An Analysis of Patients' Expectations and Perceptions of Orthodontic Dental Service Quality

by

Dr. Jonathan P. Suzuki

A thesis submitted to the Faculty of Graduate Studies of the

University of Manitoba in partial fulfillment of the requirements

for the degree of

MASTER OF SCIENCE

Dental Diagnostic & Surgical Sciences
University of Manitoba

THE UNIVERSITY OF MANITOBA

FACULTY OF GRADUATE STUDIES

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Acknowledgments

First I would like to thank Dr. Chris Lavelle for his tremendous support and encouragement during this project and my last three years here at the University of Manitoba. I know it took a while for me to "get into gear" and I thank you for your ceaseless determination to seek me out and make me feel guilty for not working. You are a great friend and mentor.

I would also like to thank Dr. Tom Hassard for all his help during the writing of this thesis. You made the most difficult part of this investigation easy for me to understand and have given me the inspiration to look further into this exciting area of orthodontics. Cheers!

I would also like to thank Dr. Robert Baker for all his help and guidance during this project, and my graduate education. You are a great teacher and advisor, and really have made a difference in my life. My experiences with you as a student and patient were part of the reason I decided to become an orthodontist in the first place. Thank you.

Last, but certainly not least, I would like to thank my father, Dr. Makoto Suzuki. You are and will always be the greatest inspiration in my life. I really don't know how I could have done it without you Dad. You're the best! Thanks so much for standing by me when I needed it most, helping me during the lean and rough times and driving me to do the best I can do, no matter what the circumstance. I hope that I can continue your tradition of professional excellence, and look forward to our years together.

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1.0 Synopsis

Orthodontists are committed to achieving excellence in orthodontic treatment. Knowing what patients think about the care they are receiving is vitally important to the orthodontist because it aids in the understanding of patient needs and therefore, contributes to the delivery of orthodontic care at the highest level. Today, consumer demands and expectations for quality in both manufactured goods and services is high and steadily increasing. The provision of goods and services that *just* match consumers' demands will be insufficient to maintain a competitive edge and/or market share in the future.

The quality of health services are generally intangible, so they cannot be counted, measured, inventoried or tested in advance of 'sale'. Patient experience, either directly or vicariously from outside sources, is therefore an important means of verifying whether provision of a health service is synonymous with high quality. This assessment has particular relevance to orthodontics, where the benefits of treatment derived from specialists versus general practitioners is not well differentiated by the general public. Enhanced patient satisfaction is also a crucial healthcare market determinant, since service quality perceptions not only impact on the derived satisfaction, but also on the selection of specialist versus non-specialist orthodontic service providers. Such market demands require specialists to be precisely informed on their patients' feelings about the treatment they provide.

Since orthodontists share substantial commonalities in their delivery of technical services, it is surprising that few monitor the non-technical aspects of orthodontic

treatment that are so integral to patient satisfaction, which is theorized to depend on the inter-relationships between their expectations and perceptions. The difference or 'gap' between these parameters provides pragmatic service satisfaction information. Recent applications of the generic SERVQUAL ('service quality') instrument have facilitated the attainment of such information for many financial and healthcare services. This is primarily due to the ***Gap Theory*** of Parasuraman et al. (1985), which defines service quality as 'a function of the gaps between the service expectations of consumers (patients) and their service perceptions', has been the primary method of obtaining this information. Since reducing these gaps must comprise the principal targets of any form of strategic marketing, this pilot study was therefore undertaken to develop customized SERVQUAL instrument to quantify patients' expectations and perceptions of orthodontic dental service quality. The feedback and modifications to the delivery of orthodontic service delivery provided by such an instrument will render a means by which orthodontists can monitor and improve their services. The satisfaction created from these improvements is of paramount importance and is related to one of the primary characteristics of the profession of orthodontics—to serve.

Over a 12-week period, patients receiving orthodontic treatment from a University graduate clinic and a private practice clinic completed a customized SERVQUAL questionnaire consisting of 19 paired expectation/perception statements scored via a ten-point Likert-type scale. Statistical evaluations of the derived scores not only provided valid and reliable assessments of orthodontic service quality viewed from the perspective of patients, but also information to facilitate strategic development for continuous improvement. These assessments proved more complex than initially

envisaged, since there were significant discrepancies between the expectations and perceptions of patients attending University and private practice clinics relative to their differential service costs. Similarly, patients and their parents/guardians differed in their respective opinions of the professionalism exhibited by the orthodontists. Further development and testing of this customized SERVQUAL instrument is therefore mandated, prior to the more general applications to the patients of orthodontic specialists in different geographic regions.

Introduction

Contents

2.0 Introduction

2.1 The Measurement of Orthodontic Service Quality

Measurements of the quality of manufactured goods (e.g. automobiles) are relatively easy to obtain, since they principally relate to their *tangible* parameters (e.g. colour, size, value etc.) and relate exclusively to outcomes. Service qualities are more difficult to measure, due to their predominant *intangible* parameters, and the fact that both process and final outcomes must be related. One method to derive such strategic objectives is to observe the day-to-day interactions between patients and staff (both professional and ancillary), as illustrated in **Table 2.1**.

Although such methods may lead to improved orthodontic services, the lack of quantitative measures and techniques of evaluation inherently constrain objective strategies for improvement of *service delivery*. Various methods have accordingly been devised to collect quantitative data to define patient satisfaction from their healthcare services (**Table 2.2**).

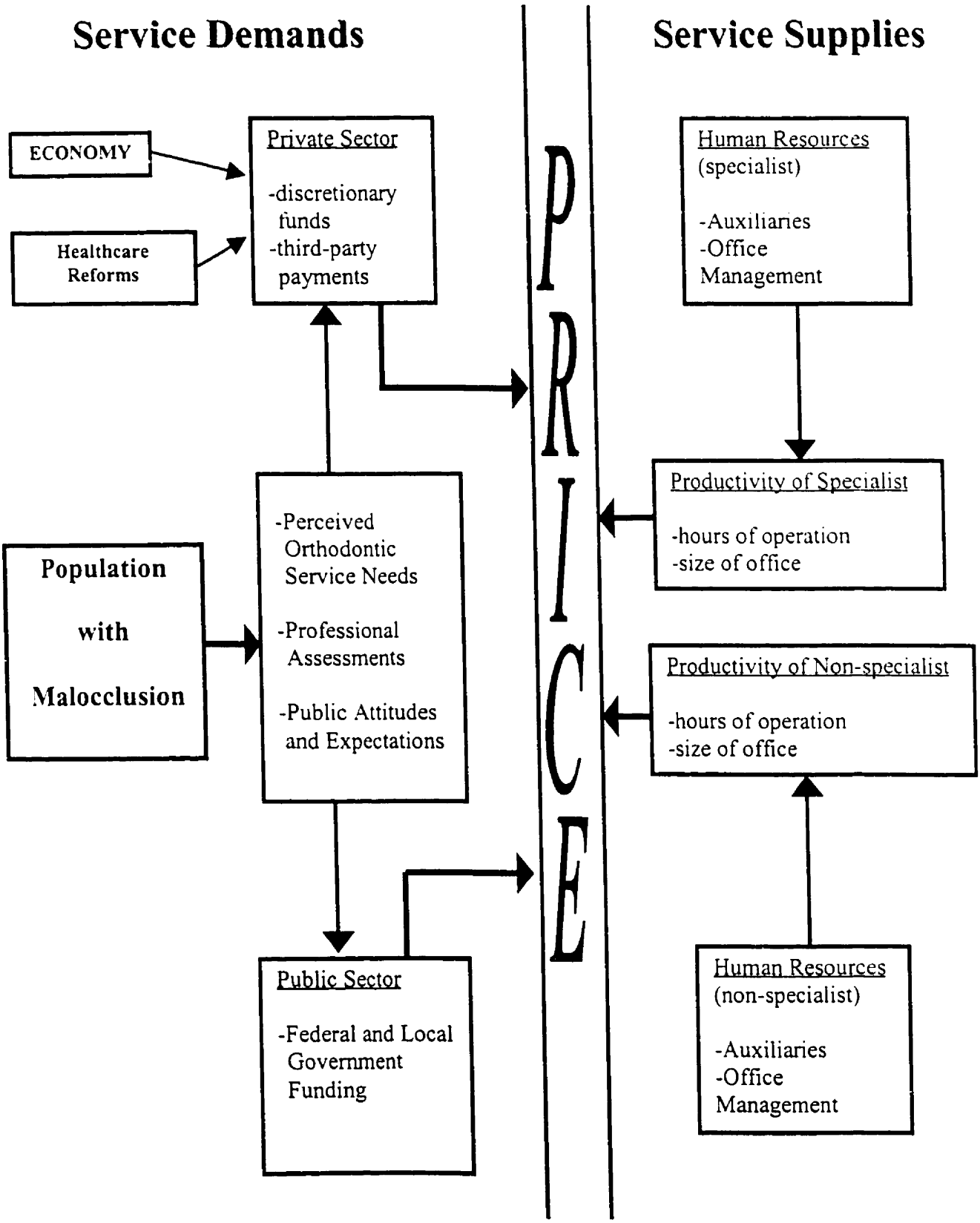
2.2 Orthodontic Service Markets

Recent dramatic improvements to North American oral health (Brunelle & Carlos, 1992) and the decreasing prevalence of third party dental coverage among the population continue to adversely affect the economic aspirations of many general dentists (Brown & Lazar, 1998). Although increased esthetic service demands have compensated these changes to varying degrees (Sheats et al., 1995), the increase in competition for elective

orthodontic services has the potential to negatively affect the market for orthodontists (Koroluk et al., 1998). The potential impact of these changes cannot be overstated, since orthodontic services were previously the exclusive domain of the specialist. (**Figure 2.1**)

Due to increased competition, inflation and the increasing costs of dental treatment, general dental service providers continue to use more and more of patients' disposable income available for elective or cosmetic dental procedures. These trends have been confirmed by a recent Michigan study, where 80.7% of the general dentists included in the survey reportedly provided orthodontic services at some level (Wolsky et al., 1996). Surveys from Iowa (Jacobs et al., 1991), Michigan (Wolsky et al., 1996) and Ohio (Ngan et al., 1998) have also indicated that many of the types of malocclusions treated and appliances used by general dentists are analogous to those utilized by specialists. Since these services included comprehensive fixed, functional and extra-oral appliances, the competitive orthodontic markets are similar to those for most other healthcare services. The recent implementation of various healthcare management organizations (e.g. preferred provider, managed care, etc.) has further exacerbated such market competition, since their expenditure constraints generally involve restricted specialist service access (Kassirer, 1994; De Porter, 1997; Bramson et al., 1998). As most other healthcare institutions (e.g. hospitals, clinics, etc.) have responded to analogous market constraints by strategic developments that ensure services match or exceed their patients' expectations (Artford et al., 1995; Lewis, 1994; Sapien et al., 1995; Hall et al., 1993; Fitzpatrick, 1991; Vuori, 1991; Nelson, 1990; Cleary et al., 1988; Pascoe, 1983; Grönroos, 1982; Bensing, 1991; Batalden et al., 1991; Waal et al., 1993),

Figure 2.1 Market domain for specialist orthodontic services



corresponding strategic marketing is imperative for elective (e.g. specialist orthodontic) services (Gottlieb et al., 1997).

This strategy principally relates to competition for such elective services with other consumer demands (e.g. vacations, education, entertainment, etc.) A recent mail-in survey underscored these trends, where the economic success of specialist orthodontic practices was largely a function of their intangible attributes (e.g. the personality traits of specialists, interpersonal relationships between office staff and patients), rather than rigidly applied business principles (Hughes et al., 1996).

Traditional *laissez-faire* market responses to these changes are therefore incompatible with specialist survival in the progressively competitive orthodontic markets. For instance, substantial commonalities in the tangible (i.e. technical) parameters of services derived from both specialists and non-specialists (e.g. active and retentive appliance design similarities regardless of the provider type) may mask discrepancies between the quality and complexity of services provided by specialists and general practitioners. Peerless service quality and continued patient satisfaction is therefore crucial for specialists to maintain their competitive advantage over non-specialists (Cronin & Taylor, 1992, 1994; Quinn, 1992; Lyttle & Mokva, 1992). Surprisingly, strategic development to achieve these objectives has yet to be systematically investigated, principally due to inadequate information on the differential determinants that distinguish the perceived quality of, and patient satisfaction with, orthodontic services provided by specialists.

Orthodontists are committed to achieving excellence in orthodontic treatment. Knowing what patients think about the care they are receiving is vitally important, because it aids in the understanding of patient needs and therefore contributes to the delivery of orthodontic care at the highest level. The feedback and modifications to the delivery of orthodontic service delivery provided by the results of this study will provide a means by which orthodontists can improve their services. The satisfaction created from these improvements is of paramount importance and is related to one of the primary characteristics of the profession of orthodontics — to serve. Clearly then, there is an urgent need to investigate not only the expectations and perceptions of orthodontic service consumers but also to differentiate the perceived benefits of orthodontic services provided by specialists relative to those derived from general practitioners.

2.3 The Strategic Importance of Healthcare Service Qualities

Since consumer demands and expectations for quality in both manufactured goods (e.g. automobiles) and services (e.g. financial or healthcare) is steadily increasing, (Melford, 1993; Moore et al., 1994) the provision of goods and services that just match consumers' demands will be insufficient to maintain a competitive edge and/or market share. This fact has particular relevance to orthodontic services, where the benefits of treatment derived from specialists or general practitioners is not well differentiated in the general public. Such distinctions are particularly relevant to many urban areas, where specialist/generalist juxtaposition in similar locations further exacerbate the competition in their respective markets. Currently, the primary distinction between specialists and

generalists mainly depends on the specialists' perceived service superiority (i.e. reputation), although even this advantage may vary over time.

In response to market competition, numerous commercial companies aggressively monitor their consumers' expectations in order to provide information to improve their products (Cronin & Taylor, 1992). Enhanced patient satisfaction is also a crucial *healthcare* market determinant (Taylor, 1994; Quinn, 1992), since service quality perceptions not only impact on their derived satisfaction, but also the selection of specialist versus non-specialist orthodontic service providers (Woodside et al., 1989). These expectations may be difficult to satisfy, however, not only due to the diverse consumers' educational, value and experience mores (Davidow & Uttal, 1989; Mefford, 1993), but also the varied and dynamic interactions with their peers. Furthermore, each consumer possesses his/her own unique preconception of how services should be delivered. Specialists must therefore ensure that they are sensitized to such varied expectations and provide the service and service outcomes that match reality (Pitt & Jeantrout, 1994). Such market demands require specialists to be precisely informed on their patients' expectations and perceptions with respect to orthodontic treatment (Davidow & Uttal, 1989; Pitt & Jeantrout, 1994). In this regard, specialists and their ancillary staff may be required to adapt and modify their service deliveries to *exceed* the unique expectations of their patients (Berry et al., 1988; Shostack, 1984). Such strategic challenges therefore not only require consistently high-quality service (Shostack, 1984), but also meticulous monitoring of service provision during the course of treatment of every patient and also during the life of the practice. All the instruments listed in **Table**

2.2 offer the potential acquisition of quantitative data to define service satisfaction – although appropriateness, consistency, reliably and validity of such data varies according to the assessment format.

This variability and complexity of healthcare services distinguish them from manufactured goods in four primary dimensions.

1. Intangibility
2. Heterogeneity
3. Inseparability from production
4. Inseparability from consumption (Parasuraman et al., 1985)

Orthodontic services are generally intangible, so they cannot be counted, measured, inventoried, tested or verified in advance of sale. Patient experience, either directly or vicariously from outside sources (friends, relatives), is therefore an important method of verifying whether provision of an orthodontic service is synonymous with high quality. Orthodontic services also vary markedly, due to the inherent diversity of patients and their service needs (e.g. types of malocclusion). The needs and performances of specialist orthodontists and their staff may also vary temporally (for example, between the seasons of the year, days of the week and times of the day), which in turn may be reflected by variations in the quality of services actually delivered.

Table 2.1 Advantages/disadvantages of selected qualitative assays of orthodontic service quality (Parasuraman et al., 1988)

Assay	Advantages	Disadvantages
Observation by Specialist	-Specialist is familiar with orthodontic service components and their relative costs -No inconvenience to patients -Opportunity to recover from service failure -Opportunity to identify problems associated with service deliveries -Minimal incremental costs for data collection	-Presence of doctor may change 'normal' attitudes and techniques of auxiliaries -Objective observation requires training -Employees disinclined to report service problems if they created them
Employee Feedback	-Employees have knowledge of service delivery problems -Patients may volunteer service experience information to employees; -No inconvenience to patients -Opportunity to recover from service failure -Employee empowerment improves morale -Opportunity to collect detailed patient feedback -Minimal incremental costs for data collection	-Employee observation requires specialized training -Employees disinclined to report service problems if they created them
Focussed specialist, staff & patient discussions	-Opportunities to collect detailed patient feedback -Opportunity to recover from service failure -Other problems may surface during discussions -Helps to build teamwork	-May only identify symptoms rather that core problems -Feedback limited to small patient sample (biased?) -Limited recollection of specific service encounters -Inconvenience necessitates incentives for participation -Information may be withheld for fear of offending others

Table 2.2 Advantages/disadvantages of quantitative assays of patient satisfaction (Parasuraman et al., 1988).

Assay	Advantages	Disadvantages
Mail-in surveys	-ability to gather data from representative target patient samples -Opportunity to recover from service failure -Opportunities for patients to reflect on their service experiences -Facilitate comparisons between different patient demographic groups -Suggest practice is interested in opinions	-Poor response rates -Variable recollections of specific service encounter details -Other service experiences may bias responses if there is a time lag -Inconvenience requires incentives for patient participation -Costs associated with the distribution and analyis of patient responses -Potential problems associated with formulating questions
Telephone interviews	-Opportunity to collect detailed patient feedback -Opportunity to recover from service failure -Suggests practice is interested in patient opinions	-Intrusion of patient telephone at home, school or work -High cost of skilled interviewers -May not generate representative patient sample -Bias due to non-anonymity
Actor patients	-Consistent and unbiased feedback -Can focus on specific service components -No patient inconvenience	-Potential for statistically invalid sample of isolated patient encounters -High costs -Not applicable to all service components -Ethical concerns

Finally, as orthodontic service production is inseparable from consumption, quality control is more difficult than the manufacture of goods (Mefford, 1993). There is clearly a need to examine patients' perceptions of service quality, even though this task is both elusive and difficult (Ford et al., 1997).

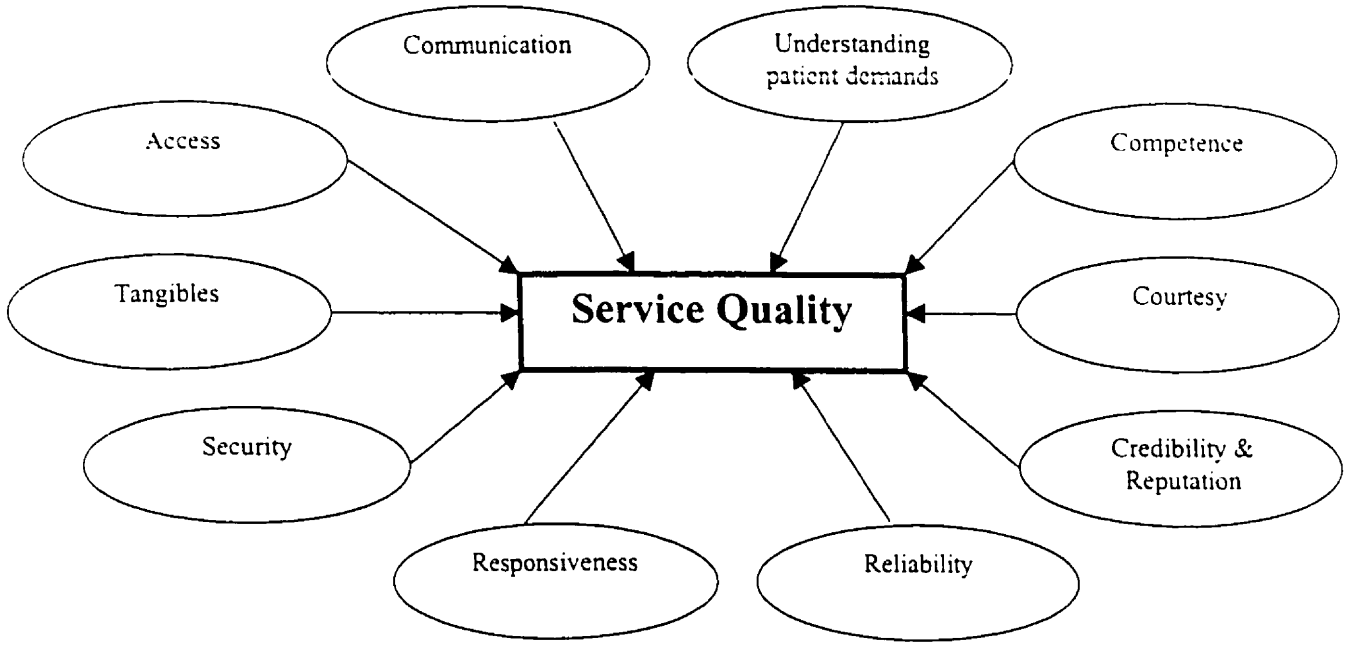
2.4 Attributes of healthcare service quality

Extensive review of the literature shows that service quality and consumer satisfaction (**Figure 2.2**) are discrete entities which display an intimately symbiotic relationship (Taylor 1994; Parasuraman et al., 1988). Therefore, the strategic focus of specialist orthodontists should be directed to the provision of services that maximize their patients' satisfaction and the technical excellence of the final outcome (i.e. a stable 'ideal' occlusion). Generally, perceptions of high service quality appear to be determined in part by the specialist's reputation (Taylor, 1994), whereas patient satisfaction is mainly associated with short-term service-encounter-specific consumer judgements (Cronin & Taylor, 1992; 1994). Such distinctions have considerable validity, due to the differential determinants of patient satisfaction and service quality. These distinctions have been summarized as follows:

1. Service quality is more difficult for the consumer (patient) to evaluate than goods quality;
2. Service quality perceptions result from the differences between consumers' expectations and the actual service performance;

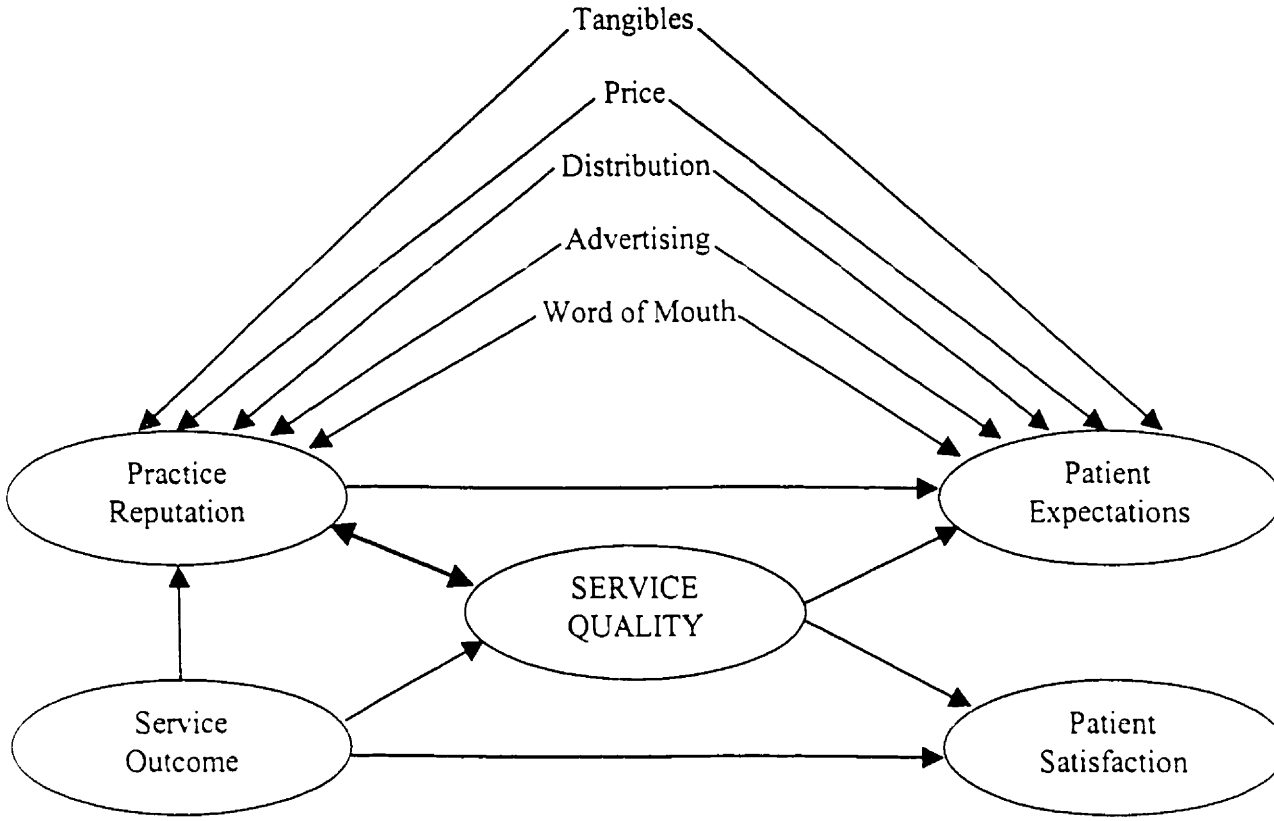
3. Quality evaluations embrace both the final service outcome and their delivery processes (Parasuraman et al., 1985).

Figure 2.2 Principal determinants of service quality assessments by patients



Even if the constructs for service satisfaction and quality are distinct, their varied interactions are also important to investigate. For instance, several studies have identified positive relationships between perceptions of service quality and patient satisfaction (**Figure 2.3**), in addition to strong associations between service satisfaction and the willingness to recommend service providers to friends and relatives (Bowers et al., 1994; Woodside et al., 1989; Peyrot et al., 1993; Doering, 1983).

Figure 2.3 Service quality as it relates to patient satisfaction



Patient service satisfaction may generally be defined by four variables (Wooley et al., 1978):

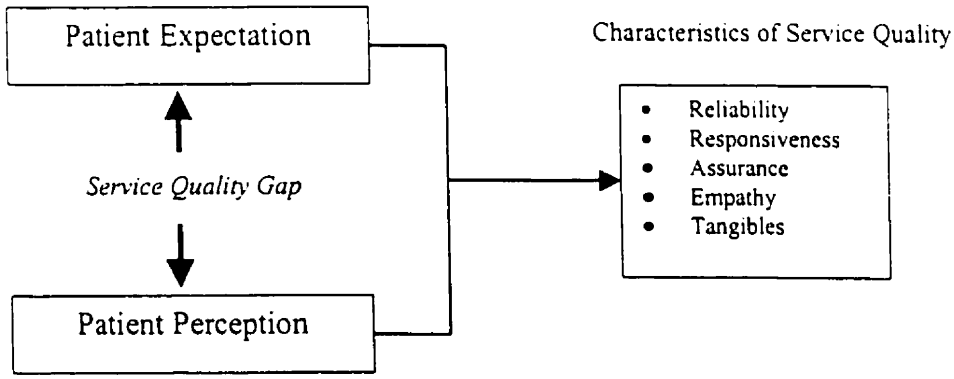
1. The associated processes and outcomes (Stimson & Webb, 1975)
2. Patient's expectations for the outcomes (Korsch et al., 1968)
3. Continuity of service quality (Hulka et al., 1970)
4. Professional/patient communications (Larsen & Rootman, 1976).

These parameters are particularly relevant to elective orthodontic services, since:

- Satisfaction is the ultimate objective for orthodontic service outcomes;
- Satisfaction ratings provide useful feedback information on both the orthodontic service processes and outcomes;
- Satisfaction/dissatisfaction can be the ultimate determinants of patient compliance (Ware et al., 1978).

Patient satisfaction with service quality depends on the inter-relationships between their expectations and perceptions (Mefford, 1993; Moore & Schlegelmilch, 1994). The differences or 'gaps' between these parameters provide pragmatic service satisfaction information. (Little & Mowka, 1992; Ross, 1995; Cronin & Taylor, 1992; Bowers et al., 1994). See **Figure 2.4**

Figure 2.4 Components of Service Quality



These gaps form the basis of the *Gap Theory* (Parasuraman et al., 1985), which postulates that discrepancies between consumers' (patients') expectations about the

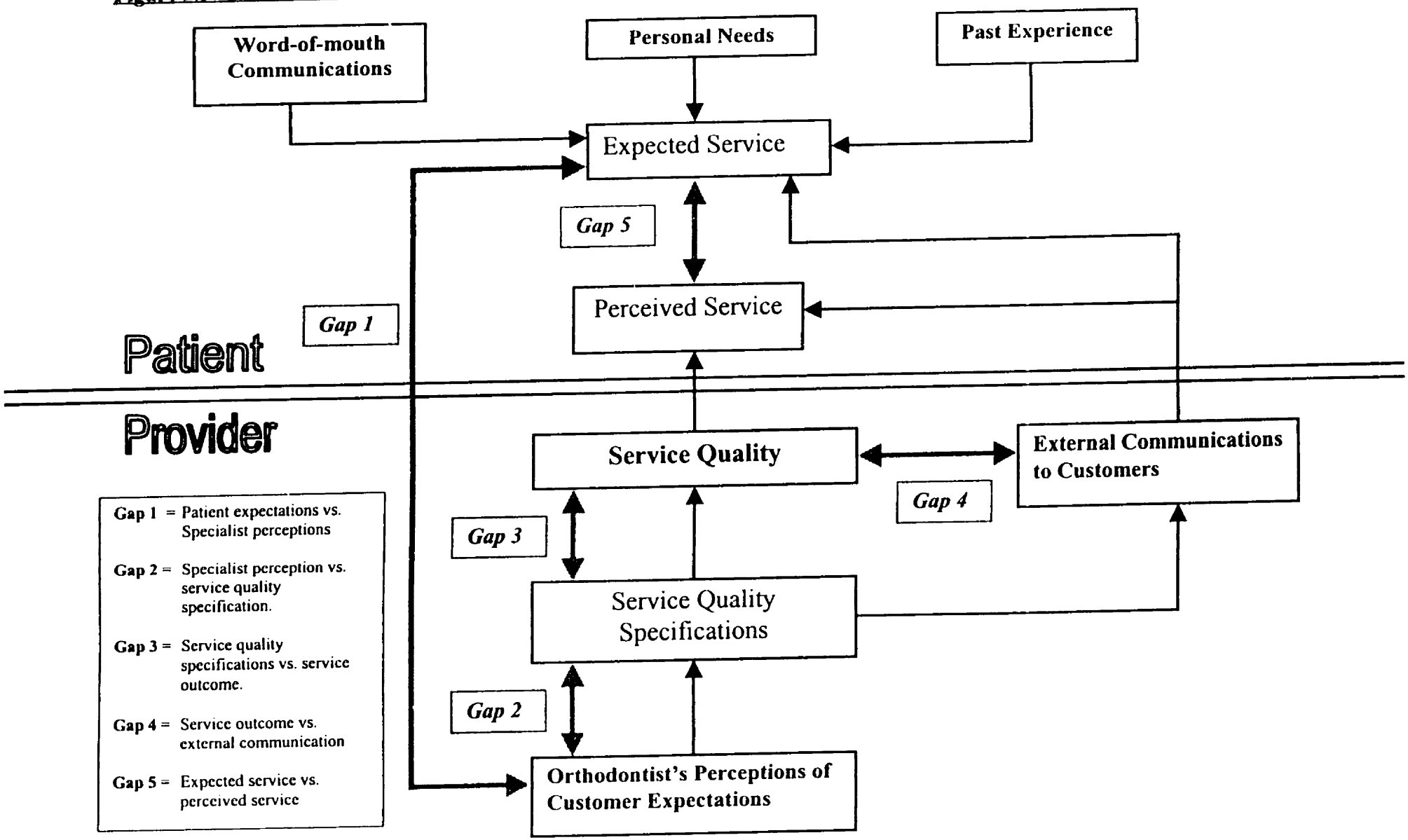
service they receive and their perceptions of the service once delivered, defines their view of service quality (**Figure 2.5**). For instance, if perceptions meet or exceed expectations, the consumer (patient) will view the service favorably and vice versa, although the service perception/expectation gap is itself further driven by other gaps within the service organization itself (e.g. the gap between what the consumers want and what the provider thinks they want).

Following a review of 113 potential instruments to measure the intangible parameters of healthcare service satisfaction devised over the past decade (van Campen et al., 1995), the Gap Theory of Parasuraman et al. (1985) was developed to conceptualize the service satisfaction model. Further Gap Theory development (Parasuraman et al., 1988) identified 5 dimensions to define the expectation/perception gaps (**Table 2.3**).

Table 2.3 The principal dimensions of the SERVQUAL instrument

Dimension	Description
Tangibles	Physical facilities, equipment, appearance of personnel and the doctor, demeanor of staff.
Reliability	Ability to perform the promised service dependably and accurately.
Responsiveness	Willingness to help customers (patients) and provide prompt service.
Assurance	Knowledge and courtesy of employees and their ability to inspire trust and confidence.
Empathy	Caring, individualized attention provided to customers (patients).

Figure 2.5 CONCEPTUAL MODEL OF SERVICE QUALITY (Parasuraman et al., 1988)



The operationalization of this Gap Theory – SERVQUAL – is the basis for a questionnaire that provides a multidimensional examination of service expectation/perception gaps based on these five dimensions. The results derived from this questionnaire not only offers the service quality manager (i.e. the orthodontist) the potential to monitor quality, but also to develop appropriate organizational responses for service quality improvement and therefore provides a rationale for the usage of this instrument in the current investigation.

Review of the Literature

Contents

3.0 Review of the Literature

3.1 The Development of Service Quality Analysis

Little has been published on the nature of the orthodontic market e.g. the reasons why patients, parents/guardians seek orthodontic care (Bergstrom et al., 1988; Tulloch et al., 1994; Oliver & Knapman 1985; Sergl & Zentner, 1998; Gosney, 1985) or the tangible benefits derived from esthetic changes in tooth alignment (Bennett et al., 1997). Although the attitudes towards orthodontic service needs differ markedly between cultural and socio-economic groups (Tulloch et al., 1994; Holst & Ek, 1988), presumably the esthetic benefits of orthodontic services are preferred over cosmetic plastic surgical options e.g. mandibular advancement, rhinoplasty (Jerrold, 1988). However, the rationale for such selections by a public that is generally unaware of the relative benefits of these alternatives remains largely obscure. For instance, few patients seem to be aware of the potential discomfort induced by initial orthodontic appliance placements (Jones, 1984; Ngan et al., 1989), the degree of patient cooperation required for successful service outcomes (Albino et al., 1991) or the need for orthodontic retention appliances in the last phase of their treatment (Blake & Garvey, 1998). Similarly, when a variety of orthodontic service options are available from many non-specialists, it is unclear why one specialist is selected over others for their provision. Presumably, such selections are primarily related to concerns to obtain the 'best' quality of service. But how do decisions relative to the final outcomes (e.g. esthetic smiles) interact with the intermediate delivery stages? Such marketing information is crucial to ensure continued demands from consumers in highly

competitive markets. Whereas orthodontists have traditionally devoted most of their attention to the quality of the final service outcomes, the potential impact of the intermediate delivery stages on the perceived quality of the service as a whole cannot be ignored. Whereas the technical standards of the specialist are integral to service satisfaction, patients are also concerned with the whole process, especially when two to four years may be required to correct a malocclusion, in addition to long-term retention appliances.

If "the customer is always right" is a recognized motto for success in the traditional retail sector, surely it is also appropriate to the progressively competitive healthcare (i.e. orthodontic) sector as well. Since the environment will inevitably become more hostile, due to inflationary overhead costs and competition not only between specialists and non-specialists but also other specialists, the provision of service satisfaction may be the best strategy to ensure continued success in the orthodontic market. This strategy will, however, be unacceptably empiric until there is accurate information on the criteria patients apply when assessing the quality of the services they receive.

Service quality can be determined by the amount of discrepancy between consumer expectations, or desires, and their perceptions of services they are receiving (Dyck, 1996). The key to good service quality is meeting or exceeding what consumers expect (Zeithaml et al., 1990). Disconfirmation theory predicts that clients will be dissatisfied with a service experience if it does not meet their expectations (Clow et al.,

1995). Hence, patients' desires serve as the foundation upon which orthodontic service quality will be evaluated by patients.

Few health services focus on patient satisfaction from the patient's point of view, especially orthodontics. Traditionally, the emphasis has been on evaluating the outcome of care provided, believing the client's knowledge of expert care is limited (Dyck, 1996). However, with the increasing level of patient awareness about the care they are receiving, and an increasing awareness of consumer rights and power, orthodontic health services need to pay attention to patient satisfaction. An improved understanding of the factors that influence patient satisfaction can provide orthodontists with useful information to manage patient expectations and perceptions more effectively, ensuring that desires are in harmony with the actual service offering. To meet or exceed patients' expectations, providers might have to change the way they deliver care, actively manage patient expectations and perceptions, or some combination of both (Clow et al., 1995).

In 1975 Canada spent $12.2 billion on health care representing 7.1% of the GDP. By 1996 this figure had risen to $ 75.2 billion or 9.5% of the GDP. By the year 2000, it is projected to be close to 12% of the GDP, and by 2010, one-fifth (Stats Canada, 1999). Although the cost of orthodontics compared to the total cost of health care is low, the trend revealed by these numbers is significant. In the future, additional expenditures may only be possible if the value of the service/goods *exceeds* the value those resources would have created if they had been devoted to the next best alternative use. Conversely, the expenditure for any such use as health care or orthodontic care should be reduced if real resources could be shifted to a use that yields a higher social value than the value that

would have been created by application of those resources to health care or orthodontic care (Speidel, 1994). Orthodontics as a profession needs to pay attention to these cost/benefit principles of economics because for orthodontics, these economic principles pose a particular problem. From a public policy or public health perspective, orthodontic care looks like a desirable but not necessary luxury for the well-to-do compared with many other health care services. The inescapable conclusion is that orthodontics has to closely attend to the question of value, and that a major component of value, in addition to cost, is quality (Speidel, 1994). Moreover, in their 1989 paper, Brown & Schwartz concluded that due to expanding competition, increasing patient sensitivity and involvement in malpractice suits and the relative lack of investigation of the role of service quality in the health and professional sector, have made further evaluation of service quality a vital issue.

If service quality is to become the cornerstone of healthcare, investigators must have the means to measure it. However, the quantification of service quality is difficult because of its elusive and abstract nature (Zeithaml et al., 1990). Services are intangible entities, and as such require complex measurement methodology. Health services in particular are even more difficult to standardize due to heterogeneity of the provider; the recipient of the service; and the unique interactions of provider and recipient. The performance often varies from provider to provider, from patient to patient, and from day to day creating further complexity of measurement. This interaction between patient and service provider plays a key role in forming a patient's impression of the quality of

service they have received (Czepiel et al., 1995) and represents a central focus of both the management and measurement of service quality.

Parasuraman, Zeithaml, and Berry (1985) developed a model of service quality representing global judgements across multiple encounters. This model of service quality, the ***Gap Theory*** was based on the assumption that it was the discrepancy between a consumer's expectations about the service they received and their perceptions of the service, once delivered, that determined their opinion of service quality (Zeithaml et al., 1990). If the perceptions met or exceeded the expectations, a favourable view of service quality was elicited, and vice versa. The performance-to-expectation gaps on attributes that consumers used to evaluate the quality of a service formed the theoretical foundation of this theory.

The most popular measure of service quality is SERVQUAL, an operationalization of the Gap Theory developed by Parasuraman et al. (1985; 1988), which has been widely cited in the marketing literature (Asubonteng et al., 1996). Parasuraman and his colleagues suggested three underlying themes after reviewing the service literature:

1. service quality is more difficult for the consumer to evaluate than goods quality;
2. service quality perceptions result from a comparison of consumer expectations with actual service performance, and;

3. quality evaluations are not made solely on the outcome of service but involve evaluations of the process of service delivery.

Parasuraman et al. (1988) defined service quality as "global judgement, or attitude, relating to the superiority of the service".

SERVQUAL was designed to measure service quality across a range of businesses. Parasuraman et al. (1985;1988) measured the quality of services provided by retail banks, a long-distance phone company, a securities broker, an appliance repair and maintenance firm, and credit card companies. It is worth noting that none of these services lay within the healthcare domain (McAlexander et al., 1994). But as Parasuraman et al. stated in 1988, "the instrument has been designed to be applicable across a broad spectrum of services. As such, it provides a basic skeleton, through its expectations/perceptions format, encompassing statements for each of the five service quality dimensions. The skeleton, where necessary, can be adapted or supplemented to fit the characteristics or specific research needs of a particular organization".

Relying on information from their focus group interviews, Parasuraman et al. (1985) identified basic dimensions that reflect service attributes used by consumers in evaluating the service quality provided by businesses. Consumers in the focus groups discussed service quality in terms of the extent to which service performance on the dimensions matched the level of performance that consumers thought a service should provide (Asubonteng, 1996). A high quality service would perform at a level that matched or exceeded the level that the consumer felt should be provided.

The SERVQUAL scale was produced following procedures recommended for developing valid and reliable measures of marketing constructs (Brown & Schwartz, 1993). Parasuraman et al. concluded from their 1985 study that consumers evaluated service quality by comparing expectations to performance on ten basic dimensions: reliability, responsiveness, competence, access, courtesy, communication, credibility, security, understanding/knowing the customer and tangibles. The scale was developed by, first, writing a set of about 100 questions that asked consumers to rate a service in terms of both expectations and of performance on specific attributes that were thought to reflect each of the ten dimensions (Parasuraman et al., 1988; Asubonteng et al., 1996). Next, the data were analyzed by grouping together sets of questions that all appeared to measure the same basic dimension, such as reliability (Asubonteng et al., 1996). A statistical analysis for dimensional identification, factor analysis, was used to determine which questions were measuring dimension number one, which questions were measuring dimension number two and so on, as well as which questions did not distinguish between dimensions and the number of dimensions in the data (Parasuraman et al., 1988; Zeithaml et al., 1990;Asubonteng et al., 1996). Questions that were not clearly related to a dimension were discarded. A revised SERVQUAL scale was administered to a second sample, questions were tested and the result was a 22-question (item) scale measuring the five basic dimensions of reliability, responsiveness, empathy, assurance and tangibles, on both expectation and performance (Asubonteng et al., 1996). Since expectations were measured using 22 questions, and performance was rated using 22 parallel questions, 44 questions in total were used (Parasuraman et al., 1988). The

items were scored on a seven-point Likert-type scale anchored by the statements, "strongly disagree" and "strongly agree". Quality was measured as performance-expectations for each pair of questions and the summary score across all 22 questions was the measure of quality (Asubonteng et al., 1996).

Parasuraman et al. (1988) also tested their SERVQUAL scale for reliability and validity. The major test of reliability used was Cronbach's coefficient alpha, a measure of the extent of internal consistency between, or correlation among, the set of questions making up each of the five dimensions (Hassard, 1991). The tests of validity proved more challenging for Parasuraman and his colleagues. The validity of a measure of service quality is difficult to test as a proven criterion is not available (Asubonteng, 1996). The general approach to testing the validity of marketing scales is to measure the agreement between the measure of interest, SERVQUAL, and a second measure of quality, convergent validity and/or a measure of a variable that should be related to quality, concurrent validity (Asubonteng, 1996). Parasuraman et al. (1988) provided evidence of convergent validity as they measured agreement between the SERVQUAL score and a question that asked customers to rate the overall quality of the company being judged and also concurrent validity, whether the respondent would recommend the service to a friend.

SERVQUAL has been adapted to measure service quality in a variety of settings. Health care applications are numerous (Babakus & Mangold, 1992; Bebko & Garg, 1995; Bowers et al., 1994; Clow et al., 1995; Dyck, 1996; Headley & Miller, 1993; Licata et al.,

1995; Lytle & Mokwa, 1992; O'Connor et al., 1994; Reidenbach & Sandifer-Smallwood, 1990; Woodside et al., 1989). Other settings include a dental school patient clinic, a business school placement center, a tire store, and an acute care hospital (Carman, 1990); independent dental offices (McAlexander et al., 1994); at AIDS service agencies (Fusilier & Simpson, 1995); with physicians (Brown & Schwartz, 1989; Walbridge and Delene, 1993); in large retail chains (such as K-Mart, WalMart, and Target)(Teas, 1993); and banking, pest control, dry-cleaning, and fast-food restaurants (Cronin & Taylor, 1992).

Disagreements between the studies have focussed on two major issues, the dimensions of service quality and linkage between satisfaction and quality (Asubonteng et al., 1996). Disagreement concerning the proposed linkage between quality and satisfaction has led to a division over causality, with one group supporting the proposition that quality leads to satisfaction (Woodside et al., 1989), other groups supporting the proposition that satisfaction leads to quality (Bitner, 1990), and others suggesting that quality and satisfaction are determined by the same attributes (Bowers et al., 1994). In the first simultaneous test of both relationships, Cronin & Taylor (1992) presented empirical evidence in favour of the proposition that satisfaction is an antecedent of service quality despite hypothesizing that the reverse would be the case. Recent studies in the health care sector (Gopalalkrishna & Mummalaneni, 1993; Peyrot et al., 1993) explored the role of demographic characteristics, convenience and perceived worth in patient satisfaction. Taylor & Baker (1994) concluded that the weight of evidence in the services literature supported the position that service quality and consumer satisfaction are best conceptualized as unique constructs that should not be regarded as equivalent in terms of

their impact on future consumer purchases. As Asubonteng et al. (1996) note, the conflicting empirical evidence (and the possibility that the nature of the relationship is situation-specific) supports the need for future research in this area.

Regardless of disagreement, important findings across studies include support for the premise that : Service attributes $A_i \rightarrow$ Important actions (behaviors) B_i (Asubonteng et al., 1996). In health care, these 'important actions' include willingness to return and willingness to recommend (Woodside et al., 1989). Bowers et al., (1994) and Reidenbach & Sandiger-Smallwood (1990) found that SERVQUAL outcomes of switching and word-of-mouth behaviour were related to service quality. In addition, while there is no agreement on the exact linkages, attributes, and dimensions of quality and satisfaction, most researchers agree that service quality comprises attributes that are both measureable and variable (Asubonteng et al., 1996).

The SERVQUAL scale has been used in a variety of studies in different settings to assess customer perceptions of service quality. Not all studies have examined the scale's psychometric properties; however there have been a few exceptions (Babakus & Boller, 1992; Babakus & Mangold, 1992; Brensinger & Lambert, 1990; Carman, 1990; Cronin & Taylor, 1992; Finn & Lamb, 1991; Headley & Miller, 1993; Lytle and Mokwa, 1992; McAlexander et al., 1994; O'Connor et al., 1994; Taylor & Cronin, 1994; Walbridge & Delene, 1993). An understanding of the psychometric properties of SERVQUAL is central to its acceptance as a meaningful measure of service quality in a given context. Clear evidence of acceptable levels of reliability and validity is essential if

any measurement scale is to have credibility. Peter et al. (1993) suggested that irrespective of issues of context, scales based on difference scores, such as SERVQUAL, have psychometric weaknesses and thus can be unreliable. Parasuraman et al. (1993) acknowledged the theoretical validity of this argument but felt the these negative outcomes would only occur in certain situations. Whether or not this is the case can only be determined by further empirical investigation.

The reviews in the literature suggest there is still more work to be done to find a suitable measure for service quality. The are more problems with the most popular measure, SERVQUAL, which involves the subtraction of subjects' service expectations from the service industry performance for specific items (Asubonteng et al., 1996). The differences are averaged to produce a total score for service quality. Cronin & Taylor (1992) found that their measure of service performance (SERVPERF) produced better results than SERVQUAL. Future research might examine the relative merit of this approach. While acknowledging that performance-only measures may on occasion offer superior predictive power to disconfirmation, Parasuraman et al. (1994) argued that "the availability of information on both customer expectations and perceptions offers the capacity to more accurately pinpoint areas of deficiency within a company and results in a superior management tool".

Medicine is universally available to patients in Canada at no direct cost. However, there is only limited direct public funding of dental care. Public sector participation in dental care varies from 2% of total expenditures in Ontario to 56% in the Yukon and

North-West Territories (in 1987) and typically covers such services as providing dental services directly to Aboriginal people in remote areas, dental services for disadvantaged children in urban areas and school dental programs (Leake et al., 1993). Overall, in 1987, only 14% of total Canada-wide expenditures on dental care came from the public sector(Leake et al., 1993).

Most of the dental services provided in Canada are, therefore, paid for directly by the patient or by private health insurers on behalf of the patient. Consequently, the receipt of dental services involves a direct exchange of cash for service which parallels the consumer's experience in the wider service sector and which, in the Canadian context, is quite different to the medical experience.

Grönroos & Masalin (1990) noted that the dental profession in the industrialized countries was facing reductions in oral diseases and an oversupply of general dental personnel. Similarly, a survey of dentists and orthodontists in Canada conducted by Konchak & McDermott in 1990, confirmed reported declines in patient load and dissatisfaction with practice busyness. This trend is clearly evident in Canada, where the decade 1980 to 1989 saw the percentage of families reporting one or more dental expenses drop from 59.1% to 53.7%, average family expenditure on dental care as a percentage of current expenditures on goods and services drop from 0.77% to 0.43% and the number of licensed dentists increase by 28% (Leake et al., 1993). Increases in the allied dental professions over the same period have been even more dramatic with, for

example, a 108% increase in the number of licensed dental hygienists (Leake et al., 1993).

This trend has inevitably created greater competition between dental practitioners and the marketing of dental services, whether at the single practitioner or group practice level. The successful management of this competition is a pre-requisite of survival (Grönroos & Masalin, 1990). Traditional external marketing methods, such as advertising, were deemed to be generally inefficient and available to Canadian dentists on a very limited basis. Grönroos & Masalin (1990) pinpointed attention to patient perceived service quality, which they classify as an "interactive marketing method', as the single most powerful tool for enhancing relationships with current patients, attracting new patients and improving practice profitability.

The measurement of perceived service quality in the orthodontic environment offers some unique challenges. The overwhelming majