

Determining the prognosis: When to treat and when to extract?

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Abstract

Introduction: The advent of implants revived the discussion of one of the great dilemmas of clinical dentistry, which is the identification, based on prognosis, of when a tooth must be extracted or when other treatment options can be considered. Periodontal, endodontic and restorative characteristics must be carefully evaluated to determine prognosis and treatment predictability and consequent development of the treatment plan. **Objective:** Due to the relevance of this topic, the objective of this work is, by means of a literature review, to assist the dentist in evaluating clinical situations requiring decision making between keeping or extracting a tooth, establishing a correct prognosis. **Results:** Findings in the literature show that authors disagree among more conservative approaches and implant placement. Factors that can distinguish those cases are the technical and scientific knowledge and professional experience, commitment to their patient's oral hygiene, as well as its systemic, dental and financial conditions. However, there is a consensus in the literature regarding the sovereignty of one technique over another for the treatment of different clinical situations. **Conclusion:** What will guide the clinician's choice is a critical and scientific analysis of the cost-benefit to establish an individualized, multidisciplinary and with greater predictability treatment plan.

Keywords: Prognosis. Dental implants. Prosthesis and implants.

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Introduction

The development of a treatment plan which is predictable to achieve long-term success requires careful evaluation of many factors which will influence the prognosis of involved teeth and the possible choice of keep them or not in the oral cavity.³

Keeping this in view, Iqbal and Kim suggested a classification to identify clinical situations that are a dilemma to the dentist. They define compromised tooth as a complex clinical syndrome, which can result of any structural and pathologic disorder that prevent the tooth of working properly without making any kind of restoration — it includes placement of prosthetic restoration and the possibility of endodontic treatment. Now, the tooth in terminal stage was defined as in a pathologic state or structural deficiency which cannot be repaired successfully by reconstructive therapies. Treatment strategies for this type of tooth include extraction and function rehabilitation with placement of fixed or removable prosthesis, or implants installation.¹⁷

The main causes of dental loss described in literature are caries and periodontal disease, however during the process of decision-making between extract or not a tooth, must identify the local and systemic clinical attributes, that can affect the functional maintenance of the tooth.⁴⁶

The factors that can distinguish the extraction causes from the more conservative possible treatments involves a technical-scientific knowledge and professional experience, the patient's commitment with its oral hygiene, as well as its systemic, dental and financial conditions.³

Against the relevance of theme, this review aims to assist the dentist to evaluate clinical situations where it's necessary the decision-making between extract or keep a tooth, establishing for this a correct prognosis.

Literature Review

One of the biggest dilemmas on dental clinic is the identification of when a tooth by the unfavorable prognosis and low predictability of other therapeutic options is indicated to extraction. It is important to highlight that the item in question is controversial, polemic and involves a wide range of factors that should be analyzed with care and knowledge.²⁴

Accordingly, the planning becomes a extreme important stage to the correct execution of a treatment and for that, must include all of the necessary stages to the achievement of proposed therapy. Thus, the clinician must establish the diagnosis, the etiology, and determine the remaining teeth prognosis, taking into account the needs and desires of the patients,^{3,8} since losing a tooth has a significant functional and psychological impact.¹¹

The development of this treatment plan requires a careful evaluation of many factors that can influence the prognosis of compromised teeth, as well as require preview of complete dental rehabilitation, of functional and aesthetic results, always putting as priority the possibility of keeping a stricken tooth, basing on risks and benefits of treatment options.^{8,11}

According to Ávila et al, the main factors that determine the decision-making of extract or not a tooth include the patient expectation, the finances, the commitment of the patient which the treatment and esthetic.² These are factors that cannot be measured objectively, but have critical relevance on developing the treatment plan. Other factor that influence the compromised teeth's prognosis, such as periodontal features, endodontics and restoratives, also should be carefully evaluated during the development of planning, for the treatment to be predictably a long-term success. All of these factors, whether local or systemic, must be identified in clinician initial evaluation (Table 1).³

In some cases, one only factor can be critical in determining to keep or not a tooth, however there are still cases in which this decision is based in accumulated factors. It should also take into account the predictability of therapeutics for the compromised tooth. In the survey of these factors, the clinician must be impartial, in other words, should not have preference in therapeutic decision, due its abilities, experiences or interests.^{7,11}

In the presentation of all these factors will be cited peculiarities that must be considered in different specialties of dentistry for the decision-making of extract or keep a tooth.

Periodontal considerations

Function, comfort, aesthetic, cost and time of treatment are relevant for the evaluation of periodontally

Table 1 - Local and general risk factors.

Factors	Unfavorable prognosis	Favorable prognosis
GENERAL		
General state of patient	Present risk factors	Good health
Medical history	Significant factors detected	None detected
Smoker	Yes	No
Genetic test	Positive	Negative
Immune system	Immunosuppressed	Normal
Medications	Cyclosporin, phenytoin	None
Nutritional state	Protein deficiency	Normal
Medication dependency	Yes	No
LOCALS		
Bacterial flora	Present pathogens	Normal flora
Loss of insertion	Greater than 50%	Less than 50%
Pocket activity	Bleeding, exudates	Normal
Amount of bone loss	Greater than 50%	Less than 50%
Speed of disease progression	Fast	Slow
Furcation involvement	Yes	No
Mobility	High	Normal
Plaque control	Inadequate	Adequate
Residual teeth	Little quantity, isolated	Most present
Crown/root proportion	Inadequate	Adequate
Occlusal trauma	Present	Absent
Parafunction	Present (bruxism)	Absent
Dental alignment	Bad	Good
Root morphology	Unfavorable	Favorable
Caries	Present	Absent
Restorations	Bad	Good
Endodontic considerations	Complicated	Favorable

Source: Modified from Davarpanah et al.⁸

compromised teeth. It is important at the moment of decision, take into account not only the tooth in question, but the global planning of case, as evaluate if the conservation of the tooth will interfere in adjacent teeth of if it will important or not for the prosthetic rehabilitation of the patient.^{24,27}

In relation to the severity of periodontal disease, one must consider the probing depth and the clinical attachment level, since this evaluation shows the amount of support periodontal tissue lose. The degree of dental mobility will be related to the severity of bone loss, so cases of third degree mobility has poor prognosis, including in function of discomfort caused to the patient.⁴

The pattern of bone loss is an important factor in determining the prognosis, because clearly interferes on the predictability of periodontal therapies. The most common patterns of bone loss are horizontals and this also imposes greater difficulty to the periodontal regeneration. The vertical or angular defects are those that occur in oblique direction, forming a bone defect.²⁹

In this context, Ávila et al consider the furcation lesion as one of the most challenging clinical situation to the periodontists.² There's no doubt that the first degree

defects can be properly treated of the teeth kept, already in cases of furcation lesion of second degree the decision of treatment becomes more uncertain,⁵ as well as the prognosis of the tooth. In these cases, it's important to highlight that the predictability of periodontal therapy surgical or not, in interproximal furcation lesions of second degree, is worse when compared to the predictability of periodontal treatment of these furcations in free surface.⁴⁰ Del Peloso Ribeiro et al, when evaluated the effect of non-surgical periodontal therapy with or without iodine in furcation lesions of second degree in free surface, showed that the majority of them can be treated only with subgingival instrumentation, without posterior surgical therapy (Fig 1 and 2).³⁹ Finally, the third degree lesions have unfavorable prognosis,^{7,15} once the regeneration of this defect is not predictable in most of clinical situations.¹⁵

It is already known that the presence of roughness on the root surface compromises the plaque control in the furcation region and others anatomic variations,⁴¹ such as cervical projections of enamel, enamel pearls (most frequent on posterior teeth)¹⁴ and root grooves (lateral superior incisive and first superior bicuspid), irrespective of its location, represent a challenge during the therapeutic or maintenance procedures.²



Figure 1 - Furcation lesion of second degree on lingual side of #46 associated to probing depth of 8 mm before treatment.



Figure 2 - Furcation lesion of second degree on lingual side of 46 associated to probing depth of 4 mm, 6 months after non-surgical periodontal treatment.

Root proximity is another relevant factor, once it has been found in literature the absence of adequate bone support (interdental bone thickness < 0.8 mm) favors the progression of periodontal disease.²² In situations of non-treatable root proximities, the indication is extraction.²

Beyond all of these local factors associated to the dental biofilm, others deeply related to the host immunoinflammatory response seems also to interfere in progression of periodontal disease and, therefore in determining the prognosis. Is known that habits as smoking and many systemic conditions, immune suppression, hematological and genetic disorder (neutropenia and interleukin 1 polymorphism) and stress have a significant impact in progression of periodontal disease and bone remodeling, being smoking and diabetes mellitus considered real risk factors.²³

On tooth, from the periodontal standpoint, according to McGuie, can be classified as having a bad, doubtful

or good prognosis.³⁰ Becker et al defined one tooth as condemned (bad prognosis), when it shows bone support loss greater or equal to 75%, pocket depth greater or equal to 8 mm, involvement of third degree furcation, crown-root improper relationship, root proximity with little bone between roots and frequent abscess.⁶ Dental elements in this situation lead to a complex planning (Fig 3).

