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Patients' perspective on selection of bone grafts: An evidence based questionnaire study

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ABSTRACT

Background: Several dental procedures currently necessitate the use of bone grafts to replace or regenerate bone volume that has been lost to disease, trauma or surgery. However, it is essential to consider the patient's opinions and preferences before administration of any such procedure. Our study aims to investigate patients' perspectives on the commonly used bone grafts in dentistry and examine its correlation with variables such as gender, age, level of education, or religious faith.

Methods: An anonymous, self-administered cross-sectional based questionnaire form was distributed to 200 individuals. The responses for acceptance, conditional acceptance, refusal and the reasons for the choice for each type of bone graft were obtained. The observed responses were compared with the participants' demographics. Descriptive statistical analysis was performed for the collected data with $P < 0.05$ considered statistically significant.

Results: Autografts had the highest acceptance rate followed by alloplast, with the least acceptance seen for xenografts. The overall acceptance rate of bone grafts was found to be 90%, 63%, 32%, and 72% for autografts, allografts, xenografts, and alloplasts respectively. A statistical influence was seen with various demographic variables at different levels to the various types of grafts.

Conclusion: The higher rejection to xenografts seen was due to religious beliefs and morals prevailing in Indian culture. Such patient-centered evaluation of treatment alternatives is pivotal in achieving enhanced satisfaction and acceptance of therapy. Therefore, it is imperative for clinicians to prioritize understanding the patient's preferences.

Keywords: Bone grafts, dentistry, informed consent, shared decision-making, questionnaire survey.

BACKGROUND

A bone graft is defined as a living tissue capable of promoting bone healing, transplanted into a bony defect, either alone or in combination with other materials.^(1,2) Many procedures

require the use of bone grafts to replace or recover bone volume that has been resorbed due to systemic pathologies, acquired/congenital defects, periodontal disease, tooth extractions or surgical procedures. In dentistry, bone grafts are used in various procedures like implant placement, sinus lift & augmentation procedures, jaw bone surgeries, extraction socket grafting, horizontal and vertical ridge augmentation, reconstruction of soft or hard tissue loss due to trauma, infection, cyst, tumor, alveolar cleft reconstruction etc.

Various materials used in bone grafting can be classified as autografts, allografts, xenografts and alloplasts.

Autografts are the grafts which are harvested from an anatomic site within the same individual whereas allografts are harvested from one individual and transplanted to a genetically different individual of the same species.⁽³⁾ They are obtained from either a compatible living donor or cadaveric bone sources. Allograft materials can be prepared in three primary forms—fresh, frozen, or freeze-dried.⁽⁴⁾

Xenografts are made of naturally derived deproteinized cancellous bone from another species such as bovine, porcine, equine bone. They are osteoconductive and biocompatible. Alloplasts are synthetic substitutes derived from hydroxyapatite or bioactive glass used as defect fillers without adverse tissue reaction or immunogenic response⁽⁵⁾ (e.g. synthetic hydroxyapatite or polymer).

The selection of an ideal bone graft for patients depends on various factors such as tissue viability, defect site, graft size and shape, cost, ethical issues, biological and biomechanical characteristics. However, the most neglected factor that is the patient's perception should also be taken into consideration. Patient's compliance and participation in decision making plays an important role in successful dental treatment. Many clinicians prioritize their experience and expertise when making decisions, often overlooking the importance of seeking patient's input including ethical issues, consent or explaining the pros and cons of various procedures and alternative options available.^(6,7) Patients' religious faith, spiritual beliefs, culture, attitude, customs, knowledge, social environment and consent significantly shape and sometimes constrain their health behaviors and treatment decisions. Understanding patients' preferences and identifying barriers to treatment can significantly enhance their compliance, acceptance, and utilization of bone graft treatment modalities.⁽⁸⁾

In addition to patients' perception, informed consent also plays an important role in safeguarding their autonomy.⁽⁹⁾ However, at present, consent procedures are not consistently implemented when utilizing biological products like allografts and xenografts in treatment of patients from varied religious and cultural backgrounds. Moreover, the awareness among healthcare professionals regarding the composition of biological products has not been systematically assessed, nor has their proficiency in obtaining informed consent from patients receiving such treatments.⁽¹⁰⁾

Patients increasingly seek comprehensive information and desire greater participation in their care. They demand autonomy in deciding which procedures they are willing to undergo and which treatments they are prepared to receive.⁽¹⁰⁾ Therefore, patients have the right to be fully informed about the procedure, including the option to refuse it, in order to foster greater cooperation and improve patient compliance with the treatment regimen.⁽⁶⁾

The preferences of patients regarding their role in treatment decision-making have been thoroughly researched in medical fields, particularly in contexts such as cancer and surgery. However, there remains a paucity of studies investigating aspects of the decision-making process in dental care, with no specific research to date on patients' preferences for participating in treatment decisions.^(11–25) Our study aims to investigate patients' perspectives on the source of commonly used bone grafts in dental treatments and examine whether acceptance or rejection to specific types of bone grafts correlates with variables such as

gender, age, level of education, or religious faith. Additionally, we seek to elucidate the reasons behind patients' rejection and conditional acceptance to these types of bone grafts.

MATERIALS AND METHODS

An anonymous, self-administered cross-sectional based questionnaire form with closed ended choices was prepared in two languages, English and a vernacular language (Punjabi). 200 individuals of which 100 were males and 100 were females who fulfilled the inclusion criteria were involved in the study. The participants who met the criteria were asked to fill out the questionnaire form in their language of choice. The inclusion criteria of the study were:

- a. Participants with age more than 18 years
- b. No previous history of any bone grafting procedure administered
- c. Not under the influence of any substance (alcohol or other drugs) which could affect their decision-making skill

The questionnaire contained an introduction about bone grafts (what are bone grafts, indications, various types, and their sources) followed by basic information about the participant's demographic profile: gender, age, religious beliefs, and level of education. Then the responses for acceptance, circumstantial/ conditional acceptance, refusal, and a reason for the choice for each type of bone graft i.e. autograft, allograft, xenograft, and alloplast were obtained through the questionnaire. Participants could mark a single or multiple responses in their questionnaire. The observed responses were compared with the obtained demographics. The participants included 100 males and 100 females and were divided into four age groups: 18-25 years, 26-40 years, 41-60 years, and >60 years. Based on the level of education, participants were divided into 4 groups: illiterate, obtained primary education, obtained secondary education, and graduated & above. Religious faith: Hinduism, Islam, Sikhism, Christianity, and others/atheists were also asked and tabulated.

The standardization of the questionnaire was validated before administration. A pilot study was conducted on 20 individuals with a less elaborate questionnaire which excluded the reasons for acceptance/rejection choice for the graft. The variability of responses was determined and the questionnaire was revised and included reasons for their responses which maintained clarity and consistency in the responses obtained.

STATISTICS

The descriptive statistics were calculated using the statistical package for the social sciences software (SPSS, version 23.0, Chicago, IL, USA). The frequencies & percentages of all observed values were determined. Chi-square test was used to ascertain the relationship between the choices filled for each type of bone graft and the demographic variables. The test results with $p < 0.05$ were considered as the threshold for statistical significance.

RESULTS

The total sample size of the study was 200 of which, 50%(n=100) were males and 50%(n=100) females aged between 18 years and above. The sociodemographic details which included patients' gender, age, level of education and religious beliefs were collected and tabulated (Table1).

The frequencies of acceptance, conditional acceptance and rejection responses to different types of bone grafts were noted and tabulated, the percentage of which is expressed in graph 1. The overall acceptance rate of bone grafts was found out to be 90% (n=180) for Autografts [simple acceptance 64% (n=128), Conditional acceptance 26% (n=52)], 63% (n=126) for Allografts [simple acceptance 11% (n=22), Conditional acceptance 52% (n=104)], 32%

(n=64) for Xenografts [simple acceptance 5% (n=10), Conditional acceptance 27% (n=54)] , 72% (n=144) for Alloplasts [simple acceptance 41% (n=82), Conditional acceptance 31% (n=62)]. Thus, it can be inferred that Autograft has the highest acceptance rate followed by Alloplast, Allograft and Xenograft. Likewise, the overall percentage refusal rate for Autografts, Allografts, Xenografts, Alloplasts was 10%, 37%, 68% and 28% respectively. Thus, it was inferred that Xenografts has the highest refusal rate followed by Allografts, Alloplasts, and Autografts.

The level of acceptance and rejection to different types of bone grafts was compared to various sociodemographic variables like gender, age, level of education and religious faith to find out any statistically significant relation; which is summarized in Table 2

No significant relation was attained between acceptance/ conditional acceptance/ rejection to bone grafts and the gender of participants in the current study. A statistically significant relation was found between acceptance/conditional acceptance/rejection of autografts, allografts, and alloplasts with age ($p<0.05$) whereas no significant relation was found between acceptance/conditional acceptance/rejection of xenograft and age. Regarding level of education a statistically significant relation was found between acceptance/ conditional acceptance/ rejection of allografts and alloplasts ($p<0.05$) whereas no significant relation was found in autografts and xenografts. In comparison of religious faith to acceptance/ conditional acceptance/ rejection to bone grafts a significant relation was seen only in autografts and xenografts ($p<0.05$).

Table 3 and 4 show circumstances under which the participant was ready to accept and reasons for rejecting different types of bone grafts. 53.8%, 44.2%, 40.7% of participants accepted autografts, allografts and xenografts respectively under the condition of it being the only last option, while for alloplasts, 61.2% of participants agreed to accept it only if it leads to best results.

Similarly, 70% of participants refused to accept autografts due to fear of pain and discomfort while 72.9% of participants refused allografts due to fear of disease transmission. For xenografts, 45.5% and 38.2% participants refused stating their religion does not approve of it and due to fear of disease transmission respectively. 85.7% of participants refused alloplasts as they preferred natural materials only.

Pain perception and receiving material from a dead donor were the least considered reasons for acceptance of different types of bone grafts. The responses obtained for the situations of conditional acceptance and reasons for the refusal of a type outnumbered the preference for that type due to the availability of multiple-choice answers.

Table 1: Demographic characteristics of the study participants (n=200)

VARIABLES	CATEGORIES	TOTAL PERCENTAGE
GENDER	Male	100(50%)
	Female	100(50%)
AGE (Years)	18-25	92(46%)
	26-40	38(19%)
	41-60	64(32%)
	>60	6(3%)
LEVEL OF EDUCATION	Illiterate	4(2%)
	Primary	36(18%)
	Secondary	52(26%)
	Graduate & above	108(54%)
RELIGIOUS FAITH	Hinduism	64(32%)

	Islam	33(16.5%)
	Sikhism	70(35%)
	Christianity	30(15%)
	Others/Atheist	3(1.5%)

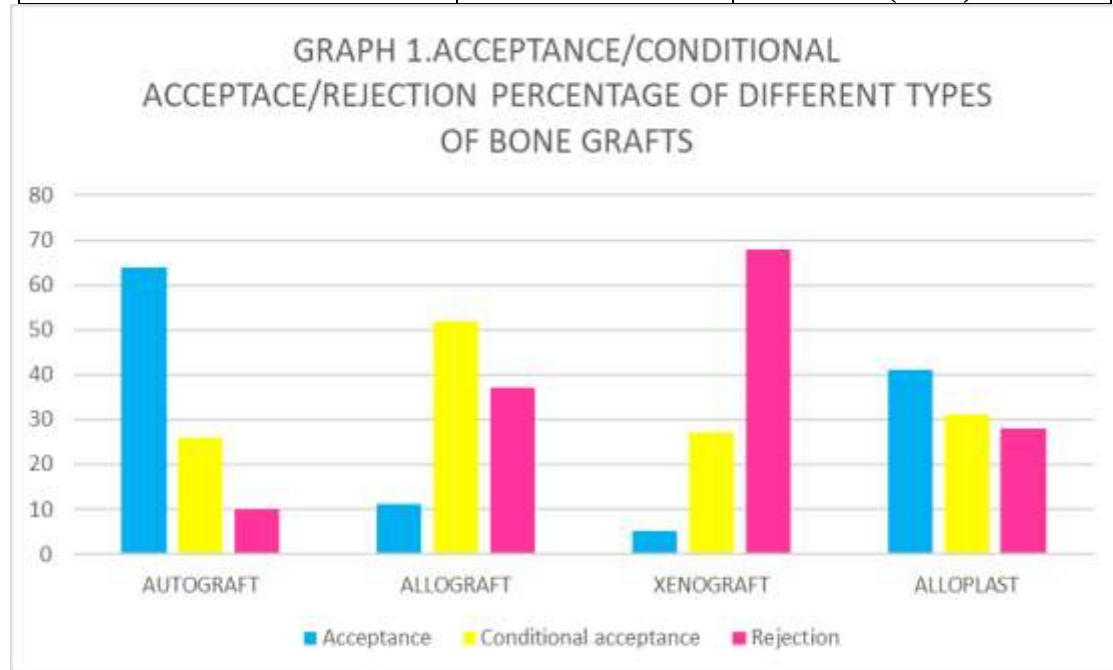


Table 2: Comparison of acceptance/ conditional acceptance and rejection rate among gender, age group, level of education and religious faith

VARIABLE	GROUP	COUNT n=200	AUTOGRAFT			ALLOGRAFT			XENOGRAFT			ALLOPLAST		
			Acceptance	Conditional acceptance	Rejection	Acceptance	Conditional acceptance	Rejection	Acceptance	Conditional acceptance	Rejection	Acceptance	Conditional acceptance	Rejection
Gender	Male	100	70(70%)	24(24%)	6(6%)	12(12%)	52(52%)	36(36%)	4(4%)	20(20%)	76(76%)	42(42%)	26(26%)	32(32%)
	Female	100	58(58%)	28(28%)	14(14%)	10(10%)	52(52%)	38(38%)	6(6%)	34(34%)	60(60%)	40(40%)	36(36%)	24(24%)
Age	18-	92	42(42%)	38(38%)	12(12%)	10(10%)	62(62%)	20(20%)	6(6%)	32(32%)	54(54%)	42(42%)	36(36%)	14(14%)

(Yr s)	25		45. 7%)	41.3 (%)	13 (%)	10. 9%)	67.4 (%)	21. 7%)	5%)	34.8 (%)	58. 7%)	45. 7%)	39.1 (%)	15. 2)
	26- 40	38	28(73. 7%)	6(1 5.8 (%)	4(1 0.5 (%)	4(1 0.5 (%)	14(36.8 (%)	20(52. 6%)	2(5. 3%)	8(2 1.1 (%)	28(73. 7%)	12(31. 6)	10(26.3 (%)	16(42. 1%)
	41- 60	64	52(81. 3%)	8(1 2.5 (%)	4(6 .3 (%)	4(6. 3%)	26(40.6 (%)	34(53. 1%)	2(3. 1%)	12(18.8 (%)	50(78. 1%)	26(40. 6%)	14(21.9 (%)	24(37. 5%)
	>60	6	6(1 00 (%)	0(0 (%)	0(0 (%)	4(6 6.7 (%)	2(3 3.3 (%)	0(0 (%)	0(0 (%)	2(3 3.3 (%)	4(6 6.7 (%)	2(3 3.3 (%)	2(3 3.3 (%)	2(3 3.3 (%)
Lev el of Edu cati on	Illit erat e	4	4(1 00 (%)	0(0 (%)	0(0 (%)	4 (10 0%)	0(0 (%)	0(0 (%)	0(0 (%)	0(0 (%)	4(1 00 (%)	2(5 0%)	0(0 (%)	2(5 0%)
	Pri mar y	36	26(72. 2%)	8(2 2.2 (%)	2(5 6%)	0(0 (%)	12(33.3 (%)	24(66. 7%)	0(0 (%)	10(27.8 (%)	26(72. 7%)	6(1 6.7 (%)	10(27.8 (%)	20(55. 6%)
	Sec ond ary	52	36(69. 2%)	10(19.2 (%)	6(1 1.5 (%)	2(3. 8%)	30(57.7 (%)	20(38. 5%)	2(3. 8%)	10(19.2 (%)	40(76. 9%)	22(42. 3%)	14(26.9 (%)	16(30. 8%)
	Gra dua te & abo ve	10 8	62(57. 4%)	34(31.5 (%)	12(11. 1%)	16(14. 8%)	62(57.4 (%)	30(27. 8%)	8(7. 4%)	34(31.5 (%)	66(61. 1%)	52(48. 1%)	38(35.2 (%)	18(16. 7%)
Reli giou s fait h	Hin duis m	64	25(39. 1%)	33(51.6 (%)	6(9 .4 (%)	4(6. 3%)	40(62.5 (%)	20(31. 3%)	0(0 (%)	13(20.3 (%)	51(79. 7%)	25(39. 1%)	19(29.7 (%)	20(31. 3%)
	Isla m	33	25(75. 8%)	7(2 1.2 (%)	1(3 (%)	2(6. 1%)	17(51.5 (%)	14(42. 4%)	0(0 (%)	9(2 7.3 (%)	24(72. 7%)	14(42. 4%)	10(30.3 (%)	9(2 7.3 (%)
	Sik his m	70	54(77. 1%)	6(8. 6%)	10(14. 3%)	13(18. 6%)	33(47.1 (%)	24(34. 3%)	10(14. 3%)	24(34.3 (%)	36(51. 4%)	33(47. 1%)	20(28.6 (%)	17(24. 3%)
	Chr istia nity	30	22(73. 3%)	6(2 0% (%)	2(6 .7 (%)	2(6. 7%)	14(46.7 (%)	14(46. 7%)	0(0 (%)	6(2 0% (%)	24(80 (%)	9(3 0% (%)	12(40 (%)	9(3 0% (%)
	Oth	3	2(6	0(0	1(3	1(3	0(0	2(6	0(0	2(6	1(3	1(3	1(3	1(3

	ers /At heis t		6.7 %)	%)	3.3. %)	3.3. %)	%)	6.7 %)	%)	6.7 %)	3.3. %)	3.3. %)	3.3. %)	3.3. %)
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Table 3: Summary of the reasons for acceptance (conditional acceptance) of different types of bone grafts

TYPE OF GRAFT	It is the last option	It leads to best results	Dentist recommends	Not painful	No living human harmed	Graft from living donor	Graft from dead donor
AUTOGRAFT	28(53.8%)	18(34.6%)	20(38.4%)	6(11.5%)	-	-	-
ALLOGRAFT	46(44.2%)	28(26.9%)	40(38.4%)	-	22(21.1%)	6(5.7%)	2(1.9%)
XENOGRAPH	22(40.7%)	12(22.2%)	14(25.9%)	-	16(29.6%)	2(3.7%)	2(3.7%)
ALLOPLAST	22(35.4%)	38(61.2%)	24(38.7%)	-	4(6.4%)	-	-

Table 4. Summary of the reasons for the refusal of the different types of bone grafts

TYPE OF GRAFT	Fear of pain/discomfort	Fear of multiple surgeries	Fear of disease transmission	Religion does not approve of it	Not feeling fine harming others	I prefer natural materials only
AUTOGRAFT	14(70%)	10(50%)	-	-	-	-
ALLOGRAFT	4(5.4%)	6(8.1%)	54(72.9%)	2(2.7%)	30(40.5%)	2(2.7%)
XENOGRAPH	-	-	52(38.2%)	62(45.5%)	16(11.7%)	40(29.4%)
ALLOPLAST	8(14.2%)	-	2(3.5%)	2(3.5%)	-	48(85.7%)

DISCUSSION

The reconstruction of maxillofacial osseous defects, including ridge defects, periodontal defects, surgical defects, or volumetric deficits, typically requires the use of a material for the reconstruction of these defects and alleviates the physical and psychological trauma to the patient. Despite ongoing efforts to regenerate alveolar bone support and the attachment apparatus, achieving predictable success has proven difficult. Bone grafts remain the sole approach supported by substantial histological evidence for effective reconstruction efforts in these cases.⁽²⁶⁾

Autogenous grafts/ autografts are considered the current gold standard bone replacement graft material as they are histocompatible, non-immunogenic, osteogenic, osteoinductive and osteoconductive.⁽²⁶⁾ However, the prospect of a second surgical donor site injury, the total

amount of tissue that can be transferred and its inherent risks and complications, which may include postoperative pain, discomfort, infection, scarring, bleeding, chronic postoperative pain, hypersensitivity, additional operating time are undesirable circumstances which are seen along with. The requirement to harvest donor tissue necessitates the need for additional local anesthesia and surgical trauma to a site often distant from the area of concern.^(2,27-30) If the intraoral defect is small, the autograft material can be obtained intraorally from the extraction sockets, edentulous ridges, ramus, symphysis, tuberosity, or from the surrounding buccal plate. In large bone defects, the material needed is larger and is typically obtained from extra oral areas, such as the iliac crest or the tibia.^(31,32)

The primary alternative to an autograft is the use of allograft material, which can be obtained from either a compatible living donor or from cadaveric bone sources. They have high success rates and have osteoconductive and osteoinductive properties, avoidance of donor site morbidity, but can induce foreign body immune response and a possibility of disease transmission and lack osteogenic properties.⁽³⁾ Although allografts undergo multiple treatments prior to use, risk of disease transmission, ethical issues and cost are still a matter of consideration. It has been estimated that the risk of human immunodeficiency virus (HIV) transmission is 1 in 1.6 million with use of allografts.⁽³³⁾

Xenografts are an alternative bone grafting materials derived from cancellous bone of non-human sources like cows, pigs, and horses (bovine, porcine, and equine sources) commercially available as BioOss. Their introduction and use in reconstruction medicine has been advantageous for both doctor as well as patient due to its easy and unlimited availability and no need for a second surgery to attain the graft material and its associated damage. Other advantages over other methods are cost-effectivity along with reduced morbidity to donor site.⁽³⁴⁾ However, transmission of zoonotic diseases, high graft rejection rates and aggressive immune response are its major disadvantages contributing to its low value in the reconstructive medicine.⁽³⁵⁾

To overcome potential immunogenicity and morbidity at donor sites, antigenicity, risk of disease transmission, artificial synthetic bone substitute materials, i.e., Alloplasts are generated to closely mimic the biological properties of natural bone. They have osteointegrative and osteoconductive properties. Materials that fall into this category include calcium phosphate ceramics, such as hydroxyapatite (HA), tricalcium phosphate (TCP) and bioglass; metals, such as nickel-titanium; polymers, such as polymethylmethacrylate (PMMA), and polyglycolides and calcium phosphate cements.^(4,36-38)

Acknowledging the pivotal role of patient participation and choices in the success of bone graft therapy, the present study aimed to evaluate patients' preferences regarding various bone grafts used in dental treatments for bone replacement.

The present study demonstrated the influence of gender, age, level of education and religious beliefs on patient preferences regarding acceptance/rejection of bone grafts. In a study conducted by Sattar et al.⁽⁴⁰⁾, 35% of the patients wished to be informed about medication ingredients and their source as a measure to protect their moral, ethical values. Another survey conducted by Chapple H et al. in United Kingdom aimed at understanding patients' preferences regarding treatment decision-making, indicated that most patients preferred to engage in a collaborative treatment planning process with their dentists.⁽³⁹⁾ This clearly indicates broadening the circle of responsibility on part of dentists/physicians for obtaining a better and a detailed informed consent regarding treatment options available to the patients.⁽⁴⁰⁾

The results of our study show that Autograft (90%) has the highest acceptance rate whether as such or under certain conditions, followed by Alloplast (72%), Allograft (63%) and Xenograft (32%) respectively. Autografts were unanimously accepted as the preferred choice

in studies conducted by Almutairi AS.⁽⁴¹⁾ among the Saudi population and Güngörmüş Z. et al.⁽⁴²⁾ in the Turkish population. Studies by Fernández RF et al.⁽⁴³⁾ in Chile and Bucchi et al.⁽⁴⁴⁾ in a multicentric European and Chilean population highlighted the primary preference for alloplasts and autologous bone grafts from intraoral donor site as graft materials. Also, in the present study, xenografts exhibited the highest rejection rates, which are consistent with findings of Almutairi AS.⁽⁴¹⁾ among the Saudi population and Güngörmüş Z. et al.⁽⁴²⁾ in Turkish population (specifically, porcine-derived xenografts). Conversely, studies by Fernández RF et al.⁽⁴³⁾ in Chile and Bucchi et al.⁽⁴⁴⁾ in a multicentric European and Chilean population underscored a primary rejection for allografts despite varying acceptance rates.

Andersen's behavioral model postulated that service utilization is determined by predisposing, enabling, and need factors, and is influenced by individuals' demographic, socio structural, and economic circumstances.⁽⁴⁵⁾ Hof et al.⁽⁴⁶⁾ in his study concluded that sociodemographic variables did not influence the refusal/ acceptance rates of various bone grafts. Regarding gender, the current study revealed, no significant relation between acceptance/conditional acceptance/rejection to bone grafts, which are consistent with findings of Bucchi C. et al.⁽⁴⁴⁾ in a multicentric population and Güngörmüş Z.⁽⁴²⁾ This is in contrast with the results of studies by Almutairi AS.⁽⁴¹⁾ in the Saudi population, where women exhibited a lower refusal rate compared to men. Additionally, Fernández RF et al.⁽⁴³⁾ in his study found out that women were more likely to refuse an allograft and to accept it only as a last resort, as compared to men; and this could potentially be influenced by the study's gender distribution bias, with 76.8% women and 23.2% men involved.

The present study demonstrated that across all age groups maximum acceptance and conditional acceptance of autografts was prevalent (n=180), and the least acceptance was given to xenograft (n= 64). A statistically significant relation was seen between acceptance/conditional acceptance/rejection rates of autograft, allograft and alloplast with age ($p<0.05$) and not with regards to xenograft. However, these findings are in contrast to the study of Almutairi AS⁽⁴¹⁾ and Fernandez RF et al⁽⁴³⁾ where age had no statistically significant influence on the acceptance and refusal to different types of bone grafts. In case of xenografts, majority of the individuals who rejected their use provided reasons related to fear of disease transmission or their religion does not approve it which is similar to the results of the study of Bucchi et al.⁽⁴⁴⁾ People from all age groups predominantly accepted autografts, allografts and alloplasts as such or under certain conditions such as; if it is the last option, if it leads to best results, if their dentist recommends it or no humans are being harmed.

The literacy levels of the participants in the present study were consistent with studies by Fernandez RF et al, Almutairi AS, Bucchi et al, and Alkhaldi MS with a higher percentage of participants being of a graduate level and above and the least quantity being illiterate.^(41,43,44,47) A statistically significant relation was seen in our study between acceptance/conditional acceptance/rejection of allografts and alloplasts ($p<0.05$) whereas none in autografts and xenografts. These results were in contrast with Fernandez RF et al and Bucchi et al with no statistically significant relation between acceptance/rejection rates and level of education. Almutairi et al postulated that more educated individuals showed better acceptance rates to different types of bone grafts than less educated groups; similar to the present study. Our results indicated that participants with a higher level of education contributed to diverse responses to choices while less educated people were marginally interested in considering a condition to accept a graft type and gave restricted/ binary responses. Participants with higher education put more effort in deciding about their choices they made and employed a situational judgment while filling out their choices. They also seem to care more about the decision being made for their health issues and participated actively in shared decision-making thus making them share the responsibility for their

health.⁽⁴⁸⁾ Higher education was associated with thinking beyond their spontaneous reactions, rational thinking, and choosing a type of graft, in case of dire need, that they would otherwise reject.⁽⁴⁹⁾ These groups tend to validate the credibility of the information provided. If the doctor administering the procedure fails to deliver the right information or withholds certain parts of it, thinking it unnecessary, can adversely affect the doctor-patient relationship and deteriorate the outcome of treatment and patient's compliance. This emphasizes the role of the practitioner to discuss the severity and need for the procedure and its associated effects and outcomes to help patients make the right choice and establish a healthy doctor-patient relationship while maintaining the autonomy of the individual receiving the treatment. This can help reinforce the trust in the practitioner. For the less educated groups, it was seen that they depend more on their cultural, religious, social, and family backgrounds to make a choice for their health. They also rely on their family and friends' reactions and thoughts about the treatment and consider it while their healthcare decision-making process. There are also a large group of people who prefer their family or doctor to make the decision and pick out the best option for them to escape the responsibility themselves. So, it is recommended for a practitioner to assess the mentality, behavior, and status of a patient and proceed with informed consent according to the situation needs.

India is a diverse homeland with a vibrant and dynamic culture encompassing a rich tapestry of traditions, customs, beliefs, and religions. It is the birthplace of major world religions such as Hinduism, Buddhism, Jainism, and Sikhism and also home to a sizable Muslim population and smaller communities of Christians, Jews, Zoroastrians, and Jains, contributing to its religious and cultural mosaic.

Religious faiths and beliefs are strongly followed amongst Indians and play an important role in the lives of millions of Indians. Orthodoxically, medicine and religion are considered conjointly and religious priests are often contemplated as the healers of body and soul. God is revered as the supreme healer and wields authority over one's well-being. The World Health Organization (WHO) has recognized spirituality as an important factor influencing health. Indians mostly try to blend the interplay of religion, spirituality, health and medicine in order to get better outcomes. This shows a significant implication of one's religious and cultural beliefs in health-related issues and decisions. Hence, undoubtedly, these factors significantly impact decision-making regarding medical and dental procedures, potentially influencing ethical dilemmas, religious beliefs, spiritual distress, litigation, and uncertainty. Therefore, it is crucial for Indian physicians and dentists to carefully consider and respectfully address their patients' religious concerns and spiritual needs to ensure clinical success.⁽⁵⁰⁻⁵²⁾

A statistically significant relation was found between acceptance/conditional acceptance/rejection of autografts and xenografts and religious beliefs. These results were partially in concordance with the multicentric population study conducted by Bucchi et al.⁽⁴⁴⁾ where significant differences were found between people of different countries following their religion and their perspective on bone grafts, concluding that religious affiliation influences patients preferences. Study conducted by GüngörmüşZ.⁽⁴²⁾ showed statistical difference between the religious belief levels of the participants who accepted or refused porcine-derived xenografts while no statistical difference between the religious belief levels of the participants was seen who accepted or refused autografts, allografts, bovine-derived xenografts and alloplast. On the other hand, Fernández RF et al.⁽⁴³⁾, in their study found no significant differences in the acceptance/refusal rates for the different bone grafts and religious beliefs. The main reason for refusal of xenograft in the present study was religious disapproval (45.5%) and fear of disease transmission (38.2%).

Empirical studies have shown that in Hindus, cows are considered as a holy, sacred and auspicious animal and are worshiped and it is considered a sin to kill/slaughter/abuse it.

Hindus prohibit the use of animal derived products, where animals/humans have been harmed for human benefit, treatment of ailments and encourage use of herbal/Ayurvedic products. Concerns have also been raised over the use of medications like gelatin (used in anesthesia, drugs, and intravenous fluids) which is derived from collagen from the skin and bones of cows and pigs. Jewish, Muslim, and Hindu religious leaders advocate prioritizing non animal products whenever possible. They acknowledge that in cases where no alternatives exist or those available are insufficient, the use of animal-derived medications may be permissible as a last resort to preserve life.^(40,53,54) Therefore, Hindus showed a tendency to reject the use of animal-derived components, particularly bovine, as supported by the findings of our study indicating that Hindus were more inclined to reject xenografts and alloplasts compared to followers of other religions.

Similarly, Sikhs abstain from consuming any animal products. The Sikh Gurus advocate against the exploitation and mistreatment of animals, leading many Sikhs to adopt a vegetarian diet. According to our study, participants of Sikh faith were highest in number to accept each type of graft as compared to other religious faiths and most prone to reject autograft and allograft. Keeping this in consideration, patients should be informed about the constituents of biological products, and the use of human-derived grafts is acceptable only when the donor has given explicit consent.^(10,55)

In Islam, the consumption of pork or porcine-derived products, blood, dead animals, or carrion is strictly prohibited, except in cases where no alternative is available to preserve life. In studies conducted by Enoch et al. and Easterbrook, Muslim leaders expressed a preference to avoid porcine-derived products, even if alternatives were more expensive and slower to heal.^(10,52) They stressed that such products should only be considered in extreme life-or-death situations where no other options exist. In our study, 72.7% of participants following Islam faith declined xenografts, indicating a strong tendency to reject them compared to other types of grafts, whereas 97% accepted autografts.

On the other hand, Christian doctrine does not oppose the use of bovine or porcine-derived products for medical purposes, and these products are considered acceptable in emergency situations or when no alternatives are available. In a study by Jenkins et al.⁽⁵⁶⁾, members of the Church of Jesus Christ of Latter-Day Saints expressed neutrality ("no opinion") regarding the use of allogeneic (human-derived), bovine, and porcine surgical products. They also affirmed that patients should have the autonomy to choose whether to accept offered treatments.^(10,42,52,55-57) In the present study participants of Christian faith showed 93.3% acceptance to autografts and 80% rejection to xenografts. In Punjab, India many individuals of poor low castes of different faith have started converting and accepting Christian faith for monetary or non-monetary incentives promised by Christian institutes. Their reluctance to accept xenografts as seen in the present study could be attributed to certain taboos, poor socio-economic strata and low level of education.

CONCLUSION

Due to global advancements, awareness regarding human rights, legal authorizations, patients want to be more engaged in the decision-making process concerning their treatment, make more rational choices, be informed about the competence of treatment, consequences, uncertain mishaps and failures, content of the biological substitutes being used, and the available alternatives. Such patient-centered evaluation of treatment alternatives is pivotal in achieving enhanced satisfaction and acceptance of therapy. Therefore, it is imperative for clinicians to prioritize understanding the patient's preferences, even if they have expertise in a specific type of treatment procedure. While the present study underscores the significance

of patient perception and decision-making in achieving successful outcomes, further qualitative investigations are warranted to gain a comprehensive understanding of this topic.

DECLARATIONS

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