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Dental implants survival rates among ectodermal dysplasia patients: aggregation and synthesis of literature data

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Abstract

Background. Consensus statements of several international congresses and conferences include option of using dental implants as a potentially effective treatment alternative for ectodermal dysplasia patients. So far ectodermal dysplasia seems to be the most common disorder which arguments need for using dental implants among growing patients.

Objective. To assess survival rates of dental implants placed among patients with ectodermal dysplasia based on previous literature data.

Materials and Methods. Bibliographic search of publications potentially related with the objective of present study was held through PubMed database (https://pubmed.ncbi.nlm.nih.gov/), while also via Google Scholar (https://scholar.google.com/) search engine to increase the probability for identification of corresponding scientific articles. Data extraction was provided in selective manner in terms to collect specific rates of dental implants survival observed among ectodermal dysplasia patients.

Results. Provided analysis revealed that in the majority of studies approximated conventional implants survival rate exceeds 90% for the first five years. Due to the data extracted from systematic reviews implants survival rates among ectodermal dysplasia patients varied in the range of 35.7-98.7%; due to the data extracted from retrospective studies – in the range of 35.7-98.7%; due to the data extracted from prospective studies – in the range of 76-100%; due to the data extracted from critical review of literature – in the range of 88.5-97.6%.

Conclusion. Provided analysis revealed that dental implants remain reliable treatment option for patients with ectodermal dysplasia. Placement of dental implants among pediatric patients with ectodermal dysplasia characterized with decreased survival rates compare to intraosseous fixtures placed among adult ED patients. Use of mini-implants helps to overcome some complications and shortcomings related with placement of conventional implants among patients with confirmed ectodermal dysplasia diagnosis.

Introduction

Due to the previous literature data prevalence of clinically established or clinically possible diagnosis of ectodermal dysplasia (ED) represented by 21.9 cases for 100000 overall, while molecular diagnostics cut off this level to the 1.6 cases per 100000 [1, 2, 3]. Nowadays nearly 189 pathological conditions may be initially categorized as ectodermal dysplasia cases [4].

Figure 1. Intraoral photo of patient with ectodermal dysplasia
(*provided from diagnostic collection of Professor Izzet Yavuz, Diyarbakir, Turkey*)

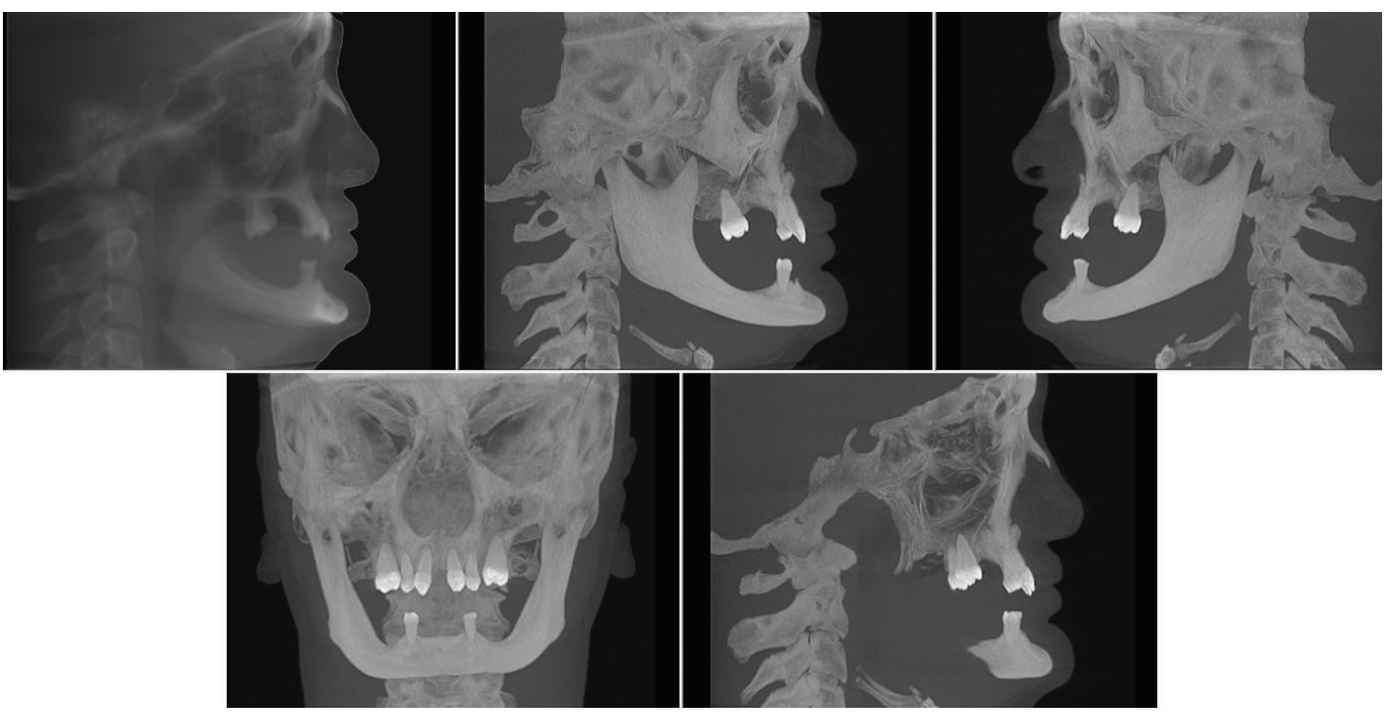

Figure 2. Dentition pattern of patient with ectodermal dysplasia presented on X-ray images
(*provided from diagnostic collection of Professor Izzet Yavuz, Diyarbakir, Turkey*)

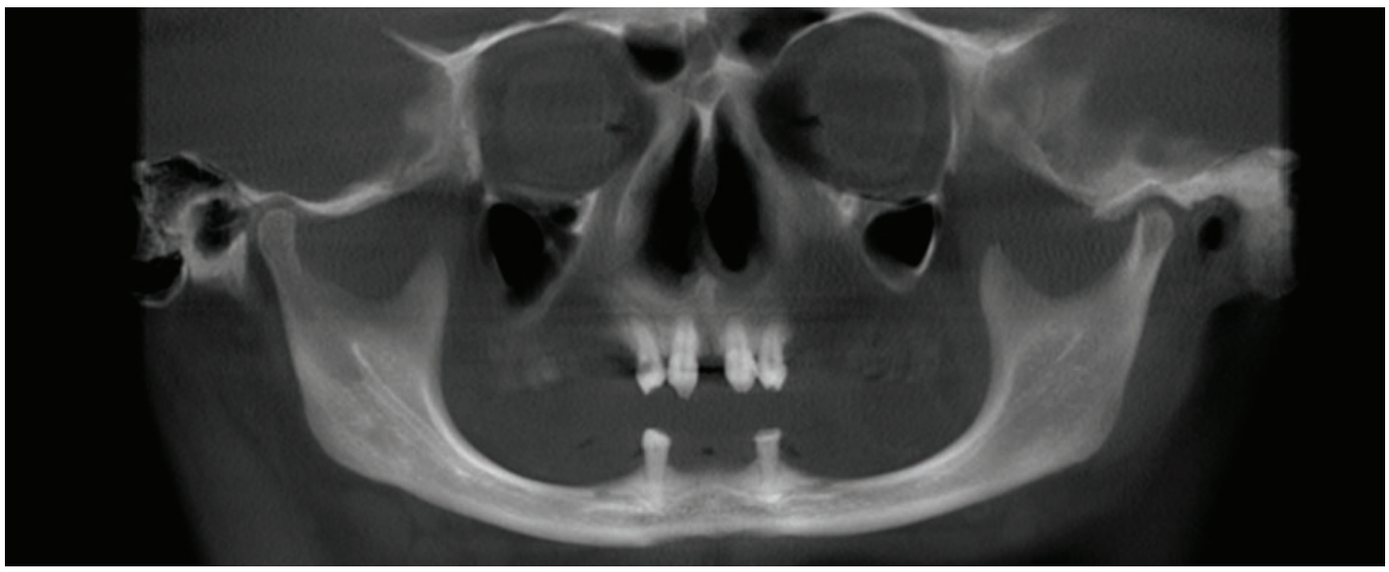

Figure 3. Dentition pattern of patient with ectodermal dysplasia presented on X-ray image
(provided from diagnostic collection of Professor Izzet Yavuz, Diyarbakir, Turkey)

Dental changes have been noted among 79% cases of clinically established ED, and among 52% of ED cases, which has been molecularly approved [2, 3, 5] (Figure 1).

Registered pattern of present and absent permanent teeth among ectodermal dysplasia patients arguments the clinical expediency for using dental implants as treatment option for efficient oral rehabilitation [5] (Figure 2-3).

Consensus statements of several international congresses and conferences include option of using dental implants as a potentially effective treatment alternative for ectodermal dysplasia patients. So far ectodermal dysplasia seems to be the most common disorder which arguments need for using dental implants among growing patients [6].

Implant placement with further prosthetic restoration by overdenture could be considered for 5-10 years old patients if mandibular rehabilitation is planned, and for 6-10 years old patients if maxillary rehabilitation is planned during complex treatment of edentulism cases associated with ED [7]. Nevertheless, implant placement for patients with ectodermal dysplasia could be provided even at earlier age period [8]. In 2022 Seremidi et al. described case series of dental implants placement for 3.5-year-old patients with ED [9]. In another case series authors named patients with ectodermal dysplasia as “Britain’s youngest implants patients” [10].

Recent systematic review dedicated to the assessment of implant success among growing patients (majority of which had ectodermal dysplasia as a main aspect of medical history) revealed that in 33.45% of all analyzed studies dental implants didn’t show any clinical problems [11]. Meanwhile only few studies were aimed to assess specifically survival rates of dental implants placed among ectodermal dysplasia patients, while collection of such data was provided due to the strict formulated inclusion criteria.

Considering this fact, it seems to be of clinical and scientific interests to update information regarding survival rates of dental implants used for the rehabilitation of patients with ectodermal dysplasia, while taking into account not only previously systematized data sets, but also results of several prospective and retrospective studies, and critical reviews of the literature to expand possibilities for targeted data aggregation.

Objective

To assess survival rates of dental implants placed among patients with ectodermal dysplasia based on previous literature data.

Materials and Methods

Literature Search and Data Collection

Bibliographic search of publications potentially related with the objective of present research was held through PubMed database (https://pubmed.ncbi.nlm.nih.gov/), while also via Google Scholar (https://scholar.google.com/) search engine to increase the probability to identify corresponding scientific articles [12, 13]. Search within PubMed database was provided using the following Mesh-terms algorithm: ("ectodermal dysplasia"[MeSH Terms] OR ("ectodermal"[All Fields] AND "dysplasia"[All Fields]) OR "ectodermal dysplasia"[All Fields]) AND ("dental implants"[MeSH Terms] OR ("dental"[All Fields] AND "implants"[All Fields]) OR "dental implants"[All Fields]). No restrictions due to the terms of publications were used, since objective of the research was to maximize potential amount of data representing specifically survival rates of dental implants placed among ectodermal dysplasia patients. Only publications written in English or at least with English abstract were considered for inclusion into the study sample and to for further content-analysis. No specific quality analysis of the studies was realized to minimize potential loss of data due to the non-correspondence with some eligibility qualitative criteria.

Data extraction was provided in selective manner in terms to collect specific rates of dental implants survival observed among ectodermal dysplasia patients and to represent the most practically valuable information regarding how different implant survival rates may be potentially associated with various clinical, implant- and patient-related factors. All the numerical and textual data related with survival rates of dental implants placed among dental patients with ectodermal dysplasia and factors that potentially may be related with some specific survival rates were categorized, grouped, and structured within Microsoft Excel software (Microsoft, United States). Tabulation of data was provided using functions of above-mentioned spreadsheet software.

Results

Primary pool of publications identified using pre-formed Mesh-terms algorithm within PubMed database included 327 items. Additional search via Google Scholar engine supported identification of 32 additional articles related with the objective of study, which were not found during primary search within PubMed database. Exclusion of non-relevant literature sources, duplicates, and those, which through the provided content-analysis were interpreted as not being associated with formulated research objective, helped to

Table 1. Detailed information of dental implants survival/failure rates registered among analyzed studies

Authorhip	Design of study	Implant survival/Failure rate
Umberto et al. (2007) [14]	Prospective study	91% (for survival rate)
Wu et al. (2015) [15]	Prospective preliminary clinical study	100% (for survival of zygomatic implants) 88.75% (for survival rate of conventional implants)
Yap et al. (2009) [16]	Critical review of literature	88.5-97.6% (for survival rate)
Sweeney et al. (2005) [17]	Retrospective study	88.5% (for survival rate)
Grecchi F. et al. (2010) [18]	Retrospective case series analysis	98.7% (for survival rate)
Bergendal et al. (2008) [19]	Retrospective study	64.3% (for failure rate)
Guckes et al. (2002) [5]	Prospective clinical trial	76-91% (for survival rate)
Kearns et al. (1999) [20]	Prospective study	94.7-100% (for survival rate)
Zou et al. (2014) [21]	Retrospective study	98.3% (for survival rate)
Filius et al. (2016) [22]	Systematic review	35.7-98.7% (for survival rate)
Wang et al. (2016) [23]	Systematic review	97.9-98.6% (for survival rate)
Chranovic et al. (2016) [24]	Systematic review	84.6% (for survival rate)
Bohner et al. (2019) [6]	Systematic review	23.4 (for failure rate)

form final study sample of 13 articles. Dental implant survival rates among ectodermal dysplasia patients were assessed based on data extracted from 4 systematic reviews, 4 prospective clinical studies, 4 retrospective studies and 1 critical review of the literature.

Provided analysis revealed that in the majority of studies approximated conventional implants survival rate exceeds 90%, while zygomatic implants survival rate may reach 100% level among ectodermal dysplasia patients.

Due to the data extracted from systematic reviews implants survival rates among ectodermal dysplasia patients varied in the range of 35.7-98.7%; due to the data extracted from retrospective studies – in the range of 35.7-98.7%; due to the data extracted from prospective studies – in the range of 76-100%; due to the data extracted from critical review of literature – in the range of 88.5-97.6%. The highest implants failure rate observed among ED patients was noted in the retrospective study of Bergendal et al. and it equaled to 64.3%, while the highest implants survival rates were noted in prospective designed studies.

Detailed information regarding implants survival rates registered in all researches, included into the study sample of analyzed publications presented in Table 1.

Discussion

Data regarding implants survival rates registered among ectodermal dysplasia patients based on the provided literature analysis characterized with significant heterogeneity due to the differences of analyzed studies' designs, sample sizes, follow-up periods, implant designs, patient-related factors and criteria used to evaluate compromised implant conditions.

Systematic review dedicated to the assessment of dental implants survival among growing patients revealed that the failure rate within such cohort reached 23.4% (taking into account that ectodermal dysplasia was categorized as a disorder the most prevalently associated with the need for dental implant placement among children and adolescents) [6].

In another systematic review it was highlighted that not only dental implantation itself is reliable and predictable treatment option for ectodermal dysplasia patients characterized with 97.9-98.6% survival of installed fixtures, but moreover bone augmentation itself also may be efficiently used among such patients' cohort to facilitate conditions for dental implant placement [23]. Analysis of retrospective case series revealed no difference in implant survival rates among ED patients despite the fact if fixtures were placed into grafted jawbone area, or into native bone: in both scenarios such parameter outreached 90% [18]. Analogically placement of implant simultaneously with guided bone regeneration was associated with over 90% survival rate both among ED and non-ED patients [14].

Critical review of literature revealed that ED patients characterized with 88.5-97.6% dental implants survival rate based on the analysis of non-randomized controlled and case-controlled studies. Authors also mentioned that placement of implants for adolescent ED patients is not associated with any additional risk of failure related with factor of craniofacial growth, while such may be present in cases of ED patients younger than 18 years [16].

Systematic review of Chranovic et al. reported cumulative survival rate of dental implants installed among ED patients at the level of 84.6%, while such was calculated for the longest so far reported monitoring period of 20 years. Meanwhile it should be noted that most of the implants were placed among patients older than 30 years, which potentially may contribute to such high cumulative survival rate, since implants placed among children and adolescent due to the available literature data characterized with much higher failure rate [24].

In the prospective clinical trial it was reported that survival rate of dental implants placed in the anterior region of mandible is higher than such registered for dental implants placed in the anterior region of maxilla (91% vs. 76%) [5]. The same pattern of distribution was found in retrospective study provided among 14 adolescent patients with ectodermal dysplasia: 20% failure rate was registered among maxillary implants, while 8.7% – among mandibular implants [17].

In the retrospective study of Bergendal et al. the highest failure rate of dental implants placed among ED patients was reported, which reached 64.3% [19]. Authors highlighted that rather deficiency of bone and associated preoperative conditions were the main risk factors for dental implants loss, but not ED pathology itself [19].

Zygomatic implants also seem to be reliable option for prosthetic treatment of patients with ectodermal dysplasia [25]. In prospective preliminary clinical study zygomatic implants demonstrated higher survival rates compare to conventional ones (100% vs. 88.75%)

[15]. 3.5-7 years follow up also revealed 100% survival of zygomatic implants placed among 9 ED patients [26].

Mini-implants also may be used for successful oral rehabilitation of patients with ectodermal dysplasia. Such approach characterized with following benefits [27, 28]:

• optimized fit of small-diameter mini-implants for ED-associated reduced width of alveolar ridge;

• possibility to provide all treatment measures in one visit (including surgical and prosthetic phases);

• lower cost compared to conventional diameter fixtures;

• possibility to overcome higher conventional implant failure due to the deficient development of bone ridge [27, 28].

Considering data extracted from the previous studies it may be resumed that dental implants of various design placed among ectodermal dysplasia patients characterized with high survival rates, that in the most clinical cases exceeds 90% margin. Placement of dental implants among pediatric ED patients associated with greater risk of fixture loss in comparison to cases of dental implants placement among adult ED patients. Implant placement at the anterior maxilla region associated with comparatively lower survival rates than at the anterior mandible region. Type of implant seems not to be an influential factor regarding implant prognosis if correct surgical planning was held before intervention; nevertheless, several shortcomings associated with the use of conventionally designed implant among ED patients may be minimized by the use of mini-implants. Zygomatic implants survival rates seem to be statistically analogical to such associated with conventional implants, even though in some studies zygomatic implants demonstrated higher survival levels.

Conclusion

Provided analysis revealed that dental implants remain reliable treatment option for patients with ectodermal dysplasia. Survival rates of dental implants placed among ectodermal dysplasia patients in the majority of the analyzed studies exceeds 90% rate during various monitoring periods. Dental implants placed at the anterior maxilla of ED patients demonstrate comparatively lower survival rates than fixtures installed at the anterior mandible. Placement of dental implant among children with ectodermal dysplasia characterized with decreased survival rates compare to the intraosseous fixtures placed among adult ED patients. Differences of survival rates for implants placed into grafted jawbone areas and native bone among ED patients has not been fully clarified based on the available literature data, but so far, their survival rates seem to be similar. Use of mini-implants helps to overcome some complications and shortcomings related with placement of conventional implants among patients with confirmed ectodermal dysplasia diagnosis.

Conflict of Interest

Authors do not have any potential conflict of interests that may influence the decision to publish this article.

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A – розробка концепції та дизайну дослідження, B - збір та або систематизація даних дослідження, C – аналіз та тлумачення даних дослідження, D – написання публікації, E – критичне доопрацювання тексту публікації, F- остаточне затвердження.

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ектодермальна дисплазія, дентальні імпланта, показники виживання, стоматологічна допомога, дитяча стоматологія

Анотація

Вступ. Консенсусні рішення декількох міжнародних конгресів та конференцій передбачають можливість використання дентальних імплантатів, як потенційно ефективної альтернативи лікування пацієнтів з ектодермальною дисплазією (ЕД). Наразі ектодермальна дисплазія є найпоширенішим розладом, який аргументує можливість застосування дентальних імплантатів у пацієнтів, які продовжують рости та розвиватися.

Мета. Оцінити рівень виживання дентальних імплантатів, встановлених пацієнтам з ектодермальною дисплазією, на основі опублікованих літературних даних.

Матеріали та методи. Бібліографічний пошук публікацій, потенційно пов'язаних з метою даного дослідження, здійснювався через базу даних PubMed (https://pubmed.ncbi.nlm.nih.gov/), а також через Google Scholar (https://scholar.google.com/) з метою підвищення ймовірності ідентифікації відповідних наукових статей. Вибір даних здійснювався селективним способом для збору конкретних показників виживання дентальних імплантатів серед пацієнтів з ектодермальною дисплазією.

Результати. Проведений аналіз публікацій показав, що в більшості опублікованих досліджень наближена виживаність дентальних імплантатів перевищує 90% протягом перших п'яти років. Дані отримані із систематичних оглядів свідчать, що рівень виживаності імплантатів серед пацієнтів з ектодермальною дисплазією коливався в діапазоні 35,7-98,7%; за даними ретроспективних досліджень – у межах 35,7-98,7%; за даними проспективних досліджень – в межах 76-100%; за даними критичного огляду літератури – в межах 88,5-97,6%.

Висновки. Проведений аналіз опублікованих досліджень показав, що дентальні імплантати залишаються надійним способом лікування пацієнтів з ектодермальною дисплазією. Встановлення дентальних імплантатів у педіатричних пацієнтів з ектодермальною дисплазією характеризується зниженим рівнем виживання порівняно з дентальними імплантатами, які встановлені у дорослих пацієнтів з ЕД. Застосування міні-імплантатів дозволяє подолати деякі ускладнення та недоліки, пов'язані з установкою традиційних дентальних імплантатів у пацієнтів з підтвердженим діагнозом ектодермальної дисплазії

Заява про конфлікт інтересів
Автори не мають потенційного конфлікту інтересів, який може вплинути на рішення про публікацію цієї статті.

Заява про фінансування
Не було отримано жодного фінансування для допомоги в підготовці та проведенні цього дослідження, а також у написанні цієї статті.

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