Is Lateral Cephalogram Necessary in Orthodontic Treatment Planning?

Dr Wong Pik Yong
DDS, MSc, MOOrth (RCS Eng)

Dr Stephen Chadwick
FDS, RCS Edin, MSc, MOOrth
INTRODUCTION

- Cephalometry: measurement of head
- First described direct measurement of dried skulls in antroplogy before 1900.
- Cephalometric radiography was introduced by Hofrath & Broadbent (1931)
INTRODUCTION

- Apparatus comprised of 3 components:
  - x-ray machine
  - image receptor system
  - cephalostat
• Standardised & reproducible nature of the projection
• Distance between x-ray source to the mid-sagittal plane of patient is fixed at 5 feet
• Distance from the mid-sagittal plane to the film cassette → individual magnification factor
• A cephalometric analysis can be obtained from tracing of cephalogram
• Various linear and angular measurements for:
  – Skeletal discrepancy in anterior-posterior and vertical dimension
  – Labio-lingual angulation of the incisors
  – Soft tissue analysis
• Superimposition of serial cephalograms allows study of growth and treatment effect
• Increasing public awareness on health risk from radiation exposure
• Radiation dose from cephalogram: 2-3μSv
  – Exposure to background (natural) radiation and man-made sources approx 4mSv /year (Visser et al, 2001)
• Cost to production, analysis & storage of radiographs
• Use of radiographs in orthodontics should be justified
Orthodontic records:

- clinical notes
- study model
- clinical photographs
- radiographs (lateral cephalometric radiograph & orthopantomogram) & its analysis
- laboratory sheet
- consent form
- correspondence between health professionals
INTRODUCTION

Clinical examination & diagnosis

Pre-treatment records (photos, x-rays, study model)

TREATMENT PLANNING

Extraction? Which teeth?

Anchorage needed?

Need orthognathic surgery?

Other factors?

Dental health/cooperation

Type of appliance? Fixed or removable?

Type of intervention? Interceptive/growth modification/camouflage

Other factors? Dental health/cooperation

Dental health/cooperation
What does the literature say?

Study models alone provided adequate information for tx plan in 55% of patients.

Clinical examination supplemented with s/model & photos provided adequate info for ortho tx planning.

To date limited number of publications. Controversial results due to variation in methodology.
Systematic review (Rischen 2013).

Ceph might influence tx planning in bimaxillary protrusion & Class II/2.

Ceph does not influence treatment planning for Class II/1 adolescents.

Han et al 1991
Bruks et al 1999
Han et al 1991
Pae et al 2001
Nijkamp et al 2008

JSM 2015_ORAL PRESENTATION_PYWONG
Aims of study

To investigate the influence of lateral cephalogram on orthodontic treatment planning by comparing the treatment plans made with and without these radiographs.

To determine whether the case complexity affects the influence of lateral cephalograms on treatment planning.

To evaluate the level of confidence for orthodontists in planning treatment without lateral cephalograms.
What have we done?

- Cross-sectional study
- Orthodontic department, University Dental Hospital of Manchester, UK
What have we done?

**Inclusion criteria:**
- Up-to-date, complete & clinically acceptable pre-treatment records

**Exclusion criteria:**
- Presence of syndrome/craniofacial malformation

30 sets of orthodontic pre-treatment records

**Group A (n=18)**
- Easy, mild & moderate
- ICON score ≤ 63

**Group B (n=12)**
- Difficult & very difficult
- ICON score > 63
What have we done?

1. What appliance type would you use?
2. Do you anticipate anchorage support?
3. Would you extract teeth on mandibular arch? Pls specify...
4. Would you extract teeth on maxillary arch? Pls specify...
5. Would you consider orthognathic surgery?
6. How confident are you in planning this case without lateral cephalogram?

13 orthodontists examined 30 cases and planned treatment.
What have we done?

13 orthodontists examined 30 cases and planned treatment

Questionnaire:
1. What appliance type would you use?
2. Do you anticipate anchorage support?
3. Would you extract teeth on mandibular arch? Pls specify...
4. Would you extract teeth on maxillary arch? Pls specify...
5. Would you consider orthognathic surgery?

Minimum 4 weeks interval
Questionnaire:

1. What appliance type would you use?
2. Do you anticipate anchorage support?
3. Would you extract teeth on mandibular arch? Pls specify...
4. Would you extract teeth on maxillary arch? Pls specify...
5. Would you consider orthognathic surgery?

Intra-examiner reliability
Minimum 4 weeks interval
What did we look at?

Primary outcome measure:
- the Kappa agreement for treatment planning made with and without lateral cephalograms

Secondary outcome measure:
- confidence of participants to plan treatment without cephalogram
Statistical analysis (SPSS version 20):

- Cohen Kappa agreement (Landis & Koch 1977):

<table>
<thead>
<tr>
<th>Kappa statistics</th>
<th>Strength of agreement</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;0.00</td>
<td>Poor</td>
</tr>
<tr>
<td>0.00 – 0.20</td>
<td>Slight</td>
</tr>
<tr>
<td>0.21 – 0.40</td>
<td>Fair</td>
</tr>
<tr>
<td>0.41 – 0.60</td>
<td>Moderate</td>
</tr>
<tr>
<td>0.61 – 0.80</td>
<td>Substantial</td>
</tr>
<tr>
<td>0.81 – 1.00</td>
<td>Almost perfect</td>
</tr>
</tbody>
</table>

What did we look at?
What did we look at?

**Statistical analysis:**

- One-way ANOVA test to detect significant difference between the means of Kappa agreement
- Level of confidence = 
  \[
  \frac{\text{Number of cases which are confident to plan}}{\text{Total number of cases examined}} \times 100\%
  \]
Intra-examiner reliability

• Mean Kappa agreement between T2 and T3 = 0.686 (SD= 0.088)

• ‘Substantial agreement’

• Only 8 out of 13 participants had completed Session 3 (T3) in this study
Did the presence of cephalogram influence the consistency of treatment planning between T1 & T2?

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A (n=18)</td>
<td>0.637</td>
<td>0.120</td>
</tr>
<tr>
<td>Group B (n=12)</td>
<td>0.689</td>
<td>0.071</td>
</tr>
<tr>
<td>Total 30 cases</td>
<td>0.661</td>
<td>0.080</td>
</tr>
</tbody>
</table>

No statistical significant difference between the two groups A & B ($p=0.164$).
What have we found?

Consistency between T1 & T2 for different aspects of treatment planning:

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appliance type</td>
<td>0.752</td>
<td>0.095</td>
</tr>
<tr>
<td>Anchorage consideration</td>
<td>0.518</td>
<td>0.228</td>
</tr>
<tr>
<td>Extraction decision</td>
<td>0.486</td>
<td>0.119</td>
</tr>
<tr>
<td>Orthognathic surgery</td>
<td>0.562</td>
<td>0.143</td>
</tr>
</tbody>
</table>

Difference for mean was significant ($p=0.001$)
How confidence were the participants to plan treatment without cephalograms?

• Varied from 20% to 100%, with an average of 65.8%.

• Level of confidence did not reflect clinical experience of individual participants.
Was the level of confidence correspond with consistency in treatment planning?

Pearson’s correlation coefficient between the consistency in treatment planning and confidence to plan without cephalograms was 0.323.
Conclusions

• Presence of lateral cephalograms did not significantly influence the orthodontic treatment plan, regardless of the case complexity.
• It has more influence on the extraction decision and anchorage consideration.
• No strong correlation between confidence of an orthodontist to plan treatment without cephalogram and consistency in planning on different occasions.
So what?

• Results of this study did not preclude the value of cephalograms in orthodontics as:
  – it provides baseline information to evaluate growth and treatment effect
  – it provides additional info to aid in diagnosis
  – it forms part of medical records

• Cephalograms may not necessary in non-growing patients with simple malocclusion treated on non-extraction basis
THANK YOU FOR YOUR KIND ATTENTION