CLINICAL EVALUATION OF CAST AND PREFABRICATED METAL POST: A 5-YEAR RETROSPECTIVE STUDY

By

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A THESIS PRESENTED TO THE GRADUATE SCHOOL
OF THE UNIVERSITY OF FLORIDA IN PARTIAL FULFILLMENT
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To my mother; the pillar of my strength

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Major: Dental Sciences

While an abundance of in vitro studies on different aspects of custom cast and prefabricated posts has been reported and discussed in the literature, few studies compared the success of clinically meaningful restorative approaches, and the materials used. It is therefore still difficult to justify a preference for cast or prefabricated post and core restorations based on in vitro studies alone. Very little clinical data are available on post and core treatment that are performed on a daily basis.

The objective of this study was to evaluate the clinical survival rate of custom-fabricated cast post and cores, and prefabricated post and cores used in dental practices, and to see if there is any significant difference in their performance and longevity as influenced by the age and gender of the population, type of post material used, length of the post, amount of alveolar bone tissue supporting the roots, location of the tooth in the dental arch, the type of cement used, the effect of opposing occlusion, and the type of final prosthetic treatment received.

This retrospective analysis will aim to prove that one of the methods for fabrication of post and cores is more predictable with a higher survival rate based on a large patient group over a five-year period.

The study population for this study was patients who had been treated at the Undergraduate Student Clinic for Fixed and Removable Prosthodontics at the University of Florida with custom fabricated cast posts or prefabricated posts, from 2003 till 2007, and whom have been treated by third or fourth year dental student, were analyzed. And information were gathered manually and recorded for statistical analysis.

Out of all the variables evaluated in this study, and their correlations to the survival of custom-fabricated cast posts and prefabricated metal posts, age of patients, post length, amount of alveolar bone supporting the root(s), and the type of final prosthetic treatment endodontically treated teeth have received, were found to be significant.

Both treatment modalities can be recommended if they are applied within indications and with the necessary caution. Metallic posts continue to be the standard for most situations because they have stood the test of time.

CHAPTER 1
INTRODUCTION AND LITERATURE REVIEW

Historical Overview of Dental Posts and Cores

The restoration of endodontically treated teeth is an important aspect of dental practice that involves a range of treatment options of varying complexity. An endodontically treated tooth should have a good prognosis. It can resume full function and serve satisfactorily as an abutment for a fixed dental prosthesis or a removable partial dental prosthesis. However, special techniques are needed to restore such a tooth. Usually a considerable amount of tooth structure has been lost because of caries, trauma, endodontic treatment, and the placement of previous restorations. The loss of tooth structure makes retention of subsequent restorations more problematic and increases the likelihood of fracture during function. The challenge may be complicated by substantial loss of coronal tooth structure and the ability to predict restorative success. Cast posts and cores are often used to provide retention and stability for final restorations of endodontically treated teeth (Robbins 1990).

The use of posts in the root canal space to retain an overlaying restoration has a history of at least 300 years (Ring 1985). In the 1700s Fauchard inserted wooden dowels in canals of teeth to aid in crown retention (Fauchard 1746). Over time the wood would expand in the moist environment to enhance retention of the dowel unit, unfortunately, the root would often fracture vertically (Shillingburg 1997). In 1871 Harris Chapin recommended a post or a " pivot" to retain an artificial crown in a root with an extirpated pulp (Harris C 1871). Additional efforts to develop crowns retained with posts or dowels in the 1800s were limited by the failure of the endodontic therapy of that era. Several of the 19th century versions of dowels also used wooden pivots, but some dentists reported the use of metal posts favored by Black (Black 1869) in which a porcelain-faced crown was secured by a screw passing into gold-lined root canal.

The Richmond crown was introduced in 1878 and incorporated a threaded tube in the canal with a screw-retained crown (Richmond 1878). The glossary of prosthodontic terms 8th edition defined the Richmond crown as " an artificial crown consisting of a metal base that fits the prepared abutment of the natural tooth and carries a post or pivot for insertion into the endodonticaly treated root canal: a porcelain facing reinforces the metal backing" (Glossary of Prosthodontics 2005). The Richmond crown was later modified to eliminate the threaded tube and was redesigned as a 1-piece dowel and crown (Hampson 1958, Demas 1957). In 1911 the Davis crown was introduced; a dental restoration supported by a dowel in root canal over which was cemented a porcelain tube tooth in direct contact with the root face of the tooth (Davis 1916). A later modification of the Davis crown involved a gold casting that improved the fit between the root and artificial tooth (Davis 1916). One-piece dowel and crown became unpopular because they were not practical. This was evident when divergent paths of insertion of the post-space and remaining tooth structure existed, especially for abutments to fixed dental prosthesis. One-piece dowel restorations also presented problems when the crown or fixed partial denture required removal and replacement. These difficulties led to the development of a post-and-core restoration as a separate entity with an artificial crown cemented over core and remaining tooth structure (Morgano 1999).

With the major advances in endodontic therapy that occurred in this century, the challenges increased for restorative dentistry. Teeth that were commonly extracted without hesitation were successfully treated with predictable endodontic therapy, and a satisfactory restorative solution was necessary, especially for teeth with severe damage. Cast post and cores became routine methods for restoration of endodontically treated teeth (Morgano 1999).

The development of cast dowel cores was a logical evolution from the Richmond and Davis crowns. An alternative method using prefabricated metal posts and composite resin or amalgam as a core material was introduced around the 1970s and has been used ever since on a large scale (Baraban 1972, Spalten 1971). Individually cast posts and cores are normally cast from metal alloy (gold alloy type III, type IV). As for prefabricated posts, these are either metallic posts such as stainless steel, titanium alloy, and non-metallic posts such as posts of zirconia and carbon fiber or glass fiber reinforced resin composite.

Traditional thought has gone from one extreme to another and back again. While Fauchard in late 1700s, used wooden posts to retain crowns (Fauchard 1746). Radke and Eismann suggested in 1991 that one function of the post is to provide reinforcement of the tooth (Cohen 1991). A cast restoration that extended at least 2 mm apical to the junction of the core and the remaining tooth structure was recommended. It was suggested that encirclement of the root with this " ferrule effect" would protect the pulpless tooth against fracture by counteracting spreading forces generated by the post. The most current literature, however, seems to dispute the reinforcement potential of posts.

Trope et al. evaluated fracture resistance of restored endodontically treated teeth; they found that preparation of post space significantly weakened endodontically treated teeth and that a post did not significantly strengthened treated teeth (Trope 1985).

Posts have one purpose, or one main indication and that is to retain the core material that can be used to support the final restoration. The decision regarding post placement should be made based on the amount of coronal remaining tooth structure. Thus, if adequate retention for the core can be derived from the use of natural undercuts in the pulp chamber and canal entrances, a post is not indicated. Cast post and core can help to change axial inclination of crowns to improve alignment.

Post placement requires the removal of additional tooth structure, and this will likely weaken the tooth further and create an area of stress concentration at the terminus of the post channel (Whitwortth 2002). There is compelling evidence that they do not strengthen teeth (Trope 1985, Sorensen 1984, Guzy 1979, Assif 1993) and a post is not necessary when substantial tooth structure is present after a tooth has been prepared. In actuality, placing a post can predispose a tooth to fracture. The use of certain post designs can predispose them to catastrophic failure, as shown by Sorensen and Engelman (Sorensen 1984).

In response to the discovery that posts do not strengthen teeth; they only serve to retain the core, research into design, shape, diameter, and length of posts now focuses on issues of retention.

Treatment Planning

When a decision is made to treat the tooth endodontically, consideration must have been given to its subsequent restoration. Before being restored, teeth that have been endodontically treated must be carefully evaluated for the following: good apical seal, no sensitivity to pressure, no exudates, no fistula, no apical sensitivity, and no active inflammation (Rosenstiel 2001). Using a post system to retain a core, over which a crown can be placed, is often necessary when inadequate coronal tooth structure remains. A unique balance exists between maximizing retention of the post and maintaining resistance to root fracture. Resistance to root fracture is directly related to he thickness of remaining dentin walls (Stockton 1999). The amount of alteration, the location of the tooth in the dental arch, its current morphology, the opposing contacts, and the manner in which it is restored, all will affect the degree to which dentin is susceptible to fracture (Hunter 1989).

Considerations and Restorations

Multiple factors must be considered in choosing a final restoration. Essential considerations include the amount of remaining sound tooth structure, occlusal function, opposing dentition, and position of the tooth in the arch, as well as length, width and curvature of the root(s).

It is also important to understand that changes occur in the dentin of endodontically treated teeth; affect its function under stress. In an in vitro study with matched teeth pairs, Sedgley and Messer were able to show that vital dentin is harder that dentin from contralateral endodontically treated teeth, but there was no significant biomechanical change that would indicate that the endodontically treated teeth had become more brittle (Sedgley 1992). This result was supported by another study by Papa et al, which showed that there was no significant difference in the moisture content between endodontically treated teeth and vital teeth (Papa 1994). It appears that the remaining amount of tooth hard tissue influences stability. Where as the preparation of pulpal access only reduces structural stability by about 5%, loss of circumferencial integrity by mesio-occlusodistal cavities reduces the stability by about 63% (Reeh 1989). The weakness is primarily caused by loss of tooth structure due to caries, previous restorations, fractures, or endodontic access procedures. Therefore, the strongest tooth is the one in which the most sound dentin and enamel can be retained and used to rebuild the tooth. The use of posts, however, does not increase the fracture resistance significantly. This was shown in several comparative in vitro studies (Guzy 1979, Baratieri 2000, Mcdonald 1990)

Anterior Teeth

Crowns placed on anterior teeth do not make teeth inherently stronger (Sorensen 1984, Sidoli 1997). Laboratory testing demonstrated a comparable resistance to fracture between sound and endodontically treated anterior teeth (Trabert 1978). Placement of a lingual or palatal dentin-bonded composite resin is the treatment of choice for anterior teeth with intact marginal ridges, cingulum and incisal edges.

Placement of a crown on an anterior tooth is indicated when there is extensive coronal destruction or the need for occlusal change, or for esthetic reasons. In such situations, the mechanical and esthetic properties of all ceramic, metal-ceramic, or modified resin crowns offer advantages over large composites (McLean 1998).

Some anterior teeth may require complete coronal coverage along with posts and cores. This is common when large proximal restorations are present, caries has undermined the remaining marginal ridges, or the majority of the incisal edge has been lost due to trauma.

Current research indicates that when an enamel-bonded porcelain veneer is being placed on an endodontically treated tooth, there is no need for post (Baratieri 2000).

Because the maxillary lateral incisor and the mandibular incisors are smaller teeth, a post is commonly indicated before crown placement (Morgano 1999). In maxillary central incisor and canine teeth, however, the decision should be made after crown preparation. If the dentist believes there is adequate remaining tooth structure to provide adequate resistance to fracture, a bonded composite is placed in the access preparation. If, in the judgment of the dentist, there is insufficient remaining coronal tooth structure to resist the functional forces, a post is placed (Robbins 2002).

Posterior Teeth

Posterior teeth present a different set of restorative needs due to their structure and the occlusal forces placed on them during function. Posterior teeth receive predominantly vertical rather than shear forces. Contemporary thought, in both research and clinical practice, supports the placement of a protective restoration with full cuspal coverage on these teeth (Sorensen 1984, Hoag 1982). This is easily accomplished with a crown or onlay when sufficient tooth structure remains. Full coverage restorations prevent the fractures that can result from occlusal forces separating cusp tips during function.

Many endodontically treated molars do not require a post because they have more tooth substance and a larger pulp chamber to retain a core buildup (Kane 1991). When a post is required as a result of extensive loss of natural tooth substance, it should be placed in the largest and straightest canal to avoid weakening the root too much during post space preparation and root perforation in curved canals. The distal canal of mandibular molars and the palatal canal of maxillary molars usually are the best canals for post placement. When core retention still is insufficient after a single post is inserted, placement of pins can be considered for additional retention (Kane 1991).

Unless a large percentage of coronal tooth structure is missing, posts are rarely required in endodontically treated molars (Robbins 2002). More conservative methods of core retention can be used.

Premolars have less tooth substance and smaller pulp chambers to retain a core buildup after endodontic treatment than do molars, and posts are required more often in premolars. In addition to root taper and curvature, many pre-molar roots are thin mesiodistally, and some have proximal root invaginations. Furthermore, the clinical crown of the mandibular first premolar often is inclined lingually in relation to its root. These anatomical characteristics must be considered carefully during post space preparation to avoid perforating the root.

However, complete coronal coverage may not always be necessary in cases of posterior teeth opposing partial or complete dentures. In these cases, the forces of mastication and cuspal interdigitation may be significantly reduced, thus minimizing chance of fracture (Shillingburg 1997).

Best Time for Restoration

Because modern endodontic therapy achieves a predictably high success rate, postponing restoration for extended periods of time to be certain of endodontic success is unnecessary and could place the tooth at risk.

Bishop and Biggs (Bishop 1995) reiterated the need for prompt restoration immediately following completion of endodontic therapy to protect the treated tooth from microbial contamination (Safavi 1987, Vire 1991). In addition, when immediate preparation of the post space after the endodontic filling was compared to delayed preparation (after at least 24 hours), neither method proved to be consistently superior (Portell 1982).

Ideally, post space preparation is completed at the appointment when the root canal is filled (Whitworth 2002). At this time, the clinician is most familiar with the canal system and reference points. He/she is also able to prepare the post space with the rubber dam in place to minimize microbial entry, and can further condense the apical segment of the root filling after the coronal gutta percha has been removed (Abramovitz 2000).

When a tooth had a periradicular lesion, some practitioners commonly waited months for radiographic evidence of healing prior to restoration. If a final restoration cannot be placed within a few weeks of endodontic treatment, a strong, leak-resistant, protective, provisional restoration is indicated. A well-processed temporary crown or bridge, glass ionomer, or acid etched composite build-up may be considered for the minimum time possible, as can a properly fitted and cemented orthodontic band (Abramovitz 2000).

Custom Casts vs. Prefabricated Posts

Custom cast post and core restorations have had a long history of successful use in restorative dentistry, especially when a coronal ferrule is provided. Its advantages include rigidity, better fit and more uniform thickness of cement.

One six-year retrospective study reported a success rate of 90.6 percent using a cast post and core as a foundation restoration (Bergman 1989). Cast gold alloy type III or IV is an inert material with modulus of elasticity (stiffness of 14.5×10^6 psi) and coefficient of thermal expansion ($15\ [C^{-1}] \times 10^6$) similar to those of dentin, and yet it has good compressive strength that can withstand normal occlusal forces (Cheung 2005) .

The main disadvantage of the cast post and core placement procedure is that it requires two visits and laboratory fabrication.

In general, custom cast post and core restorations are indicated in teeth with elliptical or excessively flared canals. It is also indicated where alignment of the proposed crown is significantly different from the inclination of the canal, which is often the case with anterior teeth. With most anterior, and some bicuspid teeth, there is also inadequate room for sufficient bulk of build-up material around the post to provide a solid unit. Thus for most anterior teeth and small bicuspid teeth requiring a post, the choice is a cast post core design.

When used, a cast post core should utilize a high-strength type III or IV gold alloy or a similar high-strength non-precious alloy.

The main disadvantage of the cast post and core placement procedure is that it requires two

visits and laboratory fabrication.

Preformed posts with an amalgam build-up are often more conservative of tooth structure than cast gold especially in posterior teeth. They are generally less expensive and quicker and easier to fabricate.

In recent years, there has been a considerable increase in the number of post systems available. An alternative to the custom cast post is a prefabricated post that can be adjusted and inserted in a single visit. Many types of prefabricated posts (in terms of shape, design, material) are available. Stainless steel, titanium and titanium alloys, gold-plated brass, ceramic and fiber-reinforced polymers have been used as materials for prefabricated posts. The ideal post and core material should have physical properties—such as modulus of elasticity, compressive strength and coefficient of thermal expansion—that are similar to those of dentin (cheung 2005). In addition, prefabricated posts should not be corrosive and should bond easily and strongly to dentin inside the root using suitable cement so that the entire assembly of a post and core resembles the original tooth.

Stainless steel has been used for a long time in prefabricated posts. However, it contains nickel, and nickel sensitivity is a concern, especially among female patients. Stainless steel and brass have problems with corrosion. Pure titanium has slightly lower physical properties such as compressive and flexural strength than alloys, but it is the least corrosive and most biocompatible material (Monaghan 1992). Titanium posts, however, have low fracture strength and tend to break more easily compared with stainless steel posts during removal in re-treatment cases (Cheung 2005). Furthermore, most titanium alloys used in posts have a density similar to that of gutta-percha when seen on radiographs, which makes them more difficult to detect.

In general, prefabricated posts are indicated with small circular canals. The prefabricated post and core remains the most widely used system. Prefabricated posts with a direct build-up work very well in posterior teeth where there is room for sufficient bulk of build-up material. Canal angulations are infrequently a problem. Custom cast posts are indicated when a prefabricated post cannot be properly fitted (Shillingburg 1997).

In regard to conservation of tooth structure, the use of tapered posts requires removing less dentin because root canal spaces are cleaned and shaped in a tapered fashion. Although parallel posts and screw posts are more retentive in the root canal, more dentin removal is required in their post space preparation. This can be undesirable, especially in post space preparation for parallel posts, as more dentin is removed from the thinner apical and middle aspects of the root canal walls. From the point view of the conservation of tooth structure alone, it seems that the use of anatomical custom posts would provide for a stronger tooth than would prefabricated posts, which require removal of additional tooth structure to adapt the canal space to the post.

Post Space Preparation

Knowing the root anatomy of different teeth is important before attempting to prepare any canal space for post installation. Clinicians must be aware that root diameter may differ in the facial-lingual and mesio-distal dimensions. To determine the appropriate post length and width to avoid root perforation, clinicians must consider conditions such as root taper, proximal root invaginations, root curvatures and angle of the crown to the root during the mechanical preparation of a post space (Cohen1991). Gutmann gave a good review of anatomical and biological considerations in restoring endodontically treated teeth (Gutmann 1992).

Studies have shown that as the post length increases, so does retention (Ruemping 1979, Kurer 1977, Standlee 1978). While longer posts demonstrate increased retention, their position in the root may lead to clinical problems. In thin or curved roots, long posts can cause perforations or fractures. In short roots, they may disrupt the apical seal (Sorensen and Martinoff 1984).

Many formulae for recommended lengths have been proposed. It is rational to prepare a post channel as long as it is consistent with anatomical limitations while maintaining 4 to 5 mm of apical gutta percha seal (Kvist 1989).

Acceptable guidelines for determining the post length include the following:

– The post length should be equal to the clinical crown length (Rosen 1961, Silverstein 1962).

– The post length should be equal to one-half to two-thirds of the length of the remaining root (Baraban 1967, Bartlett 1968).

– The post should extend to one-half the length of the root that is supported by bone (Stern 1973).

Clinical success rates support post length equal to or greater than the crown length of the tooth. In a study of 1,273 teeth restored a minimum of one year, Sorensen and Martinoff showed a 97% success rate for any post crown restoration in which the post length was equal or exceeded the crown length. Another recommendation was that the post length should be between one half and three quarters the length of the root (Sorensen and Martinoff 1984).

As was stated previously, root anatomy varies from tooth to tooth and even within the same tooth in different patients. Clinicians must consider these variations along with the guidelines. Each clinical situation is unique, so the preparation of the post space must be evaluated carefully and planned for accordingly.

Most endodontic texts and researchers advocate maintaining a 4-5 mm apical seal (Mattison1984). However, if a post is shorter than the coronal height of the clinical crown, the prognosis is considered unfavorable, because stress is distributed over a smaller surface area, thereby increasing the probability of radicular fracture. A Short root and tall clinical crown present the clinician with the dilemma of having to compromise the mechanics, apical seal or both. Under such circumstances, an apical seal of 3 mm is considered acceptable (Rosenstiel 2001).

It is accepted widely that the post diameter makes little difference in the retention of the post. An increase in the post's width, on the other hand, will increase the risk of root fracture (Standlee 1978, Caputo 1987). In general, the post width should not exceed one-third of the root width at its narrowest dimension, and clinicians should bear in mind that most roots are not perfectly rounded (Morgano 1996). An experimental impact testing with cemented posts of different diameters showed that teeth with thicker 1.8mm posts fractured more easily than those with thinner 1.3mm ones (Helfer 1972). A minimum of 1 mm of sound dentin should be maintained circumferentially, especially in the apical area where the root surface usually becomes narrower and functional stresses are concentrated (Caputo 1976). In choosing a post size, the practitioner must consider that root diameter decreases apically and that concavities in the root can be invisible radiographically. These anatomical factors can contribute to thin dentinal walls that are subject to fracture during the initial post cementation or during occlusion if the post is too wide. The cleaning and shaping procedures used in modern endodontic treatment are aggressive in the removal of dentin within the root canal space; therefore, removal of more dentin from the canal wall in the preparation of the post space should be kept to a minimum to preserve tooth substance and minimize root fracture.

Post Cementation

Dental cements lute the post to radicular dentin and properties such as compressive strength, tensile strength, and adhesion of the cement are commonly described as predictors for success of a cemented post. Other factors such as potential for plastic deformation, microleakage, water imbibition, behavior of cement during the setting process, and handling characteristics cab also influence the survival rate of a cemented post.

Cements for posts and core restorations have been investigated extensively (Chapman 1985, Young 1985, Radke 1989, Burgess 1992).

All posts, whether cast or prefabricated, are cemented inside the root canal. The cementing medium enhances retention, aids in stress distribution, and, ideally, seals microgaps between the tooth and the post.

Among the most commonly used dental cements are zinc phosphate, polycarboxylate, glass ionomer cement, resin-based composite and the hybrid of resin and ionomer cements. Zinc phosphate has had the longest history of success, and remains the standard of comparison. Historically, zinc phosphate was the cement of choice, yielding higher retentive values than polycarboxylate or standard resin cements. In addition to having an extended working time, it is compatible with zinc oxide eugenol (ZOE), which is contained in most root canal sealers. In the case of an endodontic failure, a metal post that is cemented in the canal space with zinc phosphate is easier to remove and has a lower risk of root fracture compared with a metal post that is bonded strongly with a resin-based composite cement in the root canal space (Cheung 2005).

Both zinc phosphate and glass ionomer have similar properties and are commonly used because of their ease of use, coupled with their history of clinical success (Radke 1989, Ertugrul 2005). Zinc phosphate, and resin modified glass ionomer cements such as vitremer luting, offer adequate retention and resistance to leakage and simplify post removal. Pure glass ionomer cements should work as well but are sensitive to moisture or the lack of it in a canal when setting. The use of resin cements should be reserved for cases outside of these criteria where adequate post length and retention are not available.

Many current in vitro studies have shown more favorable results with adhesive cements (Balbosh 2005, Mendoza 1994, Tjan 1987, Cohen 2000). These studies have shown a significant increase in post retention and increase in fracture resistance with adhesive resin cements compared with other cements.

However, it must always be borne in mind that, despite improved retention in some laboratory studies, especially if the post has a poor fit within the canal (Mendoza 1994), none of the cements can overcome the inadequacies of a poorly designed post, and, ultimately, the choice of luting agent seems to have little effect on post retention (Chapman 1985) or the fracture resistance of dentine (Dreissen 1997).

With regard to cements, the practitioner must keep in mind that coronal leakage is a major factor in endodontic failure. All contemporary cements are susceptible to dissolution in the presence of saliva. Therefore, the importance of close marginal adaptation of crown to tooth for protection of the cementing medium cannot be over emphasized.

Venting is a means for cement to escape must always be provided to reduce the intraradicular hydrostatic pressure created during cementation of the post. This factor is of profound importance especially with the custom cast post (Gross 1983). Most prefabricated posts have a venting mechanism incorporated in their design. A vent may be incorporated in the custom cast post with a bur prior to cementation or it may be incorporated in the wax pattern before.

Methods of cementation include placement of the cement with the post, or cement placement with a lentulo spiral, a paper point, or an endodontic explorer. Investigations of these methods have shown that the lentulo spiral is the superior instrument for cement placement (Goldman 1984, Nathanson 1993, Goldstein 1986). Another method for cement placement is using a needle tube, taking care to insert the tip of the tube all the way to the bottom of the canal space and provided that cement extrudes from the tip as it slowly is removed from the canal. After cement placement, the post is coated with the cement and is inserted (Schwartz 1996).

Objective of Study

While an abundance of in vitro studies on different aspects of custom cast and prefabricated posts has been reported and discussed in the literature, few studies compared the success of clinically meaningful restorative approaches, and the materials used. It is therefore still difficult to justify a preference for cast or prefabricated post and core restorations based on in vitro studies alone. Very little clinical data are available on post and core treatment that are performed on a daily basis.

Based on these facts, the objective of this study was to evaluate the clinical survival rate of custom-fabricated cast post and cores, and prefabricated post and cores used in dental practices, and to see if there is any significant difference in their performance and longevity as influenced by the age and gender of the population, type of post material used, length of the post, amount of bone supporting the roots, location of the tooth in the arch, the type of cement used, the effect of opposing occlusion, and the type of final prosthetic treatment received. The following specific aims are proposed:

1. To test the hypothesis that age and gender has no effect on the clinical survival rate of custom fabricated cast posts, or prefabricated posts.
2. To test the hypothesis that cast posts made of Type III gold alloy will exhibit higher clinical survival rates than prefabricated posts made of titanium alloy (Parapost XH Whaledent USA).

3. To test the hypothesis that a longer post will exhibit higher clinical survival rates in cast and prefabricated metal posts.

4. To test the hypothesis that clinical survival rates for cast and prefabricated posts are affected by the amount of bone supporting the roots.

5. To test the hypothesis that dental posts used in endodontically treated teeth that performed as abutments for removable or fixed partial dentures will exhibit a lower survival rate than those performed as abutments for single crowns.

6. To test the hypothesis that endodontically treated tooth's position in the arch affects the survival rate of custom fabricated cast posts and prefabricated metal posts.

7. To test the hypothesis that metal posts cemented with resin reinforced cements will exhibit a higher survival rate.

8. To the test the hypothesis that opposing occlusion is related to survival rates in custom fabricated cast posts and prefabricated metal posts.

This retrospective analysis will aim to prove that one of the methods for fabrication of post and cores is more predictable with a higher survival rate based on a large patient group over a five-year period.

CHAPTER 2
MATERIALS AND METHODS

Study Population

This retrospective study was approved by the Institutional Review Board at the University of Florida (approval number: 390-2007), to use six hundreds and thirty nine patient files who had received a cast fabricated post and core buildup or a prefabricated post and either a composite or amalgam buildup at the Undergraduate Student Clinic for Fixed and Removable Prosthodontics at the University of Florida, between January 2003 and December 2007, to be evaluated and acquire data relevant for the results of the study. These patients had been treated by the third and fourth year dental students with either cast (gold type III alloy) fabricated posts, or prefabricated (titanium parapost XH, Whaledent) posts.

A computer query was done using Quick Recovery and Medical Manager Programs to identify the number of cast and prefabricated post and cores made at the University of Florida-College of Dentistry between 2003 -2007. The codes D2952 was entered for cast post and cores and D2954 for prefabricated post and cores. This allowed us with the identification of the number of cast and prefabricated post and cores along with the chart numbers associated with the procedures.

A pilot study consisted of ten charts that were selected randomly, two charts from each year, starting with 2003 and ending with 2007, was conducted in order to calibrate the investigators that were participating in the study.

The patient files were analyzed using grading codes, which helped collecting the needed information to be recorded for statistical analysis.

A manual search of the charts was conducted. Data were gathered mainly from the student-doctors treatment notes, and from examining patient's dental radiographs attached in their charts.

Grading Codes

Grading codes were carried out for all patients' files fulfilling the needed information as follows:

1) Age
2) Gender
   Female = 0
   Male = 1
3) Post Type
   Prefab = 0
   Cast = 1
4) Post Length
   up to 1/2 root = 0
   more than 1/2 root = 1
5) % Root in Bone
   < 50% = 0
   50 – 75% = 1
   > 75% = 2
6) Type of Restoration
   Build up = 0
   PFM = 1
   Gold = 2
   Temporary = 3
7) Cement
   Zinc Phosphate = 0
   Other = 1
   Not available = 2
8) Tooth Position
   Anterior tooth = 0
   Posterior tooth = 1
9) Free Standing (not an abutment for FPD or RPD)
   Yes = 0
   FPD abutment = 1
   RPD abutment = 2
10) Opposing Dentition
    Natural = 0
    FPD = 1
    RPD or CD = 2
11) Failure
    Yes = 0
    No = 1

Statistical Approach

A spreadsheet was made to identify the birth year of the patients, the gender, post type (prefabricated or cast), post length, percentage root in bone, the type of restoration, cement used, tooth position within the arch, whether the tooth is free standing (not an abutment for the fixed partial denture or removable partial denture, the opposing dentition, failure, and if there is inadequate information to determine any of the preceding data.

Data and information were analyzed using the Statistical Analysis System (SAS), and were subjected to determine the survival rate for both cast and prefabricated post and cores. To ascertain if ten of the possible variables are correlated to post failure a two-step process was performed. In the first, unviariate tests of correlation were performed to test for correlation between post failure and the variables. Since nine of the variables were categorical, a Chi squared test was performed and the one-way ANOVA was used for the one continuous variable age (Weaver 2008). A P-value less than 0.05 was considered as significant.

The second step was to look at the multivariate correlation between significant variables and failure. Because failure is a binary variable, logistic regression was used (Weaver 2008). The process to find the best model was to start with all significant variables and their first order interactions, and then remove parameters till only significant variables at the 0.05 level remained.

CHAPTER 3
RESULTS AND DISCUSSION

Results

The one-way ANOVA for the continuous variable age is shown in Table 3-1 with the probability level set at 0.05 for statistical significance, and its corresponding means in Table 3-2. The study shows that age is significant and the mean age for failure for female showed to be 59 years of age, while the mean age for failure for males showed to be 52 years of age.

Ten pair wise tables and their corresponding Chi squared test results are shown in Table 3-3 through 3-11, and also, ten plots with their corresponding percent of row frequencies are shown in Figure 3-1 through 3-9.

Table 3-3 and Figure 3-1 show that male patients treated with metal posts performed slightly better than female patients. Failure was recorded in 24 patients out of total 261 female patients, compared to 29 failed cases out of 378 male patients treated with post and core in the clinic. This difference was not statistically significant with $P>0.05$. Figure 3-1 illustrates 90% survival rate of metal posts for female patients and 91% survival rate of metal posts for male patients. Therefore, gender had no statistical significance with post failures.

Table 3-4 and Figure 3-2 showed the effect of post type used and if it had any significance with the failure rate of post treatment. From the table we found 9 failed cases out 129 prefabricated post treatment and 44 failed cases out of 510 custom fabricated cast post treatment. Figure 3-2 illustrated the percentages of the survival rate of both types of posts used in the undergraduate clinic with 92% survival rate for prefabricated posts, and 91.5% for custom cast posts. The difference was not statistically significant to the study $P>0.05$.

Table 3-5 and Figure 3-3 indicated that post length had a significant influence on the survival probability of the post and core treatment. Shorter posts demonstrated larger number of failure than longer posts. Post spaces prepared to more than half of the root length had higher survival rate than post spaces prepared up to or less than half the length of the root, with failure rates of 5% and 16.5%, respectively. 26 failed posts were found in 159 patients treated with prefabricated metal posts, and 27 failed cases were documented in 480 patients treated with custom fabricated cast posts. The Chi-square test resulted in a statistical significance of post length related to metal posts survivability $P<0.05$.

Table 3-6 and Figure 3-4 illustrated the effect of the amount of bone remained supporting roots of endodontically treated teeth with metal prefabricated or custom fabricated posts. A total of 43 patients were treated with metal posts in teeth that had less than 50% of roots embedded by bone, 16 posts failure were documented. The other group was 185 teeth that had 50-75% of bone supporting roots of the treated teeth. Thirteen cases of this group had failed. The last group of this category of testing was teeth that had more than 75% of bone supporting roots of the treated teeth. There were 24 cases documented as failure out of total 411 teeth treated with metal posts. In Figure 3-4 there was shown how poorly the treatment outcome was for teeth that had less than 50% bone supporting the roots with percentage of failure of 38%. Teeth with more than 75% of bone supporting their roots had only 6% of failure. Statistically this variable has shown to be very significant on how well metal posts performed and survived $P<0.05$.

Table 3-7 and Figure 3-5 illustrated the influence of material of restorations were used to treat teeth that had metal posts performed on them. Different type of restorations was used and varied from build up restorations, PFM materials, gold, and temporary restorations. Statistical tests have shown a little influence between each group in the survival probability of metal posts, however there was not a statistical significant difference of the type of material used to restore endodontically treated teeth with percentage of failure recorded.

Table 3-8 and Figure 3-6 showed the influence of different type of cement used on the survival probability of teeth treated with metal posts. The statistical tests compared the use of zinc phosphate cements to other type of cements used in the Undergraduate Clinic for Removable and Fixed Prosthodontics at the University of Florida. No statistical significant difference $P>0.05$ was found with different type of cements used to the percentage of survival of metal posts in endodontically treated teeth. Over 90% survival of metal posts were recorded with all type of cements documented.

In Table 3-9 and Figure 3-7 an illustration of the importance of tooth position in the dental arch to the survival probability of teeth treated with metal posts was tested. It was shown that no statistically significant differences were ascertained between anterior and posterior endodontically treated teeth in the dental arch with the percentages of survival of metal posts.

Table 3-10 and Figure 3-8 demonstrated the influence of final treatment type of the endodontically treated teeth to their probability of survival of metal posts used. It was recorded that endodontically treated teeth with metal posts that were not splinted by other teeth as part of a fixed partial denture prosthesis or a removable partial denture prosthesis had a larger percentages of survival probability of metal posts used. Figure 3-8 illustrated the percentages of failure for teeth that performed as an abutment for removable partial denture prosthesis to be 18%, while it was 9% for teeth that performed as an abutment for fixed partial denture prosthesis, and 6% for teeth that performed as un-splinted single crowns. This variable appeared to be of a great statistical significance to the probability of survival of metal posts $P<0.05$.

Table 3-11 and Figure 3-9 represent the influence of opposing dentition on the survival probability of metal posts in endodontically treated teeth. From the data collected it was made clear that teeth with metal posts performed a little better when opposed natural teeth with 8%

failure of row frequency. Teeth that opposed fixed and removable prostheses performed relatively well in comparison. No statistically significant differences were determined between the different types of opposing occlusion on the survival probability of metal posts in endodontically treated teeth $P>0.05$.

Figure 3-10 demonstrates the total percentage of failure of both types of metal posts documented in this study. It exhibited 92% survival probability of prefabricated and custom-fabricate metal posts combined.

At a significance level of 0.05, four variables were shown to be correlated with failure, they are age, post length, percentages of root in the bone, and whether the tooth treated with post was a free standing crown or an abutment for fixed or removable partial denture prosthesis.

The final model of significant variables was shown to be models of post length, percentage of roots in bone, and the type of final prosthetic treatment. All these variables were significant at < 0.001. The type III tests for these effects are shown in table 12**.** To illustrate how these variables affect failure the adjusted least square means are shown in Table 13-15. The mean represents the average probability that a patient with metal post treatment would experience a failure.

Table 3-13 illustrates the probability of survival of metal posts in relation to the post length. It was found out that when metal posts are prepared to more than half the length of the roots to have a probability of survival of 91%. While the probability of survival dropped to 72% when posts were to be prepared to less than half of the length of the roots.

Table 3-14 represents the probability of survival of metal posts in relation to the amount of bone remained supporting the roots. It was found out that when teeth were supported 50-75% or more by bone tissue, had a survival probability of 90%, 92% respectively. When endodontically treated teeth had less than 50% of bone supporting the roots, the survival probability of metal posts treatment was only 56.8%.

Table 3-15 brings clear the relationship between the survival probability of metal posts performed in endodontically treated teeth and the type of final treatment associated with those teeth. It showed that the probability of survival of metal posts performed in teeth that are un-splinted single crowns, or teeth that presented as abutments for fix partial denture prostheses, was 89%. The probability of survival of metal posts dropped significantly in teeth that acted as abutments for removable partial denture prosthesis to 69%.

Discussion

The design of this study was specifically meant to assess variables that might influence the survival of 2 different metal post systems that were used for endodontically treated teeth in the Undergraduate Clinic of Fixed and Removable Prosthodontics at the University of Florida.

As regards age, older patients were reported to have less survival of metal posts than younger patients. A significant difference was recorded and illustrated in Table 3.1. Our findings could be attributed to the fact that elderly patients take various medications that might cause xerostomia, which could be a major cause of developing root caries. Another significant correlation was the fact that teeth that have been treated with metal posts were abutments for some type of removable partial denture prostheses. Many geriatric studies showed that alterations in nature of pulp sensitivity, higher risk of developing root caries, and poor oral hygiene, had a significant influence on the survival of metal posts. Pulp and dentin, like other connective tissues, undergoes changes with time. Some of these changes are natural, whereas others may be a result of injury such as caries, periodontal disease, trauma, or restorative dental procedures. Regardless of the cause changes in pulp and dentin appearance and function do occur (Waton R 2002). A deeply entrenched clinical perception persists that root canal treated teeth become more brittle, assumingly, losing resilience as the moisture content of dentin declines after pulp loss. This perception is unsupported experimentally (Walton 2002). Few studies have compared physical properties of endodontically treated versus non-treated human teeth with vital pulp. The moisture content of endodontically treated teeth was not reduced, even after 10 years (Papa 1994). Also, a comparison of these two groups revealed no significant differences in strength, toughness and hardness of dentin (Huang 1992, Sedgley 1992). Thus, susceptibility to failure cannot be reliably attributed to structural changes in dentin after loss of pulp vitality or after root canal treatment (Walton 2002). It is more attributed to the type of final treatment the endodontically treated teeth are receiving and other factors mentioned previously.

Post length was shown to have a significant influence on the survival of both types of metal post systems evaluated. In this clinical study it was illustrated that endodontically treated teeth that had longer posts; extending to more than half of the root length while maintaining the necessary apical seal; to have significantly greater survival than teeth treated with shorter metal posts. Table 3.13 shows a clear presentation of the importance of post length. It was shown that post spaces that were prepared up to half the length of the roots had a survival probability of 72.8%. While posts spaces that were prepared for more than half of the root length had a survival probability of 91.5%. An abundance of reports and documentations support our findings (Santos-Filho 2008, Asmussen 2005, Caputo 1987, Colley 1968, Cooney 1986, Holmes 1996, Sorensen 1984). Fernandes concluded in his study, that posts needed to be long enough to prevent excessive internal stresses in the roots (Fernandes 2001). The length of metal post plays an important role in its retention. Various investigators have demonstrated a significant relationship between vertical resistance to displacement and length of the post. Posts should be as long as possible with 3-5 mm of root filling left at the apex for seal (Baraban 1988, Colman

1979). Research suggests that longer the post, greater is the retention and less is the stress (Standlee 1978).

One of the significant variables that were investigated in this study was the amount of bone present to support the roots of the endodontically treated teeth. It was cleared out in this examination that the survival of metal posts was significantly reduced in endodontically treated teeth that had less than 50% of bone tissue surrounding their roots. It was exhibited in Table 3.14 that when endodontically treated teeth had more than 75% of bone tissue support present, the survival probability of metal posts treatment was 92%. While the survival probability had significantly dropped to 56.8% when less than half of the roots were supported by alveolar bone tissue. Metal post should extend to at least half the length of the root contained in the remaining alveolar bone (Jacoby 1976). It has demonstrated in this clinical investigation the importance of proper treatment planning prior to endodontic therapy of teeth. The amount of alveolar bone present with respect of the necessary apical seal should be always taken into consideration. It was apparent that teeth with good overall prognosis and adequate periodontal support as measured clinically and radiographically, would have illustrated higher survival probability of metal posts treatment assuming the proper maintenance by the clinician and patient (Walton 2002).

Another important variable examined was the different types of final prosthetic restorations that endodontically treated teeth with metal posts have received. It was brought clear in Table 3.15 that teeth that were used as abutments for single crowns, and abutments for fixed partial denture prostheses have demonstrated the highest survival probabilities when compared to teeth that were used as abutments for removable partial dentures prostheses, with survival probabilities of 89.4%, 89.1%, and 69.3%, recorded respectively. Many reports support our findings. A retrospective clinical study by Wegner aimed to evaluate the survival rate of teeth that were endodontically treated and restored with endodontic posts and prosthodontic restorations. In her study, the calculated survival rates of the abutments were found to be significantly different for fixed partial dentures and for removable partial dentures with survival rate of 92.7% and 51% respectively (Wegner 2006).   Endodontically treated teeth used as removable partial denture abutments have a five times greater failure than single teeth (Sorensen 1990). Endodontically treated teeth that serve as abutments for fixed or removable prostheses have been reported to be most prone to failure (Palmqvist 1994). A study by Kantor recommended the use of cast metal post and core for restoring endodontically treated teeth that are used as abutments for removable partial dentures (Kantor 1977).

One of our main objectives in this study was to compare clinically the cumulative survival rate of custom fabricated cast posts to prefabricate metal post used in endodontically treated teeth. Figure 3.10 demonstrated the cumulative survival rate of both types of posts used and was found to be 92% during the observation period of 5 years. 510 custom fabricated posts were documented and exhibited 91% survival, and 129 prefabricated posts were used with a survival rate of 92% reported. Few in vivo studies illustrated similar results, but did not evaluate large patient collectives and possible covariates that may affect the risk of failure. Bergman examined the success rate of cast post and cores over 6 years with 96 posts cases. The failure rate was established in relation to the type of prosthetic restoration (crown, bridge), type of tooth (anterior, premolar, molar), the jaw (maxillary, Mandibular). There was a 10% failure rate after 6 years (Bergman 1989). Ellner et al. in his prospective study of 50 posts in 31 patients recorded a success rate of 100% for the group with custom-fabricated post and cores with an excellent success probability in the observation period of 10 years. The patient collective was, however, highly selective and had only been treated with single crowns (Ellner 2003). Ferrari et al. compared in their study custom-fabricated post and cores with fiber posts. After 4 years in service, custom-fabricated post and cores showed a failure rate of 14% (Ferrari 2000). Hatzikyriakos et al. examined the failure rate with 154 post and cores involving prefabricated, screw-retained, custom-fabricated, cemented post and cores under crowns, bridges and removable dentures. The cumulative failure rate was 9.1%for custom-fabricated post and cores after a period of 3 years. The number of cases in each group was, however, too small to draw any further conclusions from findings (Hatzikyriakos 1992). Sorensen and Martinoff examined the failure rate with 1273 root-filled teeth in relation to the postendodontic treatment (no post and core versus different post systems). In this study, the majority of teeth 65.4% had not been treated with a post and core and only 19.2% had been treated with a cast post and core. The failure rate recorded for the latter group was 12.7%, but no information was provided about the time in situ (Sorensen 1985). Torbjorner et al examined the success rate of two different post designs paraposts versus custom-fabricated cast posts in a 6- years study. The 456 cast posts and cores exhibited a failure rate of 10.5 % during the observation period (Torbjorner 2004). Balkenhol et al. examined the survival time of custom-fabricated cast post and core, and evaluated different variables, which influenced the risk of failure over a period of 10 years. They have concluded that custom-fabricated post and core have a good long-term prognosis, and reported a cumulative failure rate of 11.2%, and an average survival time of 7.3 years (Balkenhol 2007).

In this study gender was found not to have a significant influence on the survival of neither of the 2 metal post systems used. Figure 3.1 demonstrated clearly the effect of gender on the survival of metal posts and showed relatively close percentages. A study conducted in Denmark have illustrated different results (Peutzfeldt 2007); where they found males to have less survival probability of metal posts, and they have related their findings to the fact that men exerted greater bite forces than women.

It was shown in this retrospective study that there were no significant differences between types of materials used for the coronal coverage of endodontically treated teeth. It was reported that most endodontically treated posterior teeth had full coronal coverage, metal or porcelain fused to metal coverage. Both type of materials performed relatively equally as demonstrated in Figure 3.5. Anterior teeth on the other hand, were found to be treated either with composite restorations, or porcelain fused to metal crowns. A slight advantage of anterior teeth that were treated with full coronal coverage had been recorded over teeth that had only filling restorations. However the difference in survival of both types of metal posts with different types of materials of coronal coverage used in anterior teeth was not significant.

Type of cements used in the clinic for retaining metal posts was another variable that has been evaluated and found to be of no significance to survival of metal posts in endodontically treated teeth. The majority of cases examined have documented the use of zinc phosphate with a survival rate greater than 90%. However, metal posts that were retained using other type of cements available in the clinic also reported relatively similar values. There was no significant difference in the survival rate of metal posts retained by different type of permenant cements considering the proper post space preparation, amount of osseos bone present, and the type of final prosthetic restoration.

Neither tooth position in the arch, nor the type of opposing occlusion showed to have a significant influence on the survival probability of metal posts with endodontically treated teeth in this study. Other studies also produced this result (Bergman 1989, Dammaschke 2003). On the other hand, a few studies recorded a prevalence of failures in the upper jaw, generally in the anterior region (Mentink 1993, Torbjorner 1995).

The data of the study were acquired using a retrospective, longitudinal study design. A typical problem with retrospective studies is the availability of analyzable, consistent data. This did not, however, pose a problem with this retrospective study, as the clinical findings had been recorded in the department of prosthodontics since the beginning of 2003 according to a standardised procedure. Operators' lack of completed training was not likely to be a disadvantage, because there was extensive treatment plan and treatments were closely supervised. It can therefore be assumed that the recorded data are representative and comparable. It would have been more practical, if the average observation period had been much longer than 5 years.

Dentists should evaluate the root length. If the root is too short, or the crown-to-root ratio is unfavorable, the tooth may be unsuitable as an abutment for removable partial denture prostheses. If the osseos support and the root length are inadequate, the dentist should relate to the patient that the prognosis is poor. These considerations, in addition to minimal coronal tooth structure, make the prognosis questionable for a compromised tooth. Pulpless teeth are commonly avoided as abutments for removable partial dentures, especially if the terminal abutment is for a distal extension (Sorensen 1990).

Limitations of the study varied from sometimes lack of documentation of all investigated variables, the uncertainty of amount of ferrule remained and number of dentinal walls maintained, and unavailability of documenting posts' width preparations.

Future clinical studies should focus on evaluating different prefabricated non-metallic posts to custom fabricated posts, and for a longer period of observation time.

Table 3-1. One-way ANOVA for failure by age.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	2117.7758	2117.7758	9.22	0.0025
Error	637	146364.1678	229.7711		
Corrected Total	638	148481.9437			

Table 3-2. Means of age for failure

Failure	Age LSMEAN
0	59.3773585
1	52.7764505

Table 3-3. Failure by gender

Gender	Failure		
Frequency	0	1	Total
0	24	237	261
1	29	349	378
Total	53	586	639
Statistic	DF	Value	Prob
Chi-Square	1	0.4711	0.4925

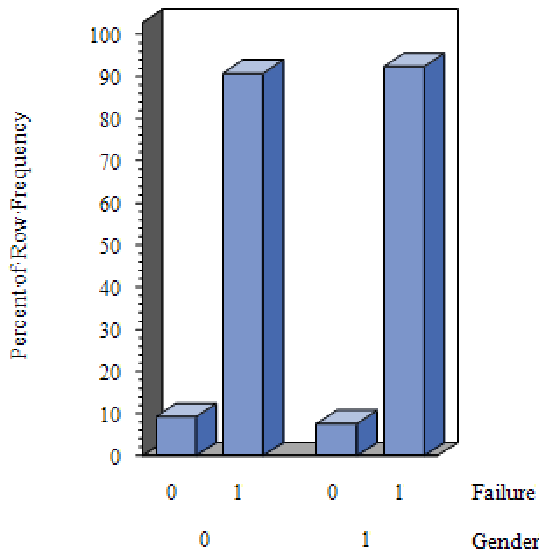

Figure 3-1. Percentage of failure by gender.

Table 3-4. Failure by post type.

Post Type		Failure	
Frequency	0	1	Total
0	9	120	129
1	44	466	510
Total	53	586	639
Statistic	DF	Value	Prob
Chi-Square	1	0.3688	0.5436

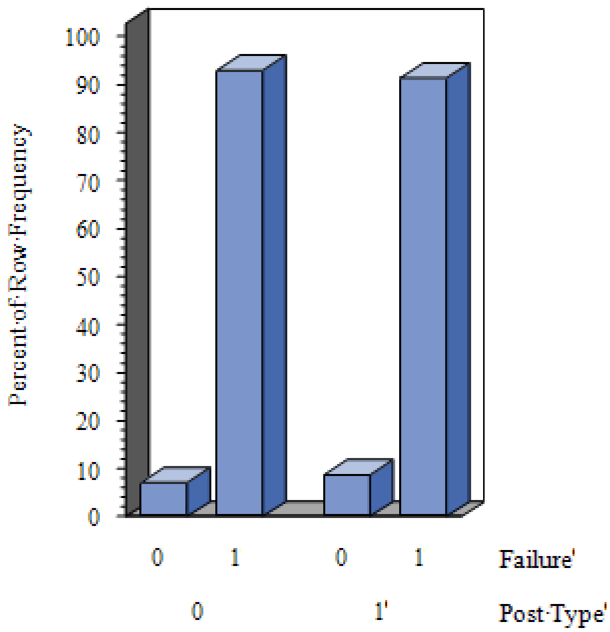

Figure 3-2. Percentage of failure by post type.

Table 3-5. Failure by post length.

Post Length	Failure		
Frequency	0	1	Total
0	26	133	159
1	27	453	480
Total	53	586	639
Statistic	DF	Value	Prob
Chi-Square	1	18.0692	<.0001

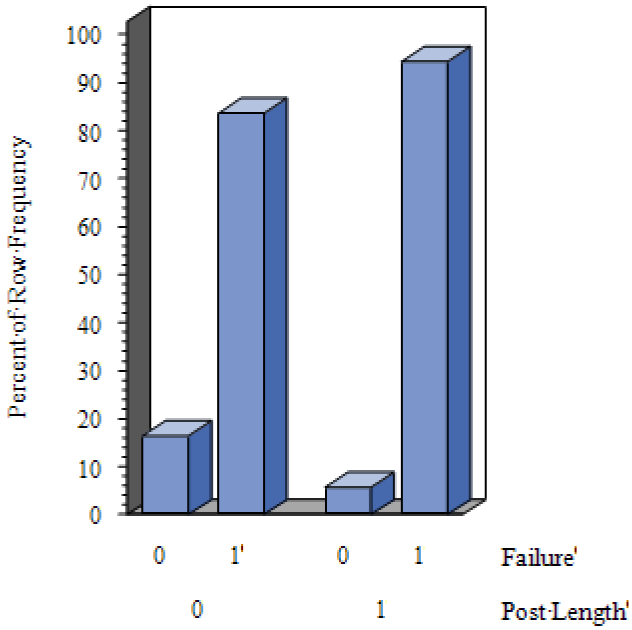

Figure 3-3. Percentage of failure by post length.

Table 3-6. Failure by percentage of root in bone.

Percentage Root in Bone	Failure		
Frequency	0	1	Total
0	16	27	43
1	13	172	185
2	24	387	411
Total	53	586	639
Statistic	DF	Value	Prob
Chi-Square	2	50.9123	<.0001

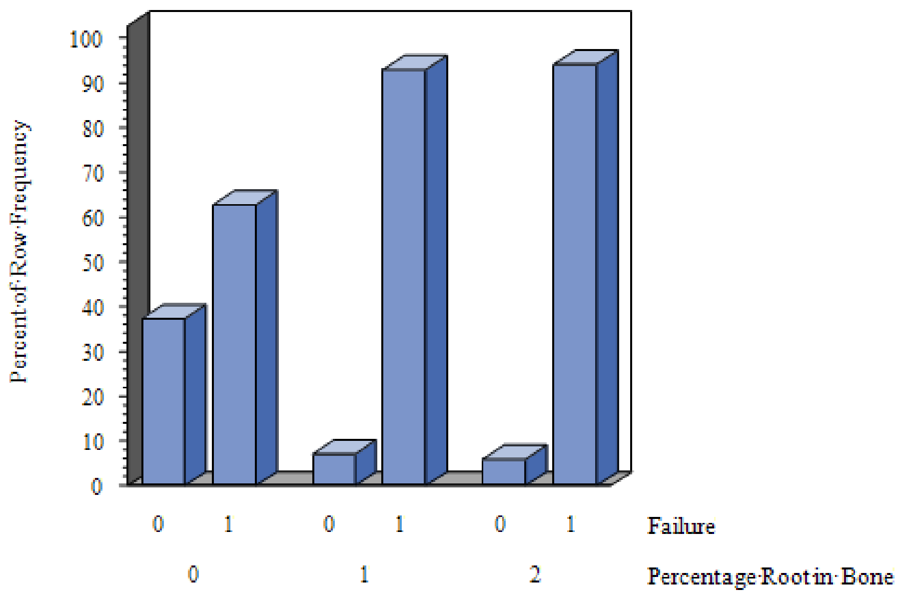

Figure 3-4. Percentage of failure by % of root in bone.

Table 3-7. Failure by type of restoration's material.

Restoration	Failure		
Frequency	0	1	Total
0	3	51	54
1	38	419	457
2	12	90	102
3	0	26	26
Total	53	586	639
Statistic	DF	Value	Prob
Chi-Square	3	4.4994	0.2123

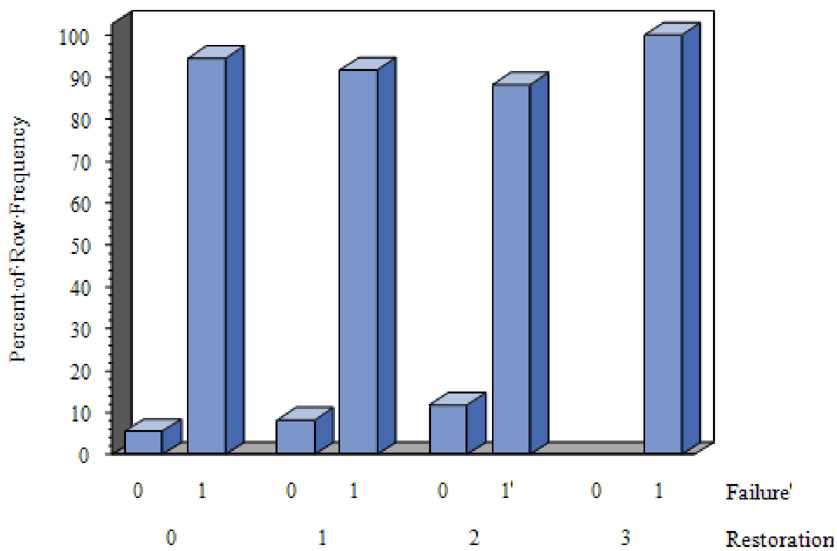

Figure 3-5. Percentage of post failure by type of restoration's material.

Table 3-8. Failure by cement.

Cement	Failure		
Frequency	0	1	Total
0	36	412	448
1	13	120	133
2	4	54	58
Total	53	586	639
Statistic	DF	Value	Prob
Chi-Square	2	0.5714	0.7515

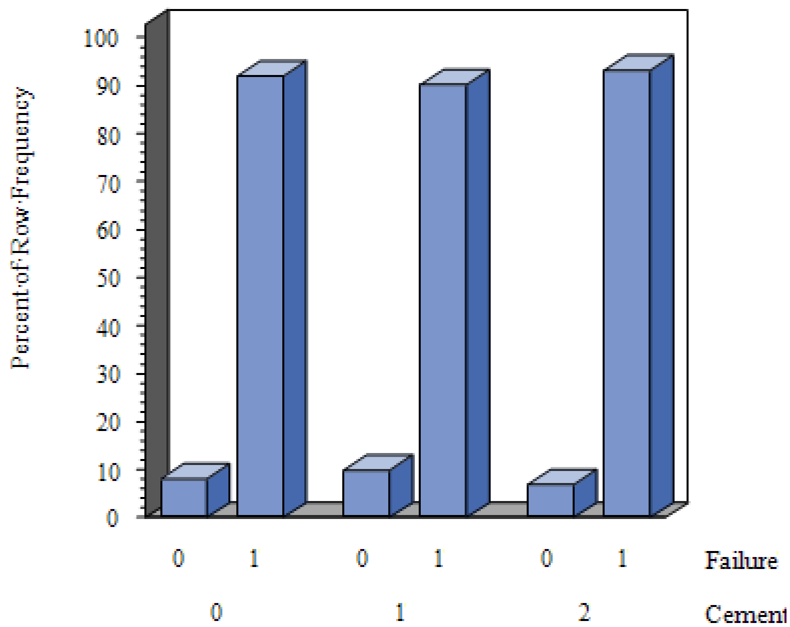

Figure 3-6. Percentage of failure by cement.

Table 3-9. Failure by tooth position.

Tooth Position	Failure		
Frequency	0	1	Total
0	30	393	423
1	23	193	216
Total	53	586	639
Statistic	DF	Value	Prob
Chi-Square	1	2.3770	0.1231

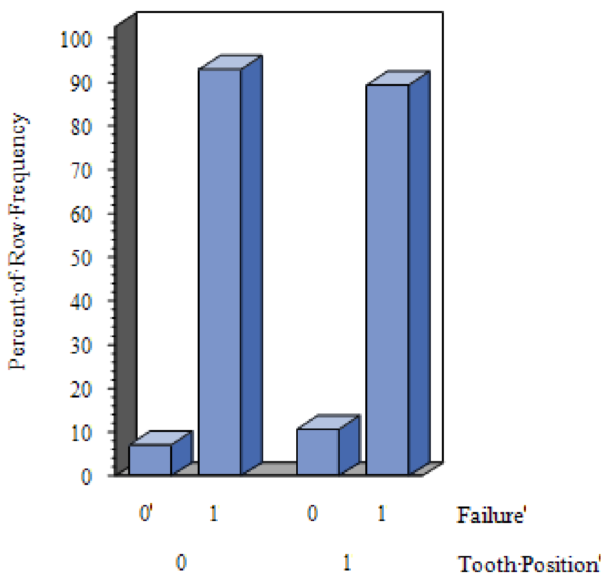

Figure 3-7. Percentage of failure by tooth position.

Table 3-10. Failure by type of prosthetic treatment.

Final Treatment	Failure		
Frequency	0	1	Total
0	22	367	389
1	11	123	134
2	20	96	116
Total	53	586	639
Statistic	DF	Value	Prob
Chi-Square	2	15.7705	0.0004

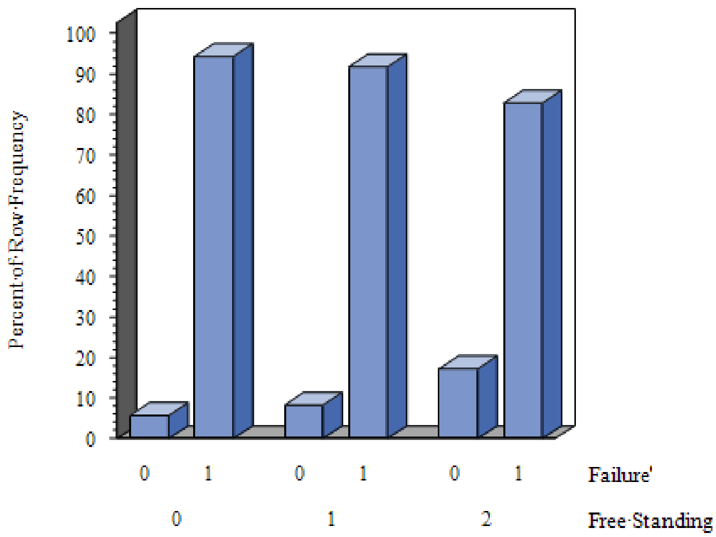

Figure 3-8. Percentage of failure by type of tooth treatment.

Table 3-11. Failure by type opposing occlusion.

Opposing Dentition	Failure		
Frequency	0	1	Total
0	28	373	401
1	12	75	87
2	13	138	151
Total	53	586	639
Statistic	DF	Value	Prob
Chi-Square	2	4.3853	0.1116

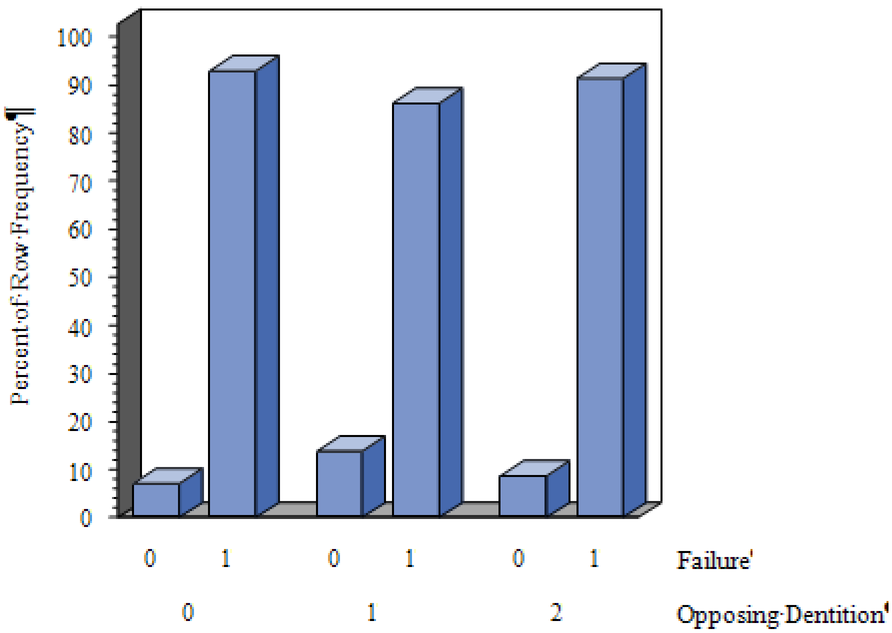

Figure 3-9. Percentage of failure by type of opposing dentition.

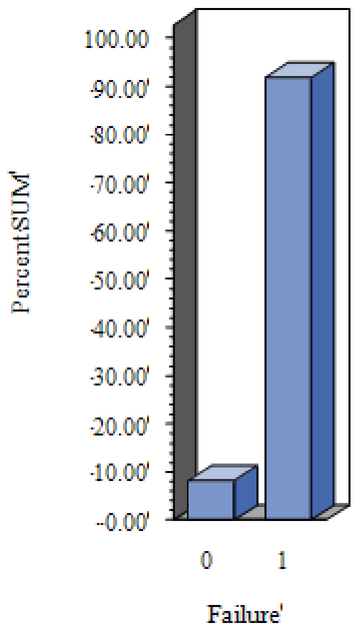

Figure 3-10. Percentage of total failure of all post types.

Table 3-12. Type III tests of the significant variables.

Effect	Num DF	Den DF	F Value	Pr > F
Percentage Root in Bone	2	633	15.76	<.0001
Post Length	1	633	18.79	<.0001
Free Standing	2	633	7.68	0.0005

Table 3-13. Post length least square means.

Post Length	Mean	Standard Error Mean
0	0.7288	0.04844
1	0.9154	0.01732

Table 3-14. Percentage of root in bone least square means.

Percentage Root in Bone	Mean	Standard ErrorMean
0	0.5683	0.08235
1	0.9086	0.02468
2	0.9230	0.01638

Table 3-15 Type of final prosthetic treatment least square means.

Type of Final Treatment	Mean	Standard Error Mean
0	0.8942	0.02295
1	0.8915	0.03330
2	0.6932	0.05960

CHAPTER 4
SUMMARY AND CONCLUSION

Within the limitations of this clinical study, multiple variables have been evaluated for their influence on survival probability of custom-fabricated cast post and prefabricated metal posts used in endodontically treated teeth. Multiple hypotheses were fabricated and the conclusions were drawn to be:

1. Age of patients did influence the survival rate of both treatment modalities, and was found that older patients exhibited less survival rate than younger patients.

2. Metal posts that were prepared for more than half of the root length while maintaining the necessary apical seal shown to have greater survival probability.

3. The percentage of alveolar bone remain to support the endodontically treated teeth was found to influence the survival probability of both treatment modalities significantly.

4. The type of final prosthetic restoration fitted has a significant effect on the survival probability. Posts under single crowns and fixed partial denture prostheses have the highest survival probability.

5. The clinical survival of custom-fabricated cast posts and prefabricated metal posts were not affected by patients' gender, type of cements used to retain posts, types of opposing occlusion, and the position of the endodonticaly treated teeth in the dental arches.

Very little clinical data are available on metal posts treatments that are performed on a daily basis. This fact, combined with the inconsistency of the clinical data that have been published we could not conclude the preference of custom-fabricated cast posts over prefabricated metal posts. Both treatment modalities can be recommended if they are applied within indications and with the necessary caution. Metallic posts continue to be the standard for most situations because they have stood the test of time.

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BIOGRAPHICAL SKETCH

The author, Hassan Mosuawi, was born in 1978 in Malta. He grew up in Kuwait City, Kuwait. Graduated from Salah Aldeen High School in Kuwait City in June1996. In August of 1996, he enrolled at the University of Missouri-Kansas-City as a dental student where he joined the six-year-combined program of Bachelor of Art and Science. In 2003, Mousawi graduated from the University of Missouri-Kansas-City School of Dentistry, with a Doctor of Dental Surgery degree. The author returned home to Kuwait and worked for the public health system of Kuwait from 2003 to 2006 before deciding to pursue a dental specialty degree in the United States. In July 2006, he enrolled in the Graduate prosthodontics program at the University of Florida. After graduation with a Master of Science in dental sciences with a specialization in prosthodontics from the University of Florida in May of 2009, he plans to return to Kuwait and work for the public health system for the betterment of the dental service of his beloved country. This is the beginning of the rest of his life.