Open platform for A Longitudinal Study in Dental Implant

School of Dentistry

Seoul National University
South Korea

- Hyun Namgoong
  E-mail:ngh@snu.ac.kr
- Senator Jeong
- Hong-Gee Kim*
  E-mail: hgkim@snu.ac.kr
- Dong Hwan Lee
- Young-Won Nam
- Myeon Ki Kim

List of Contents

- Introduction
  - Open platform for A Longitudinal Study in Dental Implant
- Related Works
  - Medical knowledge sharing and positive web sites
  - Longitudinal upper level studies
- Conventional steps for Longitudinal study
- Design of the Open Platform
  - Desiderata
  - Functionalities
  - Sorts of Data
- Conceptual view of the system
- Conclusion and Discussion
- References & Acknowledgments

Introduction

- Proposing Open platform for A Longitudinal Study in Dental Implant
  - To mitigate researchers' burden to collect, share, assess, and utilize the related research and reported cases
  - Inspired by current paradigm to Web 2.0 and collaborative intelligence
  - Providing solutions to the prolonged problem of the longitudinal study through massive **data acquisition**, broad ranging collection of cases, and **identifying the repetition** of the same cases.

- Dental implant
  - Effective treatment to restore missing teeth
  - With aesthetical and functional aspects
- Longitudinal study
  - Help a dentist choose a suitable operational option prior to therapy or manage patient's subsequent events

Related Works

- Medical knowledge sharing and positive web sites
  - GenBank: www.ncbi.nlm.nih.gov/Genbank
    - Sharing DNA and amino acid sequence and protein structure data by depositing them publicly available web databases
  - Telemakus
    - A tool to facilitate analyzing, displaying, and summarizing research reports across a domain: it provides three component
  - Delicious (http://del.icio.us)
    - Social book-marking service enabling its users to keep and share their tags and to discover new sites on the Web
- Longitudinal upper level studies
  - Problems
    - Data acquisition is rarely possible to come up with a decisive conclusion,
    - Data from papers are sometimes considerably convergent toward a particular conclusion.
    - A kind of positive effect tends to be published more often than those that do not; it is called 'Publication bias'

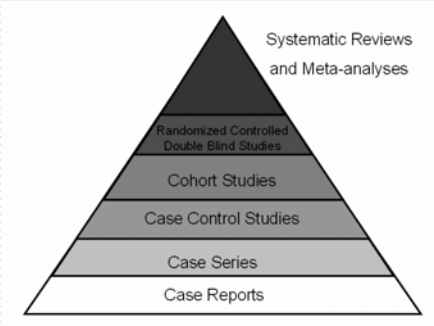

Figure 1 – Upper part of the Evidence Pyramid

Conventional steps for Longitudinal study

- **(1) *Identification of a problem and modeling of a hypothesis from one's intuition or survey*:** For example, a dentist observed a soft tissue inflammation of his patient who did not quit smoking even right after an implant treatment. The dentist constructed a hypothesis that there is a causal relationship between smoking and soft tissue inflammation.
- **(2) *Background research for a given problem*:** To examine any previous work and refutation, the doctor searched MEDLINE and other online medical literature databases. Then, he became aware of the problem that is not completely solved yet.
- **(3) *Collection of data*:** The doctor decided to test the hypothesis by collecting the related data concerning smoking, smoking amount, a condition of soft tisuue after surgery, and etc. He can gather the data, e.g., cases and surgical records, from direct hand contacts or some paper works published in conferences and journals.
- **(4) *Assessment of data quality*:** To decrease a risk of bias, a series of data are classified through his own assessment. The classification is to establish whether the data meet the inclusion criteria or not. The other criterion is whether the data measured through a right examination.
- **(5) *Extracting data according to required form*:** He makes an electronic data extraction form. Required data, for example, demographic data, implant sites, number and type, and RSTV, are extracted independently of what data extraction forms are used.
- **(6) *Data synthesis*:** From formatted data, he can identify whole connection between smoking and soft tissue inflammations.
- **(7) *Result Interpretation*:** Standardization and formalization are performed on the causal relationship identified from the study.

Design of the Open Platform - Desiderata

- The platform must be based on a collaborative intelligence widely opened to everybody. It should incite the collaborative works of researchers and research organization through the web. It also should also provide several beneficial functionalities to encourage independent researchers and get diverse cases from them.
- The platform must have efficient functions for the research. It should support most steps of a study for longitudinal analysis.
- The platform must be cost effective. Even there are diverse shapes in research information or actual data, the platform should process the data transparently to the user.
- The platform must be a richly connected network of data to enable a variety of studies. It enables researchers to identify, relate and compare research and data from multiple perspectives.
- The platform must help a researcher easily find controversial arguments according to the supported evidence. For instance, some researchers argue that mercury has lethal to patient's health while others have the other end of extreme insisting there is no evidence. Researchers can easily catch this controversial through the platform.
- The platform must be easy to use. It includes various digital record forms and interfaces for longitudinal study. Through the form and interface, it must be simple to enter, search, and access to data stored in it.

Design of the Open Platform - Functionalities

- ***Store & Categorization***: As a basic function, the platform stores and categorizes received data such as surgical reports, summarized records and performed research. A researcher can also continuously update the corresponding data.
- ***Search***: A researcher can easily find out a particular report, record and study through the platform. By a search with single and multiple factors, the platform should enable controversies to be easily caught.
- ***Relatives***: A researcher can speculate the specific research and records related to a given problem. Based on the corresponding complications, research are summarized and shown.
- ***Import/Export***: A researcher can import/export needed data. To be used in various applications, the data are formatted with an interoperable electronic document like XML and RDF (Resource Description Framework).
- ***Collaborative assessment***: A researcher can appraise the study and record whether it is archived by an explicit evaluation method or methodology. The assessment is archived collaboratively to avoid unreliable data. For example, by the collaborative assessment, a study exploiting a perio-test for bone quality measurement can be regarded as a more reliable research than a simple 4-degree leveling.
- ***Extraction***: For his/her own research, a researcher can extract and sample specified data from the platform. It is able through an optional selection provided in a user interface.
- ***Statistical view***: Statistical difference of selected data and variation of particular field are observed. It provides an overlook on the interested relation.

A Longitudinal Study with Proposed platform

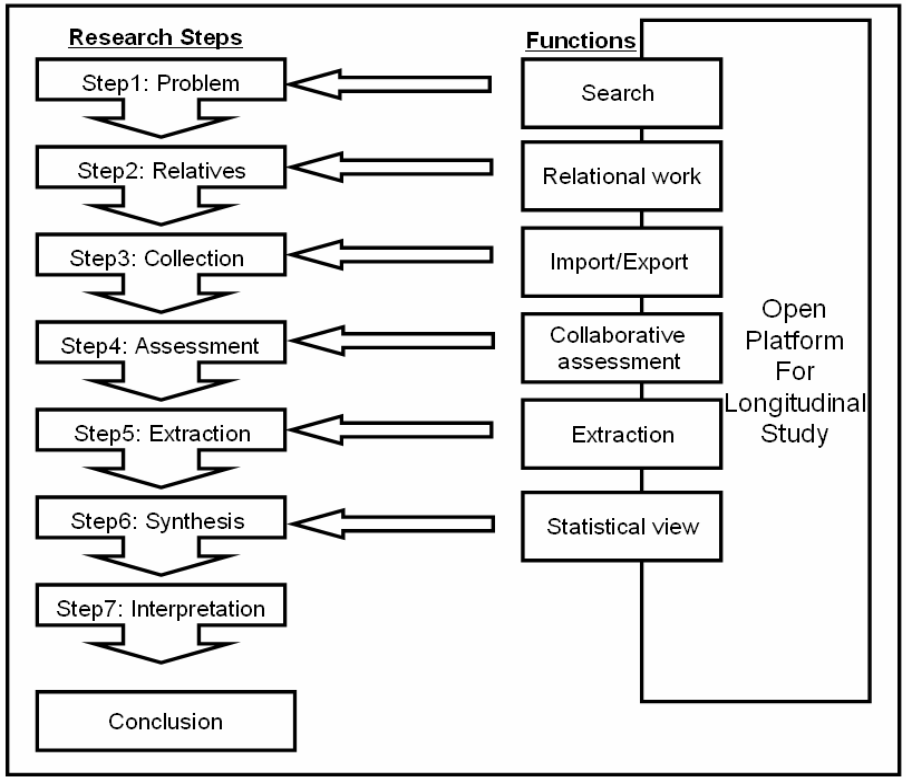

Figure 2 –Revised Scenario

Design of the Open Platform - Sorts of Data

- *Table 1 – Data Record Format for a Research*

Research	Record data	
Title	Year of Publish	
	Authors or Performers	
	Publisher	
	Related Complications	
	Linkage to Data	
	Summary of Data	Criteria for inclusion
		Reported Outcomes
		Methods of Evaluation
		Time interval

- *Table 2 – Classification of Data for Dental Implant study*

Pre-Operative Examination	Treatment & Operative Record	Post-Operative Evaluation & Maintenance
Demographic Variables	Choice of treatment	Maintenance and Follow-Up Protocol
Health Status Variables	Anatomic Variables related to operative sites	Evaluation of Patient's comfort and satisfaction
Social/ Psychological/Financial Variables	Implant-specific Variables	Periodontal Evaluation of soft tissue health around implants
Dental variables related to Oral exam	Abutment-specific Variables	Radiographic Evaluation of implant fixture
Prognosis for remaining dentition	Prostheses Variables	Complication Assessment of implant prosthesis
Operator Variables		

Conceptual view of the system

- Individual clinicians
  - Import their case reports for the qualification of their skill or reporting methods
  - Search of a case and an expectation using the case
- Research groups
  - Possess the every benefit of the platform
  - Use total functionalities of the platform including a ‘Relative’, ‘Collaborative assessment’ and ‘Extraction’.

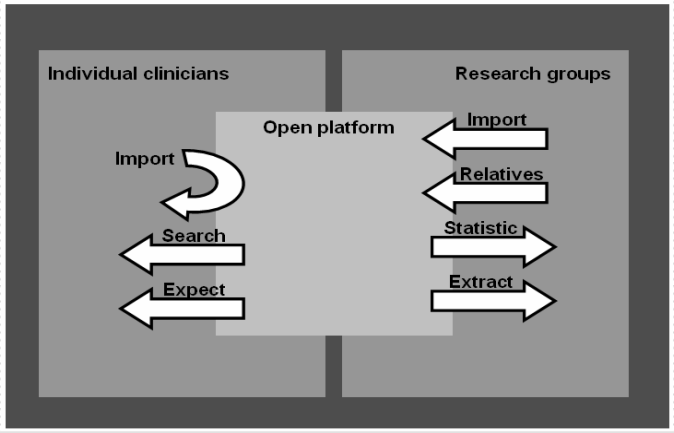

Figure 3 – Conceptual view of the open platform

Conclusion and Discussion

- We expect the platform relieves the burdens to collect, share, assess, and utilize the research and cases for the study.

- Empowering the upper level longitudinal studies at three kind of view.
  - Massive acquisition of data will lead and support decisive conclusions.
  - The broad ranging collection of records and data can be easily used for a refutation to a conclusion unevenly supported by positive pieces of results.
  - Identifying the repetition of same cases will prevent publication bias.

- Expected problems
  - Unreliable and inaccurate data
    - Problems because of the user with mischief and un-seriousness.
  - Free-riding of users.
    - Tangible benefits or compensations should be offered

References

- [1] Albrektsson T, Wennerberg A. The impact of oral implants - past and future, 1966-2042. *Journal*. May;71(5):327.
- [2] Sullivan RM. Implant dentistry and the concept of osseointegration: a historical perspective. *Journal of the California Dental Association*. 2001 Nov;29(11):737-45.
- [3]Tim O'Reilly, What Is Web 2.0 - Design Patterns and Business Models for the Next Generation of Software. [cited 2005 September 30] ; Available from: http:// www.oreillynet.com
- Bryan Alexander, Web 2.0: A New wave of Innovation for Teaching and Learning? *EDUCAUSE Review*, 2006 March/April 41(2) 32–44.
- A Guide to Research Methods. [cited 2006 November 30]; Available from: http://library.downstate.edu/ ebm/2toc.htm.
- Yukika Awazu KCD. Open knowledge management: Lessons from the open source revolution. *Journal of the American Society for Information Science and Technology*. 2004;55(11):1016-9

Acknowledgments

- This study was supported by a grant of the Interoperable EHR Research and Development (A050909), Ministry of Health & Welfare, Republic of Korea.