate the power you have to change patient’s lives