Ontology of Orofacial Pain to Improve Patient Care

Werner CEUSTERS, MD
Depts of Biomedical Informatics and Psychiatry
Jacobs School of Medicine and Biomedical Sciences
University at Buffalo
I’m not an expert in TMD, but ...

The discipline of ‘Ontology’

Describing reality within a taxonomy of precisely defined entities

<table>
<thead>
<tr>
<th>Independent Continuant</th>
<th>Dependent Continuant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material Entity</td>
<td>Quality</td>
</tr>
<tr>
<td>Joint</td>
<td>Shape</td>
</tr>
<tr>
<td>TMJ</td>
<td>Disposition</td>
</tr>
<tr>
<td></td>
<td>Function</td>
</tr>
<tr>
<td></td>
<td>Chewing function</td>
</tr>
</tbody>
</table>
The discipline of ‘Ontology’

Describing reality within a taxonomy of precisely defined entities

Theoretical ontology → work of ontologists

Independent Continuant
Material Entity
Joint
TMJ

Dependent Continuant
Quality
Shape
Disposition
Function
Chewing function

Applied ontology → work of ontologists and domain experts
Talking about definition(s) for TMD(s)?

- Many papers about classifications of TMDs or diagnosis of TMD don’t mention a definition.
  - ‘We defined the target group, those having pain-related TMD, as those having a diagnosis of pain-related TMD’

- None pass ontological muster:
  - the TMDs are a set of conditions affecting the masticatory muscles, temporomandibular joints (TMJ), and related structures.
Without ontologists ... 

- creating terms and definitions quickly runs awry:
  - ‘Pain is a sensorial and emotional experience ...’
    - ‘knee pain’ → emotional experience in your knee?
  - ‘13.1.2.4 Painful Trigeminal neuropathy attributed to MS plaque’ comes with the clarification ‘Trigeminal neuropathy induced by MS plaque’;
    - The term suggests an opinion on the side of the clinician,
    - The description suggests a causal relation on the side of the patient.

- Perspectives from outside the domain are more difficult to account for.
  - Theoretical ontology → domain independent!
Three ontological perspectives relevant to the TMD problem

1. The biological / physiological perspective.

2. The epistemic perspective.

3. The BioPsychoSocial perspective:
   3a. The objective interpretation,
   3b. The subjective interpretation.
(1) The biological perspective of OGMS

(1) The biological perspective of OGMS

Disorder / Disease / Disease course

O-Disease

O-Disease
Course
(pathological processes)

O-Disorder
### Key OGMS definitions

<table>
<thead>
<tr>
<th>O-DISORDER</th>
<th>A causally relatively isolated <strong>combination of physical components</strong> that is (a) clinically abnormal and (b) maximal, in the sense that it is not a part of some larger such combination.</th>
</tr>
</thead>
<tbody>
<tr>
<td>O-DISEASE</td>
<td>A <strong>DISPOSITION</strong> (i) to undergo <strong>PATHOLOGICAL</strong> <strong>PROCESSES</strong> that (ii) exists in an <strong>ORGANISM</strong> because of one or more <strong>DISORDERs</strong> in that <strong>ORGANISM</strong>.</td>
</tr>
<tr>
<td>O-DISEASE COURSE</td>
<td>The <strong>totality of all</strong> <strong>PROCESSES</strong> through which a given <strong>DISEASE</strong> instance is <strong>realized</strong>.</td>
</tr>
</tbody>
</table>

