Original article

Factors influencing edentulous patient decision-making while choosing dental implant

Arnun Jukisalapong[a,b,*]

[a]*Fort Khun Chueang Thammikkarat Hospital, 200 Moo.5 T.Thawangthong A.Muang Phayao province, 56000, Thailand*
[b]*School of Dentistry, University of Phayao 56000, Thailand*

Background: Edentulous patients suffer from the loss of natural teeth that results in chewing efficiency compromise. In addition, alveolar bone loss will occur in external width and height, these situations will decrease the quality of patient's life. Accordingly, the patient should wear a proper prosthesis that replaces the lost natural tooth. Nowadays, dental implant is the gold standard in tooth replacement.
Objective: This study aimed to investigate the factors influencing edentulous patient decision-making while choosing dental implants to replace the lost natural teeth by using the marketing mix theory and healthcare consumer behavior to assess the patient decision-making.
Methods: In this prospective study, 2 questionnaires were administered to 220 edentulous patients (159 male and 61 female patients) who were evaluated after undergoing oral examination. The researcher used the marketing mix theory and healthcare consumer behavior to understand the relationship of individual, marketing mix that influenced the patient's decision.
Results: The questionnaires were collected within a month of an oral examination. The individual factor scores were high and different with no statistical significance. The marketing mix factor found that the overall level was highly significant. The prediction of patient's decision-making shows that individual factor can predict the decision-making 3.1% and the marketing mix factor can predict the decision about 16.1%.
Conclusion: Patients with edentulous ridge had a high decision-making level for choosing dental implants to replace the lost teeth when considering the marketing mix theory. Consequently, providing the individual factor and marketing mix factor of dental implants can influent edentulous patient decision-making while choosing dental implants.

Keywords: Decision making, dental implant, edentulous, healthcare, marketing mix.

The impact of dental implants has affected the field of dentistry around the world. Dental implant is a well-known natural teeth replacement for edentulous patients. In the United States, the amount of dental implant placement has increased 10-fold from 1983 - 2002 and 5-fold from 2000 - 2005. More than 1,000,000 implants are inserted each year. It is found that more than 90.0% of oral surgeons can provide dental implant placement routinely; 90.0% of prosthodontists can restore implants routinely, and more than 80.0% of general dentists usually used dental implants to support fixed and removable prostheses. Information in the countries around the world reported that the amount of dental implant placement each year per 10,000 people is 230 in Israel; 180 in South Korea and Italy; 140 in Spain and Switzerland; 100 in Germany; 60 in Brazil, Netherlands, and the United States; 50 in Japan and France; 40 in Canada and Australia; and 20 in Taiwan and the United Kingdom. In Thailand, the information from the Institute of Dentistry, Department of Medical Services, Ministry of Public Health shows that the Thai dental implant campaign began to place the implants for edentulous patients amount 10,008 patients in 2007 - 2011 and 8,400 patients in 2012 - 2016.[1-6]

Alveolar bone requires stimulation to maintain form and density. In general, natural teeth transmit compressive and tensile forces to the surrounding bone. If a tooth is lost, it will lose stimulation in that bone area so that bone loss will occur in external width and height. In general, a tooth is important for the development of the alveolar bone. The stimulation of

***Correspondence to: Arnun Jukisalapong,** Fort Khun Chueang Thammikkarat Hospital, Thailand.
E-mail: chopinconcerto@gmail.com
Received: October 5, 2021
Revised: January 4, 2022
Accepted: February 23, 2022

the natural tooth can maintain the density and bone volume. A removable denture and bridge do not stimulate and maintain the bone volume, but they can accelerate bone loss from a load of mastication force to the bone surface only. The blood supply will be reduced, and the bone volume will be decreased. To prevent the consequence of bone loss, it can decrease the severity of bone loss by dental implant placement because dental implant can stimulate inside bone instead of the natural tooth. In addition, dental implants can improve the soft tissue architecture in the area of tooth loss. The results after dental implant placements reported that the denture increased stability in the oral cavity as well as improving chewing and phonetics. Patients who had undergone the dental implant placements were highly satisfied and reported that the dental implants have improved their quality of life.[6, 7]

The purpose of this study aimed to investigate the factors influencing edentulous patient decision-making while choosing dental implants to replace natural lost teeth by using the marketing mix theory to assess the patient decision-making. In this research, the marketing mix theory [8 – 10] and healthcare consumer behavior [11] were used to assess the decision-making of the edentulous patients to investigate and understand the truth. The results of this research can help patients to understand the usefulness of dental implants and realized the way to improve their oral health. Furthermore, dentists will deeply understand the decision-making of edentulous patients to choose their dental implant treatment and can provide the dental implant treatment in the right way to the patients.