In the group of teeth with doubtful prognosis, two factors must be considered: if its preservation or not is going to put in risk the adjacent teeth and if it is important or not to the rehabilitation of the patient. Teeth with insertion loss between 50% and 75%, not necessarily have to be removed, since it shows clinical aspects of normality, absence of bleeding on probing, absence of exudates and mobility between the acceptable limits of patient (Fig 4). In the group of teeth with good prognosis, teeth with favorable periodontal prognosis and that can be kept in the mouth are found.²⁴



Figure 3 - Periapical radiography of unit 26 with bad prognosis due the presence of furcation lesion of third degree (vestibule-mesial, vestibule-distal, mesiodistal), more than 75% of bone loss on distal root and great root proximity between the distal root of #26 and mesial root of #27.



Figure 4 - Periapical radiography of unit 16 with doubtful prognosis, due the presence of furcation lesion of second degree on distal side and bone loss between 50 and 75% on distal root.

Endodontic considerations

Specialists indicate that in cases with pulp involvement, the first to be realized in clinic is rather the endodontic treatment or retreatment, when the involved tooth shows a favorable prognosis to this kind of therapy. However, in cases of tooth with insufficient coronary structure and/or periodontal involvement from moderate to severe, the time and cost that will be applied in the canal treatment must be questioned as well as the replacement of these by implants.^{1,32}

Iqbal and Kim¹⁷ in a systematic review, concluded that there is no difference in predictability between the treatment of endodontic compromised teeth and the replacement of these by implants, based thus the choice of therapeutic modality in other factors.¹⁸ Furthermore, it is noteworthy that endodontically treated teeth keep the original proprioceptive mechanisms of natural teeth, while the implants are deprived of periodontal ligament and the skill of functional perception, as well as impact absorption.¹¹

In determining the prognosis of teeth that require endodontic treatment, the clinician must attempt to: presence/absence of periapical lesions since researches show that the absence of these lesions increases the rate of success of this type of therapy; type of endodontic treatment, because the technique to be used should be adequate to its respective case; post-endodontic restorative situation, because the clinical situation implies that not all endodontically treated teeth are restorable, but the ones that are have similar rate of success to the implants.¹⁹

The rate of success that have been described in literature for the endodontic treatment after 8 to 10 year is over 95%.⁴² However, a rate of until 100% can be seen when the method of evaluation used is the microscopic visualization.³

The complications after canal treatment, even minimal, can happen, such as bacterial micro-infiltration, caries and periodontitis. Papers demonstrate that most parts of causes of tooth extraction due endodontic treatment failure is due the poor coronal sealing of these teeth after concluding the therapeutic, shown a good predictability of endodontic therapy.¹³ A retrospective study of Iqbal and Kim, about factors associated to periapical health of restored and endodontically treated teeth, concluded that the good quality of root and coronal border sealing improve the endodontic therapy prognosis.¹⁸

Ng et al³⁴ identified in systematic review four conditions that can increase significantly the survival of endodontic treated teeth, citing in descending order: (1) tooth restoration after treatment; (2) teeth with proximal mesial and distal contacts; (3) buttress functionless teeth for fixed and removable prosthesis; e (4) type of tooth, specifically not molars.

Restorative aspects

Many authors profess that one of the fundamental objective of restorative practice is the maintenance of healthy natural dentition of patient.^{18,32,44} For the restorative procedure succeed, the involved tooth must have its normal function reestablished and its aesthetic must be acceptable. To make it possible we need to consider and analyze the occurrence of: fractures and failed restorations; extensive caries; proportion crown-root and core and prosthetic crown.²

The presence of defective restorations is not a determining factor in the process of decision-making between extract or not one tooth since although the excesses in restoration been associated directly or indirectly to the loss of tissue insertion, these can be easily corrected in most cases. However, it's important to evaluate its presence and relationship with the caries lesion and/or endodontic involvement, before taking any decision.

The same line of reasoning is applied on evaluation of fractured teeth, where the clinician must do the best judgment by evaluation of type and location of fracture to determine if the tooth can be or not restored.²

As well as fractures, an extensive caries lesion that extends beyond or in the level to the alveolar bone represents a challenge to the clinician in restorative terms and for the patient due the substantial increase of treatment cost. If in these cases the tooth can be restored, a surgical or non-surgical clinical crown lengthening is usually necessary to reestablish the biological distances,² what makes the treatment's final cost similar to the implants.³²

However, the clinical crown lengthening are indicated only after careful analysis of crown-root proportion, since the maintenance in long term of a tooth with a non-favorable proportion, can be challenging, due the inadequate alveolar bone support, which may lead to the increasing of mobility, and the risk of fracture.³¹ One tooth with a non-favorable crown-root proportion may also not be useful as an ideal buttress (Fig 5). The proportion 1:1 have been defined as a minimal acceptable proportion for a healthy periodontium and one controlled occlusion.¹²

In cases of extensive dental structure loss, the use of core/pin is one of the available options, which allows an appropriate coronal restoration. However, we should evaluate: the need of an endodontically treated canal, which reduces the survival of the tooth in long-term; and the patient's occlusion, since the presence of parafunctional habits also reduces the pin/core restored tooth's survival.³²

Discussion

The hard task of knowing when to preserve or extract a tooth remains a challenge in dental practice, however with the preservation of the natural dentition as a fundamental principle have been widely followed. Root resections, apicoectomies and pin and core manufacturing are some of

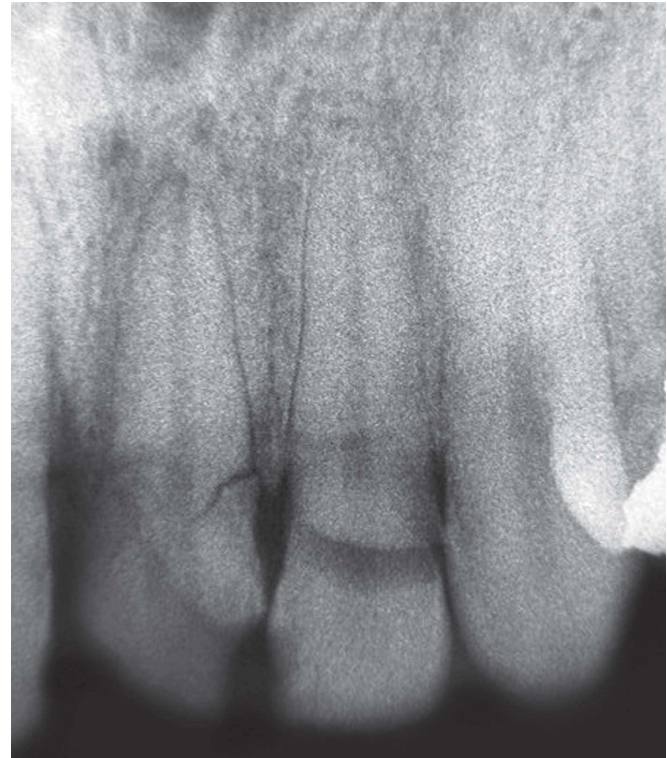


Figure 5 - Periapical radiography of fractured unit 21. The level of fracture requires crown augmentation to the reestablishment of biological space, however the analysis of crown/root proportion contra-indicates the procedure.

many periodontal, endodontic and restorative procedures realized to try the natural tooth's preservation.²⁷ Nevertheless, the extraction for implants placements have been also a good treatment alternative, even less conservative.

The Periodontal American Academy profess that every patient must be informed about the risks of failures and the alternative therapy to the implants. The high rates of implants success, as showed by Levin et al²⁶ of 92.6%, may be a dangerous mark if compromised teeth start to be extracted.³³

This decision-making requires a deep knowledge about prognosis and predictability of the different therapeutic modalities. From the periodontal perspective, the mechanical instrumentation produces satisfactory results in

most cases. It was confirmed by Ludgren et al²⁹ in some clinical cases up to 30 years of following, when demonstrating that the periodontal therapy limiting to the scaling and root planning (SRP), requiring or not one surgical flap, showed efficient in periodontal disease control, since the patient is motivated and involved in his treatment. Agreeing with this positive result, Dannewitz et al concluded in a retrospective study that the periodontal therapy results in good prognosis for molar in at least 5 years.⁷

A 10-years prospective study, associating periodontally treated teeth and implants, found a rate of dental survival of 95% and concluded that the rate of progression of insertion loss of teeth and implants is similar in the same patient.²⁰

Furcation lesions of molars respond less favorable to SRP providing thus a greater risk to periodontal disease progression, in response to the complex anatomy of the area.² Although, Huynh-Ba et al in a systematic review find authors who defends the non-surgical therapy as been effective on prevention of progression of inter-radicular disease between teeth with first degree furcation involvement. These authors obtained survival rate of 90.7% to 100% in treated teeth only with SRP that had been accompanied of 5 to 9 years. The review also addresses authors who additionally to the SRP defends the idea of treat the second and third degree furcation lesions with tunneling, where was found a survival of 42.9% to 92.9% in one period of observation of 5 to 8 years. In resection and/or root splitting procedures, the survival rate on the evaluated studies was 62% to 100% in an average of 5 to 13 years of accompaniment.¹⁶

It is clear there are many alternatives for the treatment of furcation lesions that are almost always related to the degree of lesion and then, therefore, its presence is not synonymous of needing of extraction, since when well indicated the success of treatment can be similar

to the implant.²¹ Among the procedures most commonly used to the treatment of furcation involvements we can cite: the subgingival scaling with or without surgical flap, furcation plasty, tunneling, root hemisection and resection and guided tissue regeneration (GTR).¹⁶ The adjacent alveolar bone level must be considered a critical factor to the therapy's choice, mainly regenerative therapy to furcation lesions of first and second degree. There will be greater predictability of this therapy when the level of interproximal bone is coronally located.³⁷

A GTR has been a major goal of treatment of furcation lesions, however, not even all lesions can be regenerated with predictability,⁹ which makes the respective procedures, used for more than 50 years, remain with significant procedures on periodontal therapy of these lesions. The review of Huynh-Ba et al also evaluates the survival rate of GTR associated with SRP in the period of 5 to 12 years, been this of 83.3% to 100%. It, one more time shows that the adequate indication together with the patients cooperation will be the greatest responsible of success of any therapy.¹⁶

In 2001 Fugazzoto¹⁰ in a retrospective analysis evaluated records of patients treated by the root resection technique, by the same dentist, independent of these patients realize periodic maintenance visitation or not. It is concluded that the realization of root resection seems to be more attractive choice (if one tooth already had endodontic treatment) than its removal and implant installation. These findings agree with the study of Warren's et al,⁴⁶ that also observed that patients who already realized some investment in procedures to treat a determined tooth, chose to alternative therapies in order to keep, once had already done a financial investment. However, one tooth that requires extensive treatment and yet would present a compromised prognosis must have a extraction as one alternative of therapy to be considered, after analysis of determining factors of already cited prognosis.^{10,36}

By endodontic perspective, the treatment on canal system shows a good index of success in long term. In the retrospective study of Lazarki et al,²⁵ that evaluated more than 110.000 endodontically treated teeth accompanied for period of 3.5 years, the rate of success found was 94.44%. Salehrabi and Rotstein⁴² evaluated more than 1.1 millions of patients during 8 years and found 97% of success. In this way, a systematic review found rates between 86% and 93% of survival of endodontically treated teeth of 2 to 10 years of accompaniment.³⁵

A prospective study of 2 to 4 years of accompaniment found a rate of 95% of survival to the 858 teeth that received endodontic treatment and with no difference of rate of first time treated canals.³⁴ High rate after endodontic retreatment also had been demonstrated in the 5 years study of Salehrabi and Rotstein.⁴³ Thus, in cases of failure of endodontic treatment, the retreatment must be always considered, since the cause of failure is diagnosed. For this, must pay attention to the root length for an adequate apical sealing, possibility of incomplete vertical fracture or presence of occlusal forces contributing to the failure of the treatment.³⁶

The author O'Neal and Butler suggest that the cost and amount of visitations the patient needs to accede a conservative treatment as the root retreatment and the installation of core/pin and crown is significantly greater than the implants rehabilitation alternative.³⁶ Anson¹ in a literature review professes the installation of implants over core/pin or crown rehabilitation, once the implants are not susceptible to root fractures and failure on endodontic treatment. However, most of dentistry treatments, when realized under ideal conditions of indication and execution, present high level of success. Thus, even implants are liable of failure when the clinic and biological challenge is high.

In a comparative review about treatment of endodontically treated teeth and implants, Iqbal and Kim¹⁷ concluded

that although implants are good therapeutic alternatives for endodontically compromised teeth they promote surgical pain/inflammation, are double the price of the therapy of non-surgical canals, are associated to greater intervention after treatment, and do not have better survival than endodontic treatment. Thus, assert teeth that can be treated endodontically must not have implants as a routine therapy, being these reserved only in cases of "terminal stage" teeth.

Related to restorative aspects, surgical clinic crown augmentation should be avoided in aesthetic areas, because it will result in gingival recession and consequent aesthetic defect. In these cases, the orthodontic traction even if slower and more expensive might be a viable alternative. Evaluation also needs to be done when the subgingival extension of preparation, according to the root length, so after the procedure of clinic crown augmentation the relation crown/root does not become unfavorable.¹¹

Greenstein et al,¹¹ in their literature review, cite authors who comment the magnitude of evaluate the functional load that will impact over the restored tooth. Some studies show fixed partial prosthesis that use endodontically treated teeth as buttresses tends to fail more frequently than having vital teeth as buttresses. Lundgren et al²⁹ observed that in modern dentistry both professional and patients have preferred the fixed rehabilitations than removable. Comparing with fixed partial prosthesis, the greater benefit of using implants is avoiding the preparation of healthy teeth adjacent to themselves.

Recently a longevity of teeth and implants have been focus of several reviews and what is been observed on literature is that dental implant does not overtake the tooth in terms of survival.¹³ Even though a compromised tooth by the loss of vitality and periodontal insertion is comparable to an implant, if this tooth obtained success on its treatment (Table 2).²⁸ By his systematic review,

Tomasi et al⁴⁵ concluded that in patients clinically well maintained the survival rates of teeth are higher than implants, as well as changes in bone levels seem to be smaller in teeth than in implants after a minimum of 10 years of accompaniment, highlighting the difficulty of comparison due the heterogeneity between the studies. In this context, it is important to remember that the longevity of osseointegrated implants might be compromised by infections in the tissues that lay on and support in function (peri-implant mucositis and peri-implantitis) and by occlusal overload.⁴⁴ In study of Karoussis's et al,²¹ compared the survival rate, of implants success and the incidence of peri implantitis in patients who lost their teeth due periodontal disease or other reasons as, for example, root fracture. The survival rate of implants, in patients with history of periodontitis, was 90.5%, whereas the group of patients without history of periodontitis obtained 96.5%. In the group of compromised patients by periodontal disease, there was a greater incidence of peri-implantitis (28.6%) than the group of healthy patients (5.8%).

Thus, although the implants are placed in the middle of the relatively healthy tissues, complications and failures occurs even before the osseointegration of implant (early loss of implant), or after one well succeed osseointegration (later implant loss).³⁸ From the problems that can attack the implants, the failure in osseointegration is the most relevant of these, once it directly influences the success of treatment. Furthermore, the preparation and positioning of implants are procedures of surgical nature that carry common risks to the surgical procedures, including: bleeding, neurosensitive disturb and the possible devitalization of adjacent tooth.⁴⁴ Therefore, as far implants as dental treatments shows their limitations.

There isn't in literature a consensus in respect to the sovereign of one technique over another for the treatment of different clinical situations. The consensus is to make the adequate indication for each technique for each situation and for each patient, as well as its insertion on maintenance therapy aiming the success of long-term implemented therapy.

Table 2 - Summary of results found in the studies.

Study	Type	Treatment	#	Follow up (years)	Survival
Dannewitz et al ⁷	R	PT-molars	505	≥ 5	87%
Fugazzoto ¹⁰	R	RR-molars	701	≥ 15	96.8%
		IP	1472	13	97%
Karoussis et al ²⁰	P	PT	179	10	95%
		IP	179		95%
Lazarski et al ²⁵	R	ET	110.000	3.5	94.44%
Salehrabi, Rotstein ⁴²	R	ET	1.4 million	8	97%
Salehrabi, Rotstein ⁴³	R	ER	4.744	5	89%
Ng et al ³⁴	P	ET	759	2 a 4	95.4%
		ER	856		95.3%
Karoussis et al ²¹	P	IP	112	10	90.5 a 96.5%
Levin et al ²⁶	R	IP (molar unit)	81	0.5 a 10	92.6%

R = retrospective study; P = prospective study; PT = periodontal treatment; IP = implants placement; RR = root resection; ET = endodontic treatment; ER = endodontic retreatment.

Conclusion

The hard task of deciding to extract or keep a tooth involves several factors, objectives and subjectives, that should be analyzed carefully, aiming to attend the different therapeutic needs and individualize the

treatment plan. This must be a critical analysis grounded on scientific evidence. In this way, it is responsibility of the dentist to present de case prognosis and all therapeutic possibilities as well as the predictability of each to the patient, enabling them to participate on decision-making.

REFERENCES

1. Anson DDS. The changing treatment planning paradigm: save the tooth or place an implant. *Compendium*. 2009;30:506-18.
2. Ávila G, Galindo-Moreno P, Soehren S, Misch CE, Morelli T, Wang H. A novel decision-making process for tooth retention or extraction. *J Periodontol*. 2009;80:476-91.
3. Bader HI. Treatment planning for implants versus root canal therapy: a contemporary dilemma. *Implant Dent*. 2002;11(3):217-23.
4. Becker W, Becker BE, Berg LE. Periodontal treatment without maintenance. A retrospective study in 44 patients. *J Periodontol*. 1984;55:505-9.
5. Becker W, Becker BE, Mellonig J, Caffesse RG, Warrer K, Caton JG, et al. A prospective multi-center study evaluating periodontal regeneration for Class II furcation invasions and intrabony defects after treatment with a bioabsorbable barrier membrane: 1-year results. *J Periodontol*. 1996;67(7):641-9.
6. Becker W, Berg L, Becker BE. The longterm evaluation of periodontal treatment and maintenance in 95 patients. *Int J Periodontics Restorative Dent*. 1984;4(2):54-71.
7. Dannewitz B, Krieger JK, Hüsing J, Eickholz. Loss of molars in periodontally treated patients: a retrospective analysis five years or more after active periodontal treatment. *J Clin Periodontol*. 2006;33(1):53-61.
8. Davarpanah M, Martinez H, Tecucianu JF, Fromentin O, Celletti R. To Conserve or Implant: Which Choice of Therapy? *Int J Periodontics Restorative Dent*. 2000;20:413-22.
8. DeSanctis M, Murpgy KG. The role of resective periodontal surgery in the treatment of furcation defects. *Periodontol 2000*. 2000;22:154-68.
10. Fugazzoto PA. A Comparison of the success of root resected molars and molar position implants in function in a private practice: results of up to 15-plus years. *J Periodontol*. 2001;72:1113-23.
11. Greenstein G, Cavallaro J, Tarnow D. When to save or extract a tooth in the esthetic zone: a commentary. *Compendium*. 2008;29:136-46.
12. Grossmann Y, Sadan A. The prosthodontic concept of crown-to-root ratio: a review of the literature. *J Prosthet Dent*. 2005;93:559-62.
13. Holm-Pedersen P, Lang NP, Müller F. What are the longevities of teeth and oral implants? *Clin Oral Implants Res*. 2007;18 Suppl 3:15-9.
14. Hou GL, Tsai CC. Cervical enamel projection and intermediate bifurcational ridge correlated with molar furcation involvements. *J Periodontol*. 1997;68:687- 93.
15. Hovey LR, Jones AA, McGuire M, Melloning JT, Shoolfield J, Cochran DL. Application of periodontal tissue engineering using enamel matrix derivative and a human fibroblast-derived dermal substitute to stimulate periodontal wound healing in Class III furcation defects. *J Periodontol*. 2006;77(5):790-9.
16. Huynh-Ba G, Kuonem P, Hofer D, Shimid J, Lang NP, Salvi GE. The effect of periodontal therapy on the surgical rate and incidence of complications of multicroot teeth with furcation involvement after an observation period of at least 5 years: a systematic review. *J Clin Periodontol*. 2009;36(2):164-76.
17. Iqbal MK, Kim S. A review of factors influencing treatment planning decisions of single-tooth implants versus preserving natural teeth with nonsurgical Endodontic therapy. *J Endod*. 2008;34(5):519-29.

18. Iqbal MK, Kim S. For teeth requiring endodontic treatment, what are the differences in outcomes of restored endodontically treated teeth compared to implant-supported restorations? *Int J Oral Maxillofac Implants*. 2007;22 Suppl:96-116.
19. Kao RT. Strategic extraction: a paradigm shift that is changing our profession. *J Periodontol*. 2008;79(6):971-7.
20. Karoussis IK, Muller S, Salvi GE, Heitz-Mayfield LJ, Brägger U, Lang NP. Association between periodontal and peri-implant conditions: a 10-year prospective study. *Clin Oral Implants Res*. 2004;15(1):1-7.
21. Karoussis IK, Salvi GE, Heitz-Mayfield LJ, Brägger U, Hämmerle CHF, Lang NP. Long-term implant prognosis in patients with and without a history of chronic periodontitis: a 10-year prospective cohort study of the ITI® Dental Implant System. *Clin Oral Implants Res*. 2003;14(3):329-39.
22. Kim T, Miyamoto T, Nunn ME, Garcia RI, Dietrich T. Root proximity as a risk factor for progression of alveolar bone loss: the veterans affairs dental longitudinal study. *J Periodontol*. 2008;79(4):654-9.
23. Kinane DF. Periodontitis modified by systemic factors. *Ann Periodontol*. 1999;4(1):54-64.
24. Lascala Junior N, Jardini MAN, Melo Filho AB. Quais são os fatores que indicam ou contraindicam a exodontia de dentes portadores de doença periodontal para colocação de implantes osseointegrados? In: Lotufo RFM, Lascala NT. *Periodontia e Implantodontia: desmistificando a ciência*. 1a ed. São Paulo: Artes Médicas; 2003. p. 463-90.
25. Lazarski MP, Walker WA 3rd, Flores CM, Schindler WG, Hargreaves KM. Epidemiological evaluation of the outcomes of nonsurgical root canal treatment in a large cohort of insured dental patients. *J Endod*. 2001;27(12):791-6.
26. Levin L, Laviv A, Schwartz-Arad D. Long-term success of implants replacing a single molar. *J Periodontol*. 2006;77(9):1528-32.
27. Lewis S. Treatment planning: teeth versus implants. *Int J Periodontics Restorative Dent*. 1996;16(4):366-77.
28. Lindh T. Should we extract teeth to avoid tooth-implant combinations? *J Oral Rehabil*. 2008;35 Suppl 1:44-54.
29. Lundgren D, Rylander H, Laurell L. To save or to extract, that is the question. Natural teeth or dental implants in periodontitis-susceptible patients: clinical decision-making and treatment strategies exemplified with patient case presentations. *Periodontol 2000*. 2008;47:27-50.
30. McGuire MK. Prognosis versus outcome: a long-term survey of 100 treated periodontal patients under maintenance care. *J Periodontol*. 1991;62(1):51-8.
31. McGuire MK, Nunn ME. Prognosis versus actual outcome. II. The effectiveness of clinical parameters in developing an accurate prognosis. *J Periodontol*. 1996;67(7):658-65.
32. Morris MF, Kirkpatrick TC, Rutledge RE, Schindler WG. Comparison of nonsurgical root canal treatment and single-tooth implants. *J Endod*. 2009;35:1325-30.
33. Müller HP, Eger T. Furcation diagnosis. *J Clin Periodontol*. 1999;26:485-98.
34. Ng Y-L, Mann V, Gulabivala K. A prospective study of the factors affecting outcomes of non-surgical root canal treatment: part 2: tooth survival. *Int Endod J*. 2011;44(7):610-25.
35. O'Neal RB, Butler BL. Restoration or implant planning quandary. *Periodontol 2000*. 2002;30:111-22.
36. Pontoriero R, Lindhe J. Guided tissue regeneration in the treatment of degree II furcations in maxillary molars. *J Clin Periodontol* 1995;22:756-63.
37. Quirynen M, Abarca M, Van Assche N, Nevins M, van Steenberghe D. Impact of supportive periodontal therapy and implant surface roughness on implant outcome in patients with a history of periodontitis. *J Clin Periodontol*. 2007;34(9):805-15.
38. Ng Y-L, Mann V, Gulabivala K. Tooth survival following non-surgical root canal treatment: a systematic review of the literature. *Int Endod J*. 2010;43:171-89.
39. Ribeiro EDP, Bittencourt S, Ambrosano GMB, Nociti FH, Sallum EA, Sallum AW, et al. Povidone-iodine used as an adjunct to non-surgical treatment of furcation involvements. *J Periodontol*. 2006;77(2):211-7.
40. Ribeiro EDP, Bittencourt S, Nociti FH, Sallum EA, Sallum AW, Casati MZ. Comparative study of ultrasonic instrumentation for the non-surgical treatment of interproximal and non-interproximal furcation involvements. *J Periodontol*. 2007;78(2):224-30.
41. Roussa E. Anatomic characteristics of the furcation and root surfaces of molar teeth and their significance in the clinical management of marginal periodontitis. *Clin Anat*. 1998;11(3):177-86.
42. Salehrabi R, Rotstein I. Endodontic treatment outcomes in a large patient population in the USA: an epidemiological study. *J Endod*. 2004;30:846-50.
43. Salehrabi R, Rotstein I. Epidemiologic evaluation of the outcomes of orthograde endodontic retreatment. *J Endod*. 2010;36:790-2.
44. Tang CS, Naylor AE. Single-unit implants versus conventional treatments for compromised teeth: a brief review of the evidence. *J Dent Educ*. 2005;69(4):414-8.
45. Tomasi C, Wennstrom JI, Berglundh T. Longevity of teeth and implants: a systematic review. *J Oral Rehabil*. 2008;(35 Suppl 1):23-32.
46. Warren JJ, Hand JS, Levy SM, Kirchner L. Factors Related to Decisions to Extract or Retain At-risk Teeth. *J Public Health Dent*. 2000;60(1):39-42.