---

### TMD literature: much less principled distinction

<table>
<thead>
<tr>
<th>2. Joint disorders</th>
<th>3. Joint diseases</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Disk disorders</td>
<td>A. Degenerative joint disease</td>
</tr>
<tr>
<td>1. Disk displacement with reduction</td>
<td>1. Osteoarthrosis</td>
</tr>
<tr>
<td>2. Disk displacement with reduction</td>
<td>2. Osteoarthritis</td>
</tr>
<tr>
<td>3. Disk displacement without reduction</td>
<td></td>
</tr>
<tr>
<td>4. Disk displacement without reduction</td>
<td></td>
</tr>
<tr>
<td>B. Hypomobility disorders other than disk disorders</td>
<td></td>
</tr>
<tr>
<td>1. Adhesions or adherence</td>
<td>B. Systemic arthritides</td>
</tr>
<tr>
<td>2. Ankylosis</td>
<td>C. Condylysis or idiopathic condylar resorption</td>
</tr>
<tr>
<td>a. Fibrous</td>
<td>D. Osteochondritis dissecans</td>
</tr>
<tr>
<td>b. Osseous</td>
<td>E. Osteonecrosis</td>
</tr>
<tr>
<td>C. Hypermobility disorders</td>
<td>F. Neoplasm</td>
</tr>
<tr>
<td>1. Dislocations</td>
<td>G. Synovial chondromatosis</td>
</tr>
<tr>
<td>a. Subluxation</td>
<td>4. Fractures</td>
</tr>
<tr>
<td>b. Luxation</td>
<td>5. Congenital and developmental disorders</td>
</tr>
<tr>
<td>C. Hyperplasia disorders</td>
<td>A. Aplasia</td>
</tr>
<tr>
<td>1. Dislocations</td>
<td>B. Hypoplasia</td>
</tr>
<tr>
<td>a. Subluxation</td>
<td>C. Hyperplasia</td>
</tr>
<tr>
<td>b. Luxation</td>
<td></td>
</tr>
</tbody>
</table>

Current TMD literature

O-Disorder classified as O-Disease

O-Disease described as O-Disease Course (pathological processes)
(2) The epistemic perspective of OGMS

O-Observing / interpreting

6

3

1

4

2

7

Signs & symptoms

Hypotheses & diagnoses

O-Bodily feature

O-Representation
(3a) The **objective** Bio-Psycho-Social perspective

- **‘T-Disease’:**
  - a health problem that consists of a *physiological malfunction* that results in an actual or potential reduction in physical capacities and/or a reduced life expectancy

- **‘T-Illness’:**
  - a subjectively interpreted undesirable state of health, consisting of *subjective* feeling states (e.g., pain, weakness), perceptions of the adequacy of their bodily functioning, and/or feelings of competence

- **‘T-Sickness’:**
  - a *social entity* in virtue of the poor health or the health problem(s) of an individual defined by others with reference to the social activity of that individual

(3b) The **subjective** Bio-Psycho-Social perspective

- **T-Disease:**
  - when there are negative bodily occurrences *as conceived of by* the medical profession.

- **T-Illness:**
  - when there are negative bodily occurrences *as conceived of by* the person himself.

- **T-Sickness:**
  - when there are negative bodily occurrences *as conceived of by* the society and/or its institutions.

‘Occurrence’ here means ‘process’, ‘state’ or ‘event’.

Overlap in the Bio-Psycho-Social perspective

T-Illness

T-Disease

T-Sickness

Suggestion: use the perspectives as scaffolding for a definition of TMD (and its subtypes)
Example: OGMS perspective on TMDs as ‘a group of ...’

O-Disorder type 1

O-Disease type 1

O-Disease Course type 1

O-Disorder type 2

O-Disease type 2

O-Disease Course type 2

O-Disorder type 3

O-Disease type 3

O-Disease Course type 3
TMDs as ‘a group of ...’

O-Disorder type 1

O-Disorder type 2

O-Disorder type 3

O-Disease (1 type)

O-Disease Course (1 type)
TMDs as ‘a group of ...’

O-Disorder type 1
O-Disorder type 2
O-Disorder type 3

O-Disease (1 type)

O-Disease Course type a
O-Disease Course type b
O-Disease Course type c

T-Disorder
T-Illness
T-Sickness
TMDs as ‘a group of ...’

O-Disorder type 1

O-Disorder type 2

O-Disease type d1

O-Disorder type 3

O-Disease type d2

O-Disease Course type a

O-Disease Course type b

O-Disease Course type 3
TMDs and comorbidity

- O-Disorder type 1
- O-Disorder type x

- TMD

- O-Disease type d1

- O-Disease
  - Course type a
  - Course type b

- O-Disease type d2

- O-Disease type 1

- O-Disease type 2

- comorbid

- comorbid type 1

- comorbid type d1

- comorbid type x
Conclusion

• How to arrive at an appropriate definition?
  • Retrospective:
    • Re-examine existing data,
    • Classify variables used according to the 3 perspectives,
      • Pathological processes,
      • Disorders,
      • Diseases,
      • ...
    • Generate hypotheses about the interplay of entities in an across the perspectives.
  • Prospective:
    • Design future studies comparing ‘groups’ (perspectivized TMD types / comorbidities) to (dis)prove hypotheses.