Materials and methods

This research was approved by the Ethics Committee of Western University (HE-WTU542714). Patients who agreed to participate in the study read and signed their informed the consent forms designed for this purpose. All questionnaires were sent to experts to verify the content validity and reliability. The content validity was related to the contents and the confident value was more than 0.7 by the experts from the Faculty of Dentistry and Faculty of Business Administration. After that, the questionnaires were tested for the reliability of the participants who were not in the same group as the research sample. The α-Coefficient of Cronbach was 0.817.

The data for the study were collected from research designed to assess the relationship between Marketing mix and Decision-making. The decision-making used the healthcare consumer behavior theory for assessment (Figure 1).

Patients were enrolled in an oral examination for 12 months (March 2019 to February 2020) at the dental division at the military hospitals in northern Thailand. To be included in the study group, the patients had to meet all the following criteria:
1) partially or fully edentulous patients; 2) aged 18 - 70 years; and, 3) all pretreatment examination completed. The sample size is 220 calculated by Daniel's Method (2010) from the population amount 47,983 persons, at the 0.05 level and the 95.0% confident interval.

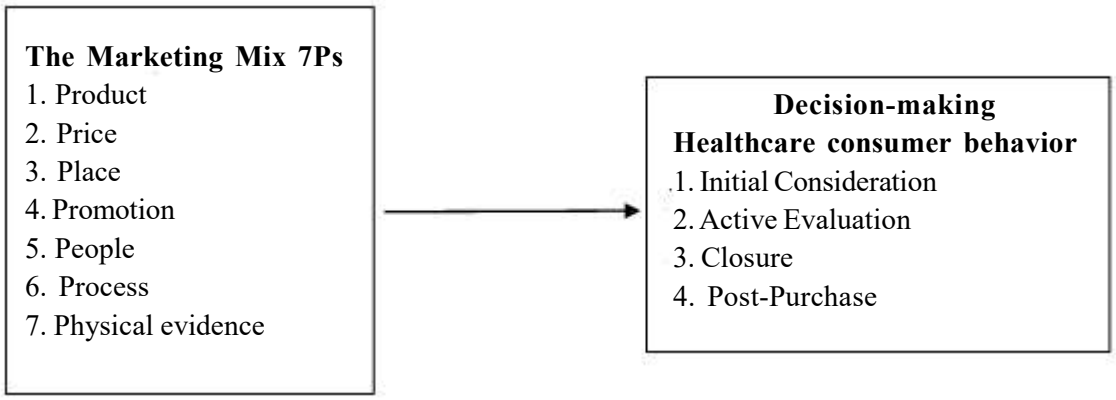

Figure 1. Conceptual framework.

Data collection

Each patient signed an informed consent form and agreed to participate in the present study. The questionnaires were divided into marketing mix issues, health care behavior issues, and individual information issues. The marketing mix issue consists of 21 questions rated on a 5-point scale. The marketing mix measures 7 principal components (product, price, place, promotion, people, process, physical evidence). The healthcare behavior issue consists of 20 questions rated on a 5-point scale. The health care behavior measures 4 principal components (initial consideration, active evaluation, closure, post-purchase) (Table 1).

Table 1. Marketing mix questionnaire.

Please read the following statements carefully to find out how important each of the statements is to you. Please check 1, 2, 3, 4 or 5: 1, strongly; 2, disagree; 3, neutral; 4, agree and 5, strongly agree

Marketing Mix	1	2	3	4	5
Product					
1. Dental implants are legal products. Not forbidden					
2. Dental implants used for treatment are manufactured from standardized manufacturers.					
3. Dental clinic has many brands of dental implants to choose.					
Price					
4. Dental implants are available in a wide range of prices.					
5. The cost of treatment is cheaper than other places. when comparing the quality and the same type of implant					
6. Able to pay in installments					
Place					
7. Dental clinics is located in the community/convenient to commute.					
8. Dental clinic is clean and safe.					
9. There is enough and safe parking.					
Promotion					
10. Dental clinic has online media for answering inquiries or promoting marketing activities.					
11. Dental clinic can educate the knowledge for public about dental implant					
12. Dental clinic has after-treatment care, such as having a phone number to call for more information					
People					
13. Dentist/staff can recommend the treatment in a simple way					
14. Dentist/staff Specializes in the dental implant treatment.					
15. The reputation of dentist					
Process					
16. The standard of treatment					
17. Dental clinic open during holidays					
18. Patients were notified prior to treatment by telephone					
Physical evidence					
19. Staff are polite and tidy					
20. The cleanliness of place					
21. The convenience of dental clinic					

Reliability and measurement error

All questionnaires were sent to experts to verify the content validity and reliability. The content validity was related to the contents and the confident value was more than 0.7 by the experts from the Faculty of Dentistry and Faculty of Business administration. After that, the questionnaires were tested for the reliability of the participants that were not the same group as the research sample. The α-Coefficient of Cronbach was 0.817.

Statistical analysis

Statistical analysis was conducted using the Statistical Package for the Social Sciences (SPSS/PC for Windows). The individual factor measurements were compared using F - test. The marketing mix measurements were compared to the independent and dependent variables using multiple linear regression. The level of significance for all tests was set at $P < 0.05$.

Results

During the 12 months, 220 patients were screened. Of these, 159 (72.3%) were male and 61 (27.7%) were female. Their average age was 26.1 years. The individual factor measurements showed that gender, age, status, education, occupation, salary, and underlying diseases were influenced by the decision-making while choosing a dental implant (Table 2).

Table 2. Decision-making for choosing dental implant.

Please read the following statements carefully to find out how important each of the statements is to you. Please check 1,2,3,4 or 5: 1, strongly; 2, disagree; 3, neutral; 4, agree and 5, strongly agree.

Stages of decision-making	5	4	3	2	1
Initial consideration					
you will make the decision from….					
1. Feature and benefit of dental implant					
2. Brands of implant, manufacture country					
3. Convenience and facilities at dental clinic					
4. Price of dental implant					
5. The online and offline information from dental clinic					
Active evaluation					
you will make the decision from….					
6. Benefit from choosing dental implant treatment					
7. Your friend's experience					
8. Brands of implant, manufacture country					
9. Treatment fee					
10. Skill of dentist					
Closure					
you will make the decision from….					
11. Credibility of dentist					
12. Convenience and facilities at dental clinic					
13. Relationships between staff and patient					
14. Decoration of dental clinic					
15. The time of treatment					
Post-Purchase					
you will make the decision from….					
16. the experience from using dental implant					
17. Relationships between staff and patient after treatment					
18. Care, appointment after treatment					
19. Cost-effectiveness of dental implants					
20. Your experience in t dental clinic					

The model summary of multiple linear regression of individual factor showed that R = 0.175, R^2 = 0.031, Adjusted R^2 = - 0.001, and standard error of the estimate was 0.175. Accordingly, the Coefficients of the predictor showed that the individual factor can predict the decision-making with significance at the 0.05 level. The prediction equation was Decision making = 4.177 - 0.017, Gender + 0.071, Age - 0.094, Status - 0.010, Education + 0.016, Occupation - 0.088, Salary - 0.041, Underlying diseases. The marketing mix factor measurements showed that that product, price, place, promotion, people, process, and physical evidence influenced the decision-making while choosing dental implants (Table 3).

The model summary of multiple linear regression of marketing mix factor showed that R = 0.401, R^2 = 0.161, Adjusted R^2 = 0.133, and standard error of the estimate was 0.47. Accordingly, the Coefficients of the predictor showed that only the process and physical evidence issues can predict the decision-making with significance at the 0.05 level. The prediction equation was Decision making = 2.751 - 0.123, Product - 0.015, Price + 0.118, Place - 0.152, Promotion + 0.102, People + 0.183, Process + 0.185, Physical evidence (Table 4).

The decision-making variable measurements showed that level of decision-making while choosing dental implants was approximately 3.94 ± 0.51. Therefore, the decision-making factor highly influenced decision-making while choosing dental implants.

Table 3. Results of multiple linear regression analysis of individual factor.

Predictions	Unstandardized Coefficients		*P* - value
	B	Std. Error	
Gender	- 0.017	0.077	0.828
Age	0.071	0.045	0.116
Status	- 0.094	0.074	0.206
Education	- 0.010	0.043	0.820
Occupation	0.016	0.025	0.523
Salary	- 0.088	0.135	0.517
Underlying diseases	- 0.041	0.131	0.752

Table 4. Results of multiple linear regression analysis of marketing mix factor.

Predictions	Unstandardized Coefficients		*P* - value
	B	Std. Error	
Product	-0.123	0.098	0.209
Price	- 0.015	0.093	0.873
Place	0.118	0.088	0.183
Promotion	- 0.152	0.089	0.088
People	0.102	0.081	0.212
Process	0.183	0.070	0.009
Physical evidence	0.185	0.072	0.011

Discussion

This study aimed to determine the marketing mix that influenced edentulous patient decision-making while choosing dental implants. The marketing mix, first introduced in 1953 by Borden NH, consists of 4 Ps (Product, Price, Place, Promotion).[10] After that Kotler P. [12] in 2014 and Kotler P, *et al*.[13] in 2016, introduced another 3Ps (People, Process, Physical evidence) added to the marketing mix. Accordingly, the marketing mix has 7Ps (Product, Price, Place, Promotion, People, Process, Physical evidence). [10 – 13] Additionally, the marketing mix has been developed and modified to 17 Ps. In this study, the researcher chooses the 7Ps marketing mix to determine the patient decision-making while choosing dental implant treatment. The marketing mix factor showed that the process and physical evidence issues can significantly predict the decision-making. The process of treatment should be considered from beginning to the complete the treatment (information finding, choosing the dental clinic, waiting at the clinic, make a relationship to the staff, treatment service, after treatment service). In the physical evidence, the dental clinic should provide the facilities and be well decorated because it's obvious to be seen by the patients at the time they stay at the dental clinic.[14 – 19] The theory of motivation describes that human decision usually depends on the emotion and reason to make the decision.[17, 18] And the dental treatment is difficult to evaluate the quality by the patients because of the complicated process of the treatment, so the patients can be evaluated from the indicator that they know such as the decoration, the kindness of the staff, the time of waiting, the convenience in the clinic.

This study showed that the process of treatment and physical evidence in the clinic can inspire the patient's emotion to accept the treatment.[19 – 21] Furthermore, the patients usually pay attention to the skill of the dentist, the personality and character of the dentist, the attitude of the dentist and staff for their treatment, the preparation of treatment, the pain control, the convenience of contacting, the location of the clinic, the parking, the waiting time, the reputation of the dentist, and the treatment fee. [22 – 24]

The model summary of multiple linear regression of marketing mix factor showed that R square = 0.161 replied that all components of the marketing mix can describe the patient decision-making approximately 16.0% and another 84.0% depending on other factors. Human behavior can be influenced by several factors such as personal experience, social culture, politics, economics, demographics, geographic.[25 – 30]

Conclusion

Patients with edentulous ridge should wear prosthetics to replace the missing natural teeth. Accordingly, edentulous patients had a high decision-making level for choosing dental implants to replace the missing teeth when considering the marketing mix factor. Consequently, providing the individual factor and marketing mix factor of dental implants can be considered for edentulous patients and dentists to plan the treatment together.

Conflict of interest

The author, hereby, declares no conflict of interest.

References

1. Nasseh K, Bowblis JR, Vujicic M. Pricing in commercial dental insurance and provider markets. Health Serv Res 2021;56:25-35.
2. Stillman N, Douglass CW. The developing market for dental implants. J Am Dent Assoc 1993;124:51-6.
3. Brickhouse TH, Dahman BA, Peters BWR, Liu H, Kumar AM. The impact of dental Medicaid reform on dental care provider activity and market penetration of dental support organizations. J Am Dent Assoc 2021;152:822-31.
4. Londoño JJ, Ramos AM, Correa SA, Mesnard M. Review of expandable dental implants. Br J Oral Maxillofac Surg 2021;59:546-54.
5. Valadas LAR, Oliveira Filho RD, Lotif MAL, Júnior FJG, Júnior EAD, Bandeira MAM, Squassi A. Development and innovation on dental products in argentina: A technological prospecting based on patents. Recent Pat Biotechnol 2021;15:3-11.
6. Resnik RR. Misch's contemporary implant dentistry. 4th ed. Elsevier: Missouri;2020.
7. Kim JJ, Ben Amara H, Chung I, Koo KT. Compromised extraction sockets: a new classification and prevalence involving both soft and hard tissue loss. J Periodontal Implant Sci 2021;51:100-13.
8. Constantinides E. The marketing mix revisited: Towards the 21st century marketing. J Marketing Management 2006;22:407-38.
9. Rafiq M, Ahmed PK. Using the 7Ps as a generic marketing mix: an exploratory survey of UK and European marketing academics. Marketing Intelligence & Planning 1995;13:4-15.

10. Borden NH. The concept of the marketing mix. J Advertis Res 1964;4: 2–7.
11. Mckinsey and company. Health Care Consumer Behaviors: 4 stages of consumer decision making applied to health care shopping and digital transformation [Internet]; c2016 - [cited 2018 Feb11]. Available from: https://www.linkedin.com/pulse/health-care-consumer-behaviors-4-stages-decision-making-bill-gaynor
12. Kotler P. Kotler on marketing: how to create, win and dominate market. 1st ed. New York :The Free Press; 2014.
13. Kotler P, Keller KL. Marketing management 15th ed. New York: Pearson; 2016.
14. McGuigan PJ, Eisner AB. Marketing the dental practice: eight steps toward success. J Am Dent Assoc 2006;137:1426-33.
15. Brown LJ, Guay AH, House DR. The effects of insurance carrier market power on dentists and patients. J Am Dent Assoc 2009;140:90-7.
16. Schwab DP. Marketing dental implants: a step-by-step approach. J Am Dent Assoc 1995;126:313-7.
17. Kim MJ, Damiano PC, Hand J, Denehy GE, Cobb DS, Qian F. Consumers' choice of dentists: how and why people choose dental school faculty members as their oral health care providers. J Dent Educ 2012;76: 695-704.
18. Belch GE. Belch MA. Introduction to advertising and promotion: An integrated marketing communications perspective. 2nd ed. Boston: Irwin Inc; 1993.
19. Lancu AI, Cîrstea SD. Promoting a dental practice on Facebook. In: Vlad S, Roman N, editors. Proceedings of international conference on advancements of medicine and health care through technology; 2016 Oct 12-15; Cluj-Napoca, Romania. Cham: Springer;2017. p. 287-90.
20. Schiffman LG, Kanuk LL. Consumer Behaviour 1st ed. New Jersey: Prentice-Hall; 2007.
21. Scholar MP. Consumer behaviour in services. J Business Management 2016;43-6.
22. Wang Z, Janda S, Rao CP. An evaluation of market segments for dental care: A determinant attribute approach. In: Gomes R. editors. Proceedings of the 1995 Academy of Marketing Science (Academy of Marketing Science) Annual Conference. Cham: Springer; 2015. p. 291.
23. Zhengyuan W, Swinder J, Rao CP. Dental services marketing: Do market segments based on usage rate differ in terms of determinant attributes?. J Services Marketing 1996;10:41-55.
24. Diaz IMR, Cataluña FJR. Antecedents of the importance of price in purchase decisions. Revista de Administração de Empresas 2011;51:370-81.
25. ChenYu HJ., Kincade DH. Effects of product image at three stages of the consumer decision process for apparel products: alternative evaluation, purchase and post purchase. J Fashion Marketing Management 2001;5:29-43.
26. Khuong MN, Duyen HTM. Personal factors affecting consumer purchase decision towards men skin care products-A study in Ho Chi Minh City, Vietnam. Int J Trade Economics and Finance 2016;7:44-50.
27. Orji O, Goodhope O. Major classic consumer buying behavior model: Implications for marketing decision. J Economics and Sustainable Development 2013;4: 164-72.
28. Blackwell R, Miniard P, Engel J. Consumer Behavior. 10th ed. South-Western: Thomson; 2006.
29. Engel JF, Kollat DT, Blackwell RD. Consumer Behavior. 1st ed. Holt. New York: Rinehart & Winston;1968.
30. Rao CP, Rosenberg LJ. A framework for consumer behaviour analysis in dental care marketing. In: Malhotra N. editors. Proceedings of the 1986 Academy of Marketing Science (AMS) Annual Conference. Cham: Springer; 2015: 342-6.