Original Articles

IS THERE AN AGE LIMIT FOR IMPLANT DENTISTRY?

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ABSTRACT

https://doi.org/10.25241/stomaeduj.2020.7(2).art.3

Introduction Aging may impede implant survival due to compromised wound healing. The present study assessed, retrospectively, whether there is an age limit for implant dentistry.

Methodology All patients treated with a single implant brand in a single medical center were included. Early implant failure (EIF) was recorded. The cohort was divided to a younger (20 to 65) and an older (≥65) group. The comparison between groups was based on: (1) gender (2) physical status (3) implant location (4) implant dimensions (5) number of implants placed per patient and (6) bone grafting.

Results Out of 121 patients, the younger group comprised 57 and the older 64. The younger cohort received 192 implants (mean: 3.25±3.68, range: 1 to 16 implants per patient) vs. 171 (mean 2.78±1.91, range: 1 to 11 implants per patient) in the older group. The older did not differ significantly ($p > 0.05$) from the younger in any of the parameters evaluated. EIF on implant and patient level was 1.0 and 3.5%, respectively in the younger vs. 1.1 and 3.1%, respectively in the older. Seven patients were ≥80 years. EIF at implant and patient level was 8.3 %and 14.3% respectively.

Conclusions Elderly patients ≥65 years old presented a similarly low EIF rate as younger patients 20 to 65 years old, while patients ≥80 years old may have a slight tendency for a higher EIF rate. Hence, there seems to be no age limit for implant dentistry.

KEYWORDS

Early Implant Failure; Osseointegration; Older Population; Dental Implant; Aging.

1. INTRODUCTION

The growing numbers of population ≥ 65 years [1] offer an important challenge for the dental profession. Implant dentistry has a major contribution to improving life quality [2-4]. Aging may compromise implant survival due to compromised wound healing [5,6]. The proliferative phase of healing is prolonged due to reduced numbers of stem cells [6]. A study in a rat model demonstrated that the younger group achieved good bone contact faster than the older one. The results suggested that the rate and volume of new bone formation around implants decrease with age [7]. Other studies on implant treatment suggested that age may be associated with a higher implant failure rate [8,9]. Bone quality and quantity are related to initial stability and longitudinal success [10,11]. Both are theoretically compromised by aging. After the age of 50 a marked increase in bone porosity and decrease in bone mass, were demonstrated [12]. Implant success can thus be compromised [10]. Bone volume may be reduced requiring grafting before or with implant placement. Bone augmentation success is age-related [13]. The decrease in the number of pluripotent cells within the bone marrow [14,15] and the reduced numbers of osteogenic cells at recipient sites combined with low vascularity [16] are suggested factors that might

Peer-Reviewed Article
Citation: Masri D, Chaushu L, Nissan J, Naishlos SA, Chaushu G. Is there an age limit for implant dentistry? *Stoma Edu J.* 2020;7(2):102-107.
Received: May 05, 2020; **Revised:** May 13, 2020; **Accepted:** May 15, 2020; **Published:** May 18, 2020
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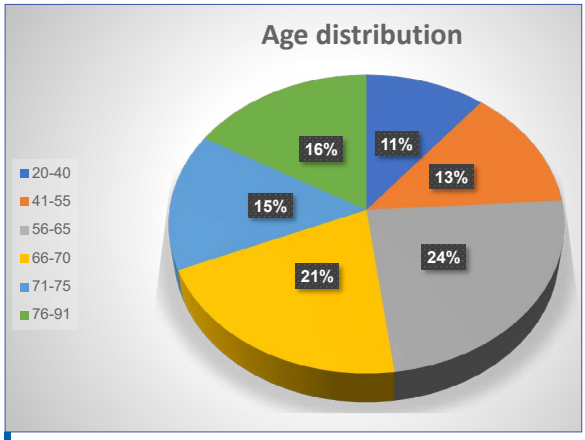

Figure 1. Patient distribution according to age.

compromise bone grafting in the elderly. Implant failures can be divided into early and late [17] according to timing of failure - abutment connection [18,19]; loading [20]; several weeks after placement of the final prosthesis [21]; 12 months after loading [22,23]. Late failures are associated with moderate to severe bone loss, a larger number of failed implants per patient, a higher incidence in men, and mostly in posterior areas. Early failures are associated with minimal bone loss, occur more in women, and in most cases the implants were intended to support single crowns [17]. There are studies indicating that increasing age alone is not a contraindication for implant treatment [24-28]. However, there is still lack of information on early implant failure (EIF) in the elderly (implant loss up to 12 months post loading). Therefore, the aim of the present study was to assess, retrospectively, EIF rate in an older (≥ 66 years old) patient cohort up to one year after prosthetic delivery, and to compare it with a younger (20 to 65 years old at time-point of implant installation) one.

2. MATERIALS AND METHODS

The present retrospective, cohort study is based on dental records of the Department of Oral and Maxillofacial Surgery, Rabin Medical Center, Campus Beillinson, Israel, which were selected automatically (electronically) based on information from the dental implant records, from 01/2017–12/2018. All treatments were performed by experienced oral and maxillofacial surgeons and the only implant type installed was molecular precision implant (MPI™), endosseous, conical, sand-blasted and acid-etched surfacing (Ditron Dental, Ashkelon, Israel). The study protocol was approved by the ethics committee of the Rabin Medical Center, Campus Beilinson, Israel (0674-19rmc). The present manuscript complies with the STROBE guidelines.

2.1. Patient population

The dental records of all patients who had received an MPI™- (Ditron Dental, Ashkelon, Israel). Dental implant between 01/2017 and 12/2018, were extracted and manually screened twice by 2 examiners (DM and GC).

Inclusion criteria – Complete documentation; minimum follow-up – 12 months following prosthetic delivery.

Exclusion criteria – history of head and neck cancer and/or immune deficiency due to immunosuppressant medication, uncontrolled systemic diseases, heavy smokers, untreated periodontal disease.

The following parameters were recorded:

- ❍ age
- ❍ gender
- ❍ physical status according to American Society for Anesthesiology (ASA)
- ❍ implant location
- ❍ implant dimensions (length, diameter)
- ❍ bone augmentation prior to or simultaneously with implant installation (yes/no)
- ❍ number of implants placed
- ❍ early implant failure (EIF) – lack of osseointegration up to 12 months after prosthesis delivery and occlusal loading (yes/no; primary outcome variable).

2.2. Statistical Analysis

The descriptive statistics were calculated for patient- and implant-related characteristics. The cohort was classified into 2 age sub-cohorts: (1) 20-65 years old at time-point of implant installation) and (2) ≥ 66 years old at time-point of implant installation. The Fishers' exact test or chi-squared test was used to assess any potential differences regarding the various categorial parameters (gender; ASA status; implant location; implant dimensions; bone augmentation; number of implants placed; number of EIF). Patient specific parameters have been compared at patient level, while implant specific parameters at implant level. A statistical analysis was performed using SPSS Version 24.0 (SPSS Inc., Chicago, IL, USA) and p-values < 0.05 were considered as statistically significant.

3. RESULTS

3.1. Patient population

Most of the patients were between 56-70 years old (45%) (Fig. 1). Out of 121 patients, the younger group comprised 57 and the older 64. Mean age was: 50.5 ± 0.53 years (range: 20-65 years; 61.4% females) vs. 73.1±5.65 years (range: 66-91 years; 65.6% females) respectively.

3.2. ASA status

All patients had physical status either I or II. No statistically significant differences between the groups ($p>0.05$).

3.3. Implant data

The younger patient cohort received 192 implants (mean: 3.25±3.68, range: 1 to 16 implants per patient) vs. 171 (mean 2.78±1.91, range: 1 to 11 implants per patient) in the older group. Data on

Table 1. Implant number and dimensions (diameter & length) according to location.

			Diameter (mm)				Length (mm)			
		Number	Mean	Min.	Max.	Median	Mean	Min.	Max.	Median
Maxilla		163								
Anterior	**Young**	33	3.70	3.3	3.75	3.75	11.90	8	13	11.5
	Old	32	3.83	3.3	4.2	3.75	11.97	10	13	13
Premolar	**Young**	34	3.86	3.75	4.2	3.75	11.67	8	13	11.5
	Old	21	3.85	3.75	5	3.75	12.40	8	13	13
Molar	**Young**	24	4.18	3.75	5	4.2	11.375	8	13	11.5
	Old	19	4.16	3.75	5	4.2	11.5	10	13	11.5
Mandible		200								
Anterior	**Young**	35	3.76	3.75	5	3.75	11.56	10	13	11.5
	Old	38	3.74	3.3	4.2	3.75	11.32	8	16	11.5
Premolar	**Young**	37	3.71	3.3	4.2	3.75	9.97	8	13	10
	Old	34	3.74	3.3	4.2	3.75	10.15	8	13	10
Molar	**Young**	29	3.98	3.3	5	3.75	9.29	6	11.5	10
	Old	27	3.99	3.3	5	3.75	9.26	8	11.5	10

implant locations- number of implants per jaw area and implant dimensions (length and diameter) per area are presented in Table 1. The older group did not differ significantly ($p>0.05$) from the younger group in any of the parameters. Bone grafting was performed in 14/57 (24.6%) of the patients in the younger group vs. 18/64 (28.1%) of the older group. Mean follow-up was 27.3±8.4 months in the younger group vs. 24.9±6.2 months on the older one.

3.4. Early Implant Failure (EIF)

In the younger patient group, 2 patients had one EIF each. EIF on implant and patient level was 1.0 and 3.5%, respectively. In the older patient group 2 patients had one EIF each. EIF on implant and patient level was 1.1 and 3.1%, respectively.

3.5. Patients ≥80 years old

A special attention was given to 7 patients (3 females and 4 males) ≥80 years old (Table 2). A total of 12 implants were placed (1-3 per patient). The locations varied. Bone augmentation was not performed in any of the cases. One implant failed in the oldest patient (91 years old). EIF at implant and patient level was 8.3 % and 14.3% respectively. We speculated that the extremely poor-quality soft bone of the posterior maxilla could be the failing reason.

4. DISCUSSION

In the present study EIF were not more frequent in older (≥ 65 years old) vs. younger patients (20-55 years old), and in general rare (around 1% on implant and between 3 to 4% at patient level). This corresponds with the existing literature on implant therapy in the elderly. A review on implants in older patients reported implant survival rates of 98% at 1 year and 91% at 10 years [29]. Another review on implant failure in older vs. younger patients, reported no significant differences of implant survival (94 vs. 95%, respectively) [30]. The failure of osseo-integration was suggested as the main reason for EIF [31]. Contributing factors may be patient-related [18,19], surgeon-related [22], and biomaterial-related [32].

These studies used many implant systems with different designs, which could have greatly affected the results. Consequently, we concentrated on a single implant from a single implant system in the present study. The group comparison accounted for 5 factors, i.e., gender, ASA status, jaw site, implant characteristics (number and dimensions), and need of bone grafting, while some other factors were controlled through inclusion criteria - choosing the same type of implant (i.e., MPI / Ditron™ Dental) and implant insertion by experienced oral and maxillo-facial surgeons.

A review points out 65 years of age has been as the cut-off to define "older" in several studies [29]. That is the reason for choosing this age as cut-off in the present study. The age of 7 patients was ≥ 80 years old, contributing 12 implants. Bone augmentation was not performed in any of those patients and the number of implants did not exceed 3 implants.

Those facts emphasize the desire to keep implant dentistry at age ≥ 80 years simple and with minimum potential morbidity. EIF at implant and patient level was 8.3 % and 14.3%, compared with the entire older (≥66 years old) patient group, in the present study, which resulted in EIF of 1.1% and 3.1%, respectively. Nevertheless, it should not be forgotten that these fractions still represent only one EIF case. This EIF is compatible with previously reported risk factors for EIF – women and implants intended to support single crowns [17]. Correspondingly, other studies reported higher EIF in patients ≥ 80 years old [33, 34]. Specifically, 4.5% at implant level [33], or 9.7% at patient level [34]. Still, 6/7 patients aged ≥ 80 years

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Table 2. Implant characteristics for patients ≥80 years old.

Age (years)		80	80	80	83	84	90	91
Gender		Female	Male	Male	Male	Female	Male	Female
Number of implants		1	1	1	2	3	2	2
Follow up (months)		20	28	22	24	38	23	26
1st Implant	Location	27	23	21	35	42	42	15
	Dimensions (mm)	4.2/ 13	3.75/ 11.5	3.75/ 13	4.2/ 11.5	3.75/ 10	3.75/ 11.5	3.75/ 11.5
2nd implant	Location				41	43	43	26
	Dimensions (mm)				4.2/ 11.5	3.75/ 10	4.2/ 11.5	3.3/ 11.5
3rd implant	Location					44		
	Dimensions (mm)					3.75/ 10		
Bone augmentation		No	No	No	No	No	No	No
Failure		No	No	No	No	No	No	1

old in the present study showed successful primary osseointegration and received final prosthetic restoration.

Considering the limitations that the present study is retrospective, the physical status of both elderly and younger patient groups was good, the operators were experienced oral and maxillofacial surgeons, and only few EIF were observed, it is still reasonable to conclude, that there is no age limit for implant dentistry.

5. CONCLUSIONS

Elderly patients ≥65 years old presented a similarly low EIF rate as younger patients 20 to 65 years old, while patients ≥80 years old may have a slight tendency for a higher EIF rate. Hence, there seems to be no age limit for implant dentistry.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

DM: conception and design of the study, acquisition of data, analysis and interpretation of data, drafting the article, final approval of the version to be submitted; LC: conception and design of the study, analysis and interpretation of data, drafting the article, final approval of the version to be submitted; JN: conception and design of the study, analysis and interpretation of data, drafting the article, final approval of the version to be submitted; SAN: conception and design of the study, analysis and interpretation of data, drafting the article, final approval of the version to be submitted; GC: conception and design of the study, acquisition of data, analysis and interpretation of data, drafting the article, final approval of the version to be submitted.

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Questions

1. Timing of early implant failure in the present study?

❑a. At surgery;
❑b. At 2nd stage surgery;
❑c. Up to one year after loading;
❑d. Up to 6 weeks after loading.

2. EIF rate for patients ≥80 years old?

❑a. Was similar to younger group;
❑b. Was similar to older group;
❑c. Had a slight higher tendency;
❑d. Was better than younger group.

3. The main wound healing problem in the older?

❑a. Lack of myofibroblasts;
❑b. Reduced numbers of stem cells;
❑c. Lack of osseointegration;
❑d. Lack of ossification.

4. Implant dimensions in the older were?

❑a. Similar;
❑b. Higher;
❑c. Lower;
❑d. Not recorded.