Review Article

Structural factors affecting prosthodontic decision making in Japan

Noriyuki Wakabayashi*, Junichiro Wada

Department of Removable Partial Prosthodontics, Graduate School, Tokyo Medical and Dental University (TMDU), Tokyo, Japan

Received 1 October 2014; received in revised form 17 February 2015; accepted 3 April 2015

KEYWORDS
Prosthodontics; Decision making; Health insurance; Dental education; Decision model; Clinical pathway

Summary Prosthodontic treatment strategies, prosthetic designs and materials, and treatment procedures are not determined solely by the diagnosis. We discuss the major effect of structural factors surrounding prosthodontic care on treatment decisions in Japan. These structural factors are related to the dentist, such as the dentist’s education, postgraduate courses, and access to the latest research, and to the health care support system, including the social insurance system. Education content from schools of dentistry has clear effects on dentists’ treatment decisions, and the specific modalities taught depend highly on the school faculty. The use of research, especially clinical studies, in treatment decisions is currently limited. Regarding the health care support system factors, the public health insurance system has a strong effect on the actual prosthodontic treatments performed in Japan. To maintain the current piecework payment system, efforts should be encouraged to preclude both overtreatment and undertreatment. New perspectives on treatment decisions associated with technological advancement and changes in health care needs should be established to ensure that the Japanese population can enjoy high-quality prosthodontic treatment that meets international standards. The development of a clinical pathway and decision-making model that adheres to academic-based clinical guidelines and the insurance system will be necessary.

© 2015 Japanese Association for Dental Science. Published by Elsevier Ltd. All rights reserved.

Contents
1. Introduction ........................................................................................................... 97
2. Factors related to the dental care provider ............................................................ 97
  2.1. Dental education ............................................................................................. 98

* Corresponding author at: 1-5-45, Yushima, Bunkyo, Tokyo 113-8549, Japan. Tel.: +81 3 5803 4935; fax: +81 3 5803 0200.
E-mail address: wakabayashi.rpro@tmd.ac.jp (N. Wakabayashi).

http://dx.doi.org/10.1016/j.jdsr.2015.04.001
1882-7616/© 2015 Japanese Association for Dental Science. Published by Elsevier Ltd. All rights reserved.
1. Introduction

Prosthodontic treatment strategies are generally decided once the patient consents to a plan that is drafted by the dentist and based on the results of a patient interview and an oral examination. Medical interviews are used to gather information on the history of the patient’s present oral condition, such as their chief complaint and their relevant medical, drug, and social histories. Information regarding the status of the teeth, periodontal tissue, implants, bone, and soft tissue in the oral cavity is obtained from routine oral examinations along with X-rays and diagnostic casts. This information also serves as the basis for judging whether a more detailed enquiry is necessary.

However, a definitive diagnosis based on the above process does not necessarily guarantee that decisions can be made immediately regarding prostheses selection, clinical procedures, prosthetic design, and the material used to produce the prostheses. Because prosthodontic treatment offers a wide variety of options that require consideration of minute details, the treatment modality is normally decided based not only on the diagnosis but also on complex factors such as the dentist’s judgment, the patient’s opinions and expectations, and socioeconomic factors, such as the patient’s method of payment for treatment expenses [1]. Due to these types of structural factors that are unrelated to the patient’s oral conditions, it is not unusual to observe different prosthodontic treatments used in different countries and regions for patients with the same diagnosis [2,3]. Until now, there have been few summaries of these factors based on clinical dental practice in Japan. This lack of material makes it difficult to formulate plans for improving prosthodontic science and education in the country. Thus, the objective of the present paper was to analyze the structural factors that affect the selections and decisions regarding prosthodontic treatment in Japan.

2. Factors related to the dental care provider

The process of selecting and deciding on a treatment modality is exceedingly complex. The dental care provider possesses a great deal of information regarding dental treatment decisions, whereas the patient has very limited amounts of such information. This disparity in information arises from the patient’s need, in many cases, to have the dentist determine which dental services the patient requires. “Informed consent,” wherein the dentist provides his/her information to the patient, is a rather recent practice [4]. Currently, patients generally select a treatment modality based on this information. Additionally, the patient sometimes takes an active role in decision making regarding treatment; for example by visiting multiple dental clinics and making the final decision on where they will receive treatment. Nevertheless, the information is ultimately provided by the dentist. Therefore, the dentist still plays an important role in deciding the treatment, regardless of the patient’s involvement.

Many patients want their dental treatment to be decided by a set of general standards regardless of who the dentist is. However, in reality, it is not uncommon for different dentists to use different processes to make treatment decisions. In general, the number of applicable prosthodontic treatment modalities is somewhat narrowed by the results of the diagnoses of the teeth and dental arches. However, a wide variety of treatment options remain available at this point, each of which has both advantages and disadvantages.

One notable characteristic of decision making in general health care is that the final decision regarding treatment involves not only the health care provider but also the patient, who attempts to derive a conclusion based on his or her own experience and expectations [5]. For example, if a patient has a vivid experience regarding similar disease or treatment with themselves or their family, this memory will greatly affect their decision making in subsequent treatments. Moreover, dentists’ decision making regarding the latest treatments is also greatly affected by their experiences of success and failure [6]. Although neither of these determinant factors is based on scientific evidence, they can exert a powerful influence on the decision making of both health care providers and patients.

Generally, if treatments for a given oral condition include modalities that are always appropriate (“white”) and those
that are always inappropriate ("black"), many prosthodontic treatment modalities are in reality considered "gray"; i.e., their appropriateness varies with the patient's status. For example, consider designing a removable partial denture for a patient with a periodontally compromised premolar tooth with slight tooth mobility that is targeted for use as an abutment. In this case, a common design would be the engagement of a retentive clasp arm with an occlusal rest on the abutment; other potential modalities include having the premolar tooth receive only an occlusal rest as a component of the secondary fixation by the framework or having the premolar tooth fixed to a mesial adjacent tooth by means of splinted crown restorations. The choice between these modalities is difficult because, in some cases, a previous design causes no problems as long as regular maintenance is performed following denture insertion; however, there are also, unfortunately, cases in which the premolar tooth must be extracted in the early stage. The long-term prognoses of abutment teeth is affected not only by the progression of periodontal disease and the status of the periodontal tissue but also by several other factors, such as the patient's bite force, the habitual characteristics of the patient's tooth contact, the patient's oral hygiene, and whether they smoke [7]. Therefore, the choice of the best modality for an individual patient is not easy [8].

In this context, whether a treatment is considered "white" in a given situation varies significantly with the patient's status; however, a treatment modality that is considered "gray" does not necessarily indicate that it is absolutely inappropriate. Therefore, aside from extreme cases in which, for example, the first molar is extracted without any signs or symptoms of dental caries, periodontal disease, or pain, no modality can be considered "black." Ironically, when a modality is considered "gray," it can occasionally create a widespread dental orthodoxy or "dogma" among dental care providers wherein a treatment policy and method are advocated by small groups of dentists even when it is not based on any empirical evidence [9].

However, there is a greater fear that if dentists have no discretionary powers regarding decisions about treatment modalities that are "gray," it would be difficult for them to perform almost any type of prosthodontic treatment. The difficulty in these discretionary powers is that judgments regarding "gray" modalities often differ according not only to the patient but also the dentist. Therefore, to improve the specification of discretionary powers, it is necessary to understand what factors into the dentists' decisions in choosing among "gray" modalities, particularly the structural factors including educational background and access to academic resources. Thus, we investigated a number of dentist-related structural factors that affect dentists' decisions.

2.2. Guidelines and specialized education

Academic societies can play important roles in decision making regarding treatment strategies [15]. The Japan Prosthodontic Society publishes journals in Japanese and English to disseminate the latest research results and present dissertations, and these journals are managed and edited by a specialized peer review system. The Society also publishes prosthodontic treatment guidelines; although these guidelines are primarily for use by society members, they can also be viewed online by non-members [16]. These guidelines are based primarily on publicly available data from published academic papers, and cover treatment fields such as therapeutic strategies in general prosthodontics, removable prosthodontics, relining and rebasing, adhesive bridges, and infection measures in treatment. However, these guidelines have yet to cover all fields of prosthodontic treatment to date. Furthermore, the Society has no data regarding the extent to which members and non-members apply these guidelines in actual clinical practice. Therefore,
the influence of these guidelines on clinical practice is unknown.

Many academic societies, as part of their annual meetings, hold lectures that serve as post-graduate training, and promote information dissemination via open lectures that target the public. Providing information in this manner to patients, although lacking in immediate effect, is an effective method for making appropriate treatment strategy decisions easier in a broad sense.

In addition to academic societies, dentists have many opportunities to obtain information from lectures and courses and from publications such as non-academic-based journals and circulations written for commercial reasons for wider audiences. For many clinical dentists, these can provide more accessible educational opportunities than can be provided by academic societies, as the latter function more as settings for presenting research. These media could perhaps have a notable effect on treatment decisions in clinical settings. However, almost no publications from sources other than academic societies go through a peer review system; therefore, the information obtained from such publications is not as reliable as information published by academic societies.

2.3. Utilization of research data

The information provided by lectures and books is often based on the content of original research articles. Therefore, rather than reading these books, checking the original articles makes it possible to obtain more precise information without as many misinterpretations or biases. In recent years, the expanded availability of various databases and the increase in electronic resources such as online journals has made it possible to retrieve literature from anywhere. Consequently, the utilization of research data has become more useful than before. However, the utilization of research data in treatment decisions presents the following problems.

The first problem stems from the characteristics of academic data themselves. Treatment modalities are subject to many factors that determine their appropriateness, including patient conditions (e.g., the presence of comorbidities) and health care provider conditions (e.g., the techniques used by and experience of the health care provider and the functions of their institutions). Thus, any method of evaluating the efficacies of these modalities would need to account for these factors. Indeed, because few methods can do so perfectly, the development of evaluation methodology constitutes an objective of study. Currently, the gold standard in analyzing the effects of a treatment modality is the use of randomized controlled trials (RCTs). In RCTs, patients are divided into multiple groups with equal characteristics and disease severity, and each group is randomly assigned a different treatment modality. Consequently, the differences in patient characteristics are offset, which makes it possible to statistically verify the relative merits of the treatment modalities in question. Unfortunately, very few prosthodontics studies have ever been conducted as RCTs in Japan [17].

The RCT is recognized as a scientifically well-grounded method. However, verification of treatment efficacy is based on statistical analysis; i.e., the superiority of one treatment to another is represented probabilistically. Therefore, modalities with low probabilities sometimes yield better results than do modalities with high probabilities. Additionally, RCTs are intended for patients who fulfill established conditions (e.g., the absence of comorbidities); thus, they are difficult to use for elderly patients with many comorbidities who are likely to be targets for actual treatment. In other words, efficacy under the established conditions of an RCT and actual clinical effectiveness are completely separate discussions. Furthermore, the results are greatly influenced by the selection of the outcomes for evaluation [18]. Prosthodontic treatment outcomes in particular often cannot be assessed using life expectancy or other unidimensional evaluations as is often the case with cancer treatments. For this reason, quality of life measures have frequently been used in recent years to comprehensively and objectively evaluate outcomes [19]. However, one of the major characteristics of prosthodontic treatment is the importance of individualized responses to patients’ chief complaints and the details that patients expect, such as tooth color and individualized teeth alignment. Thus, dental professionals’ responses to these factors have a major effect on patients’ satisfaction. In other words, there are limits to comparing the effectiveness of prosthodontic treatments in a manner similar to anti-cancer drugs. For this reason, the results of even carefully conducted clinical studies cannot be assumed to possess a definitive influence in actual prosthodontic settings [20].

The second problem is that, although databases that include only Japanese-language papers and international information sources with English-language papers are both accessible in Japan, there are very few clinical studies that have been conducted in Japan. It is not unusual for a Japanese dentist to search for clinical research data relevant to a specific decision and find that nearly all of the search results are from clinical studies that were conducted outside of Japan. Studies conducted outside of Japan occasionally differ from Japanese studies in terms of the target patients’ physical characteristics [21] and sociodemographic backgrounds [22] and the prosthodontic materials used. Thus, these studies are often not suitable as references for treatments that are to be performed in Japan. Additionally, many dentists do not necessarily have knowledge about how to access these databases on the web or have the skill to search for relevant content in papers written in English. If individual dentists, who are in a position to diagnose patients, do not proactively and ambitiously access research information, they will have little opportunity to encounter more up-to-date and potentially more accurate knowledge. Note that the second problem is not unique to Japan but is rather common to all Asian countries because the ethnic makeup of these countries differ from those of the West, and English is not a native language. Thus, measures for handling these issues are desirable.

3. Factors related to the health care support system

Medical expense payment methods are known to affect treatment modality decisions [23–25]. Here, we will analyze the characteristics of the Japanese health insurance
system (a part of the larger social security system) and its effects on prosthodontic treatment. It should be noted that the number of people enrolled in private insurance plans that cover dental treatment is far lower in Japan than in countries such as the United States. Therefore, dental treatment in Japan is actually paid for using the public insurance system or entirely out of pocket without insurance support.

3.1. The health insurance system

In Japan, everyone is covered by some form of public insurance [26] and thus can receive necessary medical and dental services at relatively low costs by paying certain insurance premiums and co-payments (10–30%) at the reception desk. The public health insurance systems that workers subscribe to include the insurance managed by the Health Insurance Society, which covers employees of large enterprises, and the Japanese Health Insurance Association’s insurance, which covers the workers of small- and medium-sized enterprises. Additionally, National Health Insurance is provided by municipal governments for people who do not have any other insurance plan. Furthermore, people aged 75 or older subscribe to the medical care system for the elderly. This universal health insurance system was established based on the policy that people’s health and lives must be protected; thus, everyone should be able to receive medical services regardless of their income or type of work. However, the increasingly insufficient finances for health insurance due to increased medical expenses, a declining birthrate, and a rapidly aging population have become an imminent issue that requires a solution.

Thus, the public health insurance system, which attempts to guarantee a “minimum” level of health care for all citizens as stipulated in the Constitution, encounters some problems. In particular, the difficulty of defining “minimum” makes it difficult to classify health care services and drugs as “fundamental.” In the field of medicine, which addresses life-threatening diseases, the only fields which society can agree on as not being considered “fundamental” are cosmetic surgeries and upgraded hospital rooms. It has also been reported that patients are more likely to use dental services when their insurance coverage reduces the co-payments [27,28]. This situation results in a financial aggravation of the insurance system that is caused by skyrocketing medical expenses and limited financial resources.

3.2. Piecework payment system

The Japanese insurance system has adopted a “payment on a piecework basis” wherein payments are made to a dental care provider in accordance with the treatment techniques (e.g., tests, surgery, fillings, and impression taking), medication, and prostheses provided. The results of studies in countries outside of Japan have shown that treatment opportunities and their costs expand when this payment system is used [29–32]. Alternative payment systems include “batch payment” (the patients are divided into different groups based on disease, and a batch amount is paid for each group) and “budgeting” (a certain amount is paid to a health care institution as a whole). For both of these payment systems, the costs of tests and drugs are borne by the health care institution. This situation is considered to easily lead to undertreatment and reductions in treatment opportunities [30].

In Japan, to ensure the validity of claims for treatment fees, an organization (the Health Insurance Claims Review & Reimbursement Services) that is independent of both insurance payment institutions and health care providers audits the details of these claims. Regarding the structure of prosthodontic treatments, fees are set for each treatment process, such as impression taking, bite registration, denture insertion, and post-insertion maintenance, and dentist is tacitly urged to proceed with prosthodontic treatments that accord with these treatment processes. Consequently, the social insurance system is expected to serve a role similar to a set of treatment process guidelines. However, this system has been maintained such that the income and expenditures of the insurance system as a whole are balanced; therefore, the nature of this system fundamentally differs from that of the academic-based treatment guidelines. For example, impression taking using individual trays and many other prosthodontic materials and clinical tests that are all included in the education curriculum are not on the insurance payment list. This situation potentially precludes a dentist from employing these techniques and materials unless that dentist considers them essential to the patient’s treatment regardless of expense. Even if a treatment is not covered by insurance, the dentist should perform it anyway if they know that the patient needs it. However, the mere fact that the treatment is not covered is often a powerful deterrent for the dentist. Therefore, on the one hand, the piecework payment system tends to result in overtreatment because the dentist might even perform unnecessary treatment processes with no substantial cost to the patient. On the other hand, the lack of coverage for a given treatment, even if that treatment would be effective in a specific case, tends to result in undertreatment.

Governmental efforts were necessary to minimize the increases in medical and dental costs to maintain the piecework payment system that tends to result in overtreatment. For prosthodontic treatment in particular, the suppression of treatment costs has been practically induced by limiting the treatment modalities and materials covered by public insurance. In this system, the treatment modalities that require expensive materials or equipment are excluded from coverage; treatments not covered by the public insurance are paid for either by the patient out of pocket or by private insurance. This system has recently created the following two major problems.

3.3. Limitation of treatment selections

The first problem is the recent emergence of a large gap that is specific to prosthodontics between the treatment modalities covered by insurance and those desired by many patients. Underlying this gap is the increasing sophistication of prosthodontic care and advancements in the materials. Treatments that are first-line treatments in many parts of the world are often not covered by the Japanese insurance system. For example, metal–ceramic crowns, which have been demonstrated to exhibit considerable longevity and
safety [33], are the most common type of restoration. However, neither anterior nor posterior dentition with metal–ceramic crowns is covered by the Japanese insurance system. Consequently, when a patient who desires treatment covered by insurance requires a molar crown, the only available option is a full-cast metal crown made of silver–palladium-based alloys. Therefore, an enormous number of premolar and molar crowns inserted in Japan are full-cast metal, and this situation is not observed outside of the country. Furthermore, the recent rises in the prices of palladium have made full-cast metal crowns relatively expensive, which means that this situation is not effective in limiting expenses. The reason that metal–ceramic crowns have not yet been covered by public insurance is considered to be closely related to the second problem, which is described below.

3.4. Underrated treatment costs

The second problem is that dentists do not always accept the fees for treatments covered by insurance when those fees are compared to health care providers’ working hours and costs. For example, when a patient with missing bilateral mandibular molar teeth is treated using a removable partial denture, the follow procedures are performed: preparation of the abutment teeth, impression, occlusal registration, and delivery of the denture. These procedures, along with the post-insertion adjustment of the dentures, typically require a minimum of four treatment sessions for which the health care provider is paid treatment fees of ¥6310 (approximately US $58) from the insurance provider. Furthermore, after the denture delivery, another ¥17,410 (US $160) is paid from the insurer as a fee for the dentures. This fee covers the cobalt–chromium alloy framework that consists of a lingual bar, three clasps with occlusal rests, artificial denture teeth, and an acrylic denture base. When these fees are summed, they equal only one-quarter of the fee charged for partial dentures by public facilities in the United States [34]. To make matters worse, the dentist must use a portion of these fees to pay for the technician’s fee, which includes the materials used. This rule motivates the dental care provider to keep the technician’s fee low, which creates a secondary problem of curtailing the dental technician’s income.

Expecting a health care provider to provide economically unviable treatments is unrealistic. In such cases, what actually happens is that the dentist is encouraged to select cheap materials and designs. For example, for removable partial dentures, many designs use wrought wires to form the lingual and palatal bars and even the occlusal rests, all of which are found on the list of insured treatments. The technician’s fees for these designs are lower than those for cast frameworks; however, the above denture design and materials are not described in any contemporary textbook based on internationally accepted standards [35], and they are not recognized in any international academic society. Additionally, there is a trend among Japanese dentists to use acrylic dentures that do not incorporate a metal framework not only as temporary dentures but also as definitive prostheses. There are no objective data regarding the numbers of cases of, or costs incurred from, denture repair or re-construction due to fractures that result from the use of acrylic dentures. Thus, it remains unclear whether such underrated treatment costs are effective in the total financial balance sheet of the insurance system.

When a patient pays out of pocket to have partial dentures made, dentists often charge the patient ¥200,000 (~US $1819) or more. In such cases, while the decision making regarding the design and materials used is still strongly influenced by the dentist’s perspective and policy, both the dentist and patient have a wide variety of treatment choices to select from. Nevertheless, the vast majority of Japanese citizens who want treatment covered by insurance must accept modalities and materials that are not considered first-line by international standards. The Japanese insurance system has allowed nearly all Japanese citizens to enjoy the minimum medical and dental care. However, with its effects on modalities, materials, and prosthesis design, the public insurance system is currently the greatest determinant, or possibly limiting, factor in prosthodontic treatment for the citizens of Japan.

4. Factors related to changes in the dental care environment

4.1. Technical advancements

The prevalence of new techniques has also greatly affected treatment modality decisions. For example, due to the prevalence of chair-side CAD/CAM restorations, the proportion of composite and cast alloy restorations is now generally decreasing. Precedent suggests that the prevalence of such new techniques will likely result in a gradual expansion of the range of treatment options that dentists consider “appropriate.” For example, when cone-beam computed tomography (CT) was not yet prevalent in Japan, its use was limited to implant placement and the extraction of impacted teeth. However, cone-beam CT is currently also used in tests and diagnoses for numerous endodontic and periodontal treatments [36]. Therefore, a time might come in the near future when making a decision to extract teeth without the guidance of the results of a CT test could lead to malpractice lawsuits.

4.2. Changes in health care needs

Periodontal disease and associated tooth loss should be considered chronic illnesses with no possibility of complete recovery similar to lifestyle illnesses such as diabetes and the weak constitution brought on by aging. Tooth loss, which can progress even in well-controlled elderly patients with chronic periodontitis, characteristically differs from dental caries, which can be treated using more “conservative” treatments such as composite filling and endodontic treatment. Additionally, the post-treatment maintenance for prosthodontic treatments for progressive tooth loss becomes a permanent part of the patient’s life [37]. It is desirable that dentists’ plan treatment proposals for the loss of teeth that, unlike plans for dental caries and injury, assume that the treatment “will not be concluded” given that this form of support should be based on realistic
expectations. Patients with reduced physical functioning are limited in their capacity to manage the hygiene of the oral cavity and prostheses [38,39]. Therefore, for elderly patients in whom tooth loss is expected to progress, it is important to propose treatment plans that are based on the patient’s post-treatment living environment and access to dental care. For example, patients with reduced motor function would find it difficult to clean fixed prostheses; as such, removable dentures would make hygiene management easier for both the patient and their caregiver. In Japan’s markedly aging society, it is important to respond to such changes in patient needs.

5. Necessary measures

To standardize the process of prosthodontic decision making by dental care providers, the enhancement of academic-based approaches is highly encouraged. Clinical pathway and decision-making models that meet the prerequisites for clinical guidelines based on the dental sciences and on the social security system will likely be necessary in the near future.

5.1. Clinical pathways

Clinical pathways were originally developed in the United States to demonstrate the quality of health care provided by hospitals and to standardize health care patterns in response to fears of undertreatment when a batch payment system based on disease type was adopted [40,41]. These clinical pathways, which generally reflect specialized academic society guidelines and research results, prescribe detailed health care services for each specific disease [42,43]. As previously stated, the Japanese public insurance system exhibits some influence as a treatment process guideline; however, its purpose is fundamentally different from that of the clinical pathways. In most cases of actual prosthodontic treatment, it is necessary to respond to a wide variety of patient complaints, socioeconomic backgrounds, and dental statuses. In other words, prosthodontic patients generally cannot be effectively treated using a series of simple clinical steps. In particular, making a decision regarding a treatment modality requires a great deal of time for patients with long and complex histories behind their present illnesses. Therefore, adding patient-specific variations to a baseline standardized treatment pattern (i.e., the clinical pathway) would be considered an efficient method. Additionally, although a cost-utility analysis, which can predict the time and costs required for a given treatment, is under consideration in the field of medicine in Japan [44], this type of analysis has not yet been introduced to prosthodontic treatment. A clinical pathway system that adheres to clinical guidelines and suits the Japanese health insurance system will likely be necessary in the near future.

5.2. Decision making models

Decision trees are a useful method of assisting in treatment strategy decision making; such trees allow the dentist to decide on a treatment modality by examining its overall effectiveness relative to other modalities [45]. For example, when prosthodontic treatment is performed, the prognosis for the treated teeth is divided into “good prognosis with stable periodontal status,” “increased probing depth,” “fracture of restorative materials,” “tooth in need of extraction,” and so on. The probability of each of these prognoses is determined using clinical study data. At the next branch in the decision tree, these respective probabilities are calculated again in the event of a remake or secondary treatment following the failure of the initial restoration. If extraction is performed at the first circle, a larger-scale prosthodontic treatment is performed, and the probability of the next circle is calculated. However, prosthodontic treatment generally involves periodontal disease, tooth loss, and other complications which progress over the long term; therefore, the branches can easily become vast and complex [46].

The Markov model is considered a more effective prediction model for prosthodontic treatment [47]. This model is suited to accommodating changes in treatment effects, exacerbation of dental status, and stability of the health condition as a result of the time course in patients with chronic diseases; thus, this model is suited for prosthodontic treatment. Indeed, it is assumed that the probability of a given outcome when a certain treatment is performed can be predicted based on the status of the tooth immediately before treatment. The probabilities of the status remaining unchanged for a certain period or transitioning to a different status are estimated primarily based on clinical data. By including all possible status outcomes in the model, it is possible to calculate the predicted effectiveness and cost of a given treatment modality in a certain period following treatment [48]. Additionally, if Markov models are constructed for each treatment modality, the respective modalities can be compared objectively [49]. However, obtaining accurate figures for the cited probabilities (i.e., treatment success rates) is crucial to the precision of the model. Clinical studies should be planned based on the assumption that the data they generate will be used in these types of decision-making models.

6. Conclusions

The current dental education content requires further improvements involving the inclusion of effective plans for dealing with clinical uncertainty that can reduce this variability in clinical dentistry. Prosthodontic modality decisions associated with technological advancements and changes in health care needs should be established so that the people of Japan can enjoy high-quality prosthodontic treatment that meets international standards. The development of a clinical pathway and decision-making model will be encouraged in the near future.

Conflict of interest

There are no financial relationships between the authors and any commercial, public, or governmental institute that might create any conflict of interest relevant to this paper.
References


[42] Rotter T, Kinsman L, James E, Machotta A, Steyerberg EW. The quality of the evidence base for clinical pathway effectiveness:


