A Novel Quality Register Study and Review of Implant Treatment of Patients with Dental Agenesis

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Recent decades have witnessed an increasing interest in the quality assessment of services delivered by the health care system with the purpose of promoting the best possible care with the least possible costs. Formal quality assessments and quality assurance of dental intervention procedures are uncommon, and most of the databases that could be used for such quality assurance purposes have been established for less specific monitoring and surveillance or for purely administrative purposes. Administrative registers have even been used for quality assessment, as recently demonstrated for dental implant therapy in Sweden. Treatment of dental agenesis includes modalities such as orthodontics, surgical insertion of dental implants, and fixed prosthetic restorations. The patients are often young and may require life-long treatment, thus indicating a further need for quality assurance of dental implant treatment of patients with dental agenesis.

“Quality assurance” is defined as an activity that aims to ensure concordance between explicit quality targets and the level of quality actually achieved. Quality assurance includes the identification of a problem, data collection, quality assessment based on specific standards and indicators, analysis of causes of breaches of quality, and corrective actions.

Purpose: (1) To present a Danish quality register (AMETO) concerning dental implant treatment for dental agenesis, assess its indicators and standards, and compare them with those acknowledged and outlined by the Institute of Medicine (IoM), World Health Organization (WHO), and Organization for Economic Cooperation and Development (OECD), classified as the quality domains efficiency, effectiveness, patient-centered care, timely care, safety, and equitability; and (2) to perform a systematic literature search and review to verify whether any quality register exists according to the six quality domains. Materials and Methods: (1) The AMETO register is comprised of 16 process and result indicators and standards, which were compared to the six quality domains outlined by the IoM and WHO. (2) A systematic literature search was carried out using the search engines PubMed, Embase, CINAH, Web of Science, and SveMed+. The included articles were assessed for quality indicators and standards to determine whether they conformed to the six quality domains. Results: AMETO indicators and standards conformed to the quality domains outlined by the IoM. A search of “(dental agenesis) AND (dental implants)” yielded a total of 381 publications, of which 27 were included for qualitative synthesis. A search on quality indicators and dental agenesis registries yielded no results. Due to considerable heterogeneity in the reported quality indicators related to effectiveness, patient-centered care, and safety, a meta-analysis could not be conducted. Conclusion: AMETO conforms to the quality domains described by the IoM, WHO, and OECD. Few studies have investigated dental implant treatment of dental agenesis. Moreover, no published quality register for dental implant treatment currently exists. Int J Prosthodont 2021;34:373–380. doi: 10.11607/ijp.6652
and initiation of improvement initiatives in the event of failing quality. Standards and indicators of quality form the basis for the assessment and evaluation of quality.

It is generally agreed that high-quality care is efficient, effective, patient-centered, timely, safe, and equitable, as defined by the Institute of Medicine (IoM), World Health Organization (WHO), and the Organization for Economic Cooperation and Development (OECD). The efficiency of care refers to avoidance of waste, including waste of equipment, supplies, ideas, and energy. Efficiency refers to doing things right and how the tasks must be carried out. Effectiveness concerns the provision of services based on scientific knowledge to all who can benefit and abstention from provision of a service to those unlikely to benefit. Effectiveness refers to doing the right things and which tasks must be carried out. Patient-centered implies respectful and responsive care related to individual patient preferences, needs, and values and ensuring that patient values guide all clinical decisions. Timely care reduces waiting time. Safety means avoiding injuries to patients when providing the intended care and takes into account the adverse effects of medication and techniques. Equitable care entails offering the same quality of treatment independent of personal characteristics such as gender, ethnicity, geographic location, or socioeconomic status. The quality of the underpinning database or register is likewise crucial to the ability to accurately assess the quality of care. This implies assessment of completeness, validity, coverage, reliability, and possibility for health-economics evaluations. Completeness refers to the number of patients actually registered out of the total number of patients who would be eligible for entry into the register. In Scandinavian countries, it is typically possible to cross-reference data from a specific quality database with that of a national patient registry. Validity refers to the correctness of the information.

Coverage concerns how many of the total number of health care facilities (e.g., clinics, hospitals, departments) actually provide data for the register. Reliability refers to the consistency or precision of the data. Health-economics evaluations include cost-benefit, cost-effectiveness, and cost-utility analyses. Such information has been utilized for decades in the Scandinavian medical fields within orthopedic surgery and total hip arthroplasty registers.

In Denmark, dental implant treatment in adolescents is only registered if carried out in the realms of the regional dental care services run by the five Danish regions or by the two Danish odontologic knowledge centers. These two entities are responsible for the dental rehabilitation of patients with dental agenesis or who are suffering sequelae from dental trauma. The prevalence of dental agenesis varies among studies from different countries, ranging from 2.2% to 10.1%. The prevalence of dental aplasia due to agenesis is approximately 7% in Denmark, equating to 2 students out of a class of 25 pupils, and an estimated 60% of these patients require dental rehabilitation. The incidence of tooth loss due to dental trauma was reported to be 0.045%. However, the number of those in need of dental rehabilitation is unknown.

In 2006, the Danish Health Authority suggested the formation of a Danish register, AMETO, for the purpose of collecting data on dental implant treatment in agenesis patients. AMETO was jointly developed by specialists within the fields of orthodontics, pediatric dentistry, oral and maxillofacial surgery, and general dentistry and was accepted as a clinical quality register by the Danish Health and Medicines Authority (reference number 2009, 7-201-03-62/1/KIKR).

AMETO was initially developed as a research register in collaboration with the Centre for Quality Assurance of West Denmark, which surveils the quality assurance of all medical and odontologic diseases. This implies that clinical data comprise the foundation of the monitoring process, as well as treatment indicators. The AMETO database, which covers the treatment of adolescents with the diagnoses dental agenesis, mineralization disturbances, ectopic tooth development, trauma, and other oral diseases, was fully operational in 2006 in the Region of Southern Denmark, which is comprised of a population of approximately 1.2 million inhabitants. Since these young patients are treated within the Danish community as well as the regional dental treatment systems, it is possible to gain access to patient data. The Scandinavian practice of registering each person by an identification number offers a unique opportunity to follow patients for research and registration purposes.

The purpose of this study was twofold: (1) To compare the quality indicators and standards used in the AMETO database to those acknowledged by the IoM, WHO, and OECD, classified according to the quality domains efficiency, effectiveness, patient-centered care, timely care, safety, and equity; and (2) to provide an overview of published registers in the literature on dental implant treatment of dental agenesis.

The null hypotheses were that (1) no published register on the quality of dental agenesis implant treatment exists, or, (2) if such a register does exist, that it does not conform to the quality dimensions of the IoM.

MATERIALS AND METHODS

AMETO Register

The AMETO database is comprised of clinical and radiologic data, patient questionnaire data, and 16 indicators and standards, of which 2 are process indicators and 14 are result indicators (Table 1). The AMETO process indicators concern the process of registration in AMETO.
prior to initiation of the dental implant treatment and the result of orthodontic treatment. They were obtained at registration into AMETO by the regional dental care center. The result indicators comprise common clinical measurements based on clinical standard measures and were measured during every clinical and control visit. Parameters included Gingival Index; bleeding index; soft tissue evaluation; probing depth; implant survival; functional parameters such as occlusion; and radiologic evaluation of bone level. The AMETO result indicators concerned patient-reported data.

The result standards were based on internationally accepted measures and success criteria for regular dental implant treatment.

Information Sources
A systematic literature search was carried out using the search engines PubMed, Embase, CINAHL, Web of Science, and SveMed+ to verify whether any quality register existed based on the six quality domains and to identify literature describing dental agenesis registries and implant treatment quality indicators. If such literature existed, it was classified according to the quality indicators obtained from the IoM, WHO, and OECD.

Search Strategy
The following syntax was used for quality registries of dental agenesis in PubMed, CINAHL, Web of Science, and SveMed+:

- (Dental Agenesis AND Register AND Quality indicators) OR (Dental Agenesis AND Register AND Efficiency) OR (Dental Agenesis AND Register AND Quality Effectiveness) OR (Dental Agenesis AND Register AND Patient-centered care) OR (Dental Agenesis AND Register AND Timely) OR (Dental Agenesis AND Register AND equitability) OR (Dental Agenesis AND Register AND Implants).

Also, searches were made with the individual quality parameters “dental agenesis” and “dental implants”:

- (Efficiency) AND (dental agenesis) AND (dental implants), (Effectiveness) AND (dental agenesis) AND (dental implants), (Patient-centered) AND (dental agenesis) AND (dental implants), (Safety) AND (dental agenesis) AND (dental implants), (Equitability) AND (dental agenesis) AND (dental implants), (Timely) AND (dental agenesis) AND (dental implants).

Finally, to make sure no publications were overlooked, a search was made on “(dental agenesis) AND (dental implants).” A hand search was performed in the reference list of each included reference.

Study Selection
The inclusion criteria were as follows:

- Register studies
- Literature reviews of dental agenesis registries
- Literature reviews of treatment of dental agenesis with dental implants
- Quality indicators of implant treatment
- Completeness of reporting in relation to the registries
- Dental implant treatment of dental agenesis
- English, Danish, Norwegian, or Swedish language

The exclusion criteria were as follows:

- Languages other than those mentioned above
- Articles relating to other surgical treatments (orthodontic, prosthodontic)

Table 1  AMETO Indicators and Standards

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<th>Indicator Description</th>
<th>Standard</th>
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<td>The number of patients with congenital dental agenesis or loss of teeth who have been registered by the Regional Dental Care center at the latest at the age of 18 years</td>
<td>≥ 99%</td>
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<td>The number of patients with stable space conditions in the regions that are planned to have dental implants inserted after pretreatment</td>
<td>≥ 95%</td>
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<td>The number of inserted dental implants still in their original places after 5 years,</td>
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<td>the number of implants with peri-implant bone loss ≤ 2 mm after 5 years</td>
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<td>The number of implants that show exposed implant/abutment surface cervically after 1 year</td>
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<td>The number of implants with keratinized peri-implant mucosa</td>
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<td>The number of inserted implant-supported fixed partial dentures in their original places after 5 years</td>
<td>≥ 95%</td>
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<td>The number of inserted tooth-to-implant–supported FPDs in their original places after 5 years</td>
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<td>The number of inserted implant-supported single crowns in their original places after 5 years</td>
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<td>The number of regions with agenesis with overeruption ≥ 2 mm of antagonist</td>
<td>≤ 5%</td>
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<td>The number of regions with agenesis with risk of tilting of neighboring teeth into the agenesis region</td>
<td>≤ 10%</td>
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<td>The number of patients with satisfactory cosmetic results in the incisor region, as evaluated by the patient</td>
<td>≥ 95%</td>
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<tr>
<td>The number of patients with satisfactory cosmetic results in the incisor region, as evaluated by the professional</td>
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<td>The number of patients in whom the number of teeth replacements was reduced compared to the total number of dental agenesis</td>
<td>≥ 40%</td>
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<td>The number of patients who asked for re-treatment because of recurrent malocclusion after initial treatment</td>
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<td>The number of patients with iatrogenic damage to neighboring teeth due to implant insertion (necrosis, loss of attachment)</td>
<td>≤ 2%</td>
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Data Collection Process
Abstracts were independently assessed in duplicate by both authors for inclusion. Following abstract assessment, the full texts of the included articles were obtained, and the authors assessed both the abstract and full text according to the inclusion and exclusion criteria listed above. In case of disagreement, consensus was reached by discussion between the authors.

Candidates for inclusion were read and assessed for the quality indicators and standards, which were subsequently classified according to the six IoM quality dimensions of efficiency, effectiveness, patient-centered care, timely care, safety, and equitability. References were likewise cross-checked and assessed.

In order to evaluate bias, the articles were assessed using the Jadad scale and Delphi list (Table 2).

Two concepts of quality were investigated in accordance with the IoM quality dimensions: (1) quality of the treatment (dental implant), and (2) quality of the register.

The indicators efficiency and effectiveness were considered present when any treatment modality and when some form of implant survival rate was described, respectively. When patient-centered care indicators were present (patient-reported outcome measures of quality

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27 studies

Jadad (J) Score of ≤ 3 or a Delphi (D) Score of ≤ 5 indicates a high risk of bias.
Jadad Score > 4 or Delphi Score > 6 indicates a low risk of bias.
J1 = randomization; J2 = double blinding; J3 = description of withdrawal/dropouts; JTotal = total Jadad score; D1a = randomization; D1b = allocation concealment; D2 = homogeneity of test subjects at baseline regarding prognostic factors; D3 = eligibility criteria specified; D4–D6 = blinding of outcome assessor, care provider, or patient, respectively; D7 = point estimates and measures of variability; D8 = inclusion of intention-to-treat in analysis; DTotal = total Delphi score.

Reviews

The International Journal of Prosthodontics

Table 2 Risk of Bias of Studies Included in Qualitative Synthesis

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of life, pain, function, and patient satisfaction), they were subsequently included. Indicators of safety included reports of implant revision or any other adverse effects, and of equity included the provision of care as related to age, gender, ethnicity, or socioeconomic background. Indicators of timely care were considered present when information was found on waiting time until surgical placement of dental implants.

Quality of the register was considered when indicators such as completeness, validity, coverage, and reliability were present. When health economics—effectiveness, cost-effectiveness, cost-benefit, or cost-utility analyses were identified, they were likewise included. Completeness was considered when the departments that delivered the data participated in reporting placement of dental implants to the National Board of Health. Validity was considered when medical records were examined to compare the data in the register, such as personal identity number and implants, with the data registered in the reporting department entries.

Coverage was considered present when the proportion of the participating departments was compared to the remaining reporting departments as a percentage.

Reliability was considered when data from the reporting departments used test variables to determine whether the register met the base requirements for precision and reliability.

AMETO Register
The AMETO database contains a total of 16 indicators and standards (Table 1). Numbers 1 and 2 are process indicators, and numbers 3 to 16 are result indicators.

According to the defined IoM quality dimensions, AMETO indicator 1 relates to the quality of the register, and indicator 2 conforms to the timely care and efficiency dimensions related to the orthodontic pretreatment for processes delivered when the patients are deemed ready for dental implant treatment. Indicators 3 to 9 relate to effectiveness, and indicators 10, 11, and 14 concern efficiency. Result indicators 10 and 11 represent additional information on timely care within orthodontic treatment. Indicators 12 to 14 represent patient-centered care, while safety is represented by indicators 15 and 16.

The level of standard registration of ≥ 99% is ordinary for databases within the Danish health care sector (Table 1).

The second standard, > 95%, concerning readiness and stable space based on orthodontic treatment before dental implant treatment, was set as a regular expectation of general orthodontic treatment in a young patient. The standard numbers for 3 through 6 were based on Albrektsson et al. The standard numbers for 7 and 8, concerning implant-supported fixed partial dentures (FPDs) and tooth- and implant-supported FPDs, were based on Gotfredsen and Karlsson, as well as similar principles listed by Wolleb et al.

The standards for 9, 12, and 13 were based on similar principles to those listed by Wolleb et al, Gotfredsen, and Dueled et al. For 10, 11, and 14, the standards were based on similar principles to those outlined by Johal et al, and for 15, the standard was based on similar principles to those outlined by Jung et al.

Literature Review
Study Selection
The initial electronic search yielded only three publications, and only one of these studies, a review, was included. A subsequent search on the quality dimensions efficiency, effectiveness, patient-centered, safety, equityability, and timely care yielded a total of 0, 3, 3, 1, 0, and 1 publications, respectively. Of these, two publications were included. A search for “(dental agenesis) AND (dental implants)” yielded a total of 381 publications (Fig 1). In the screening process, 200 abstracts were read, and their screening resulted in 104 titles for full-text analysis, resulting in the inclusion of 24 articles. Another 16 references were included from other sources, including from a textbook that contained a description of legislation on treatment of
dental agenesis in Denmark, an evaluation of a quality register from the Total Hip Arthroplasty Register, and information on quality assurance in general, making for a total of 40 studies. Twenty-seven studies were included in the qualitative synthesis.

**Results of Individual Studies**

The studies on the prevalence of dental agenesis showed a 2.2% to 10.1% prevalences. Due to considerable heterogeneity in the reported quality indicators and explanatory variables related to effectiveness, patient-centered care, and safety, it was impossible to conduct a meta-analysis.

**Bias**

Except for the systematic review by Andrade et al, all studies in the qualitative synthesis had a high risk of bias according to the Jadad Scale and Delphi List (Table 2). Thus, only a descriptive analysis could be conducted.

**DISCUSSION**

The Danish AMETO register is the first published quality assurance register and the only known database to report on dental implant treatment in patients with dental agenesis. The AMETO register conforms to the IoM and WHO quality dimensions used by the OECD.

The AMETO reports on effectiveness, efficiency, patient-centered care, safety, equityability, and timely care quality dimensions. Therefore, this register seems to cover the quality evaluation of dental implant treatment in patients with dental agenesis. The quality assessment of the register is not currently fully evaluated. Completeness, validity, and coverage are all possible to evaluate, whereas reliability, health economics—effectiveness, cost-effectiveness, cost-benefit, and cost-utility analyses are not.

Consistent and adequate high-level treatment is always important. Dental implant treatment in patients with dental agenesis often comprises presurgical orthodontics prior to dental implant installation in order to obtain a sufficient occlusion. Hence, fulfilling the timely care and safety indicators is vital to avoid the risk of root damage if a re-treatment has to be instituted due to the lack of a correct onset and failure to fulfill this presurgical treatment. This may lead to an increased risk of root resorption and diminished patient compliance. A re-treatment, therefore, diminishes the cost-benefit and increases financial consumption, which is a significant issue in a society based on common funding. Thus, biologic and cost-benefit components need to be taken into consideration.

Due to the unique civil registration (CPR) number, it is possible in Scandinavia and Denmark to follow patients and carry out a systematic gathering of knowledge, which is the intention of the Danish Health and Medicines Authority. This may, in turn, form the foundation for future systematic follow-up and serve as an inspiration for the initiation of other quality assurance databases. The research potential of AMETO is therefore something unique and tremendously valuable.

Currently, there seems to be a lack of new studies focusing on the prevalence and treatment of dental agenesis. As this literature review revealed, no quality assurance register exists that exclusively assesses the treatment of dental agenesis with dental implants.

Only one dental database reports on implant therapy in a population, but it does not specify dental agenesis. The authors used an administrative database in Sweden for the purpose of quality assessment; however, the database used is mainly preoccupied with the quality dimensions of effectiveness and patient-centered care. There is no current active register published on implant treatment of patients with dental agenesis that also includes all of the IoM quality dimensions. Although a quality assessment of dental implant treatment related to implant failures and surgeon role was reported by Jemt et al, it failed to include all of the IoM quality dimensions.

Subsequently, the null hypothesis was accepted.

The literature regarding quality assurance on implant treatment of dental agenesis is scarce and unsystematic. Only one article discusses patient-reported outcomes. Only two articles discuss a quality assessment of implant treatment of dental agenesis within the last decade. As such, AMETO can provide new insight into a field that has long needed an update. As the OECD states in its 2017 report, Denmark is at the forefront of assisting patients in making informed choices about their care, including the use of patient-centered initiatives. This leads to high-value care. AMETO includes the patient-centered care quality dimension, thus contributing to this trend. Even though AMETO seemingly still needs to be properly validated and scrutinized, it is apparently the only existing quality assurance register on implant treatment of dental agenesis that adheres to the IoM’s dimensions of quality. The goal for the ongoing process of validating the AMETO register is to obtain the same improvements within dental implant treatment for patients with dental agenesis as those that have been seen within the medical field in Scandinavia—improvements that patients and societies have benefitted from for decades.

**CONCLUSIONS**

The AMETO register conforms to the quality dimensions described by the IoM, the WHO, and the OECD, and efficiency, effectiveness, patient-centered care, timely care, safety, and equitability are all included as important indicators. The current review revealed that the available literature does not have much updated literature on the prevalence of dental agenesis, dental

ACKNOWLEDGMENTS

The authors report no conflicts of interest related to this study. Dr Florescu’s PhD salary and tuition were partially supported by the regional dental care center, Region of Southern Denmark.

REFERENCES

Emergence profile design is important for stable peri-implant tissues and esthetically pleasing results with dental implant restorations, which are influenced by factors such as implant position and surrounding soft tissues. Different aspects of the emergence profile have been described, but detailed explanations of the different zones and corresponding designs are missing. This article describes the esthetic biologic contour (EBC) concept, differentiating important areas of the emergence profile and recommending particular designs for those zones. The EBC concept considers specific parameters for proper design of the emergence profile of implant-supported restorations. Understanding the different zones of the emergence profile and their relation to factors like implant position, implant design, and soft tissue thickness is key. The suggested guidelines are geared toward providing more stable and esthetic results when restoring dental implants in the esthetic zone. Each of the zones described in the EBC concept has a specific function in the design of the emergence profile. Understanding the importance and specific design features of the EBC zones facilitates esthetic and biologically sound treatment outcomes with interim and definitive implant restorations. Proper emergence profile design supports esthetic outcomes and provides favorable biologic response to implant-supported restorations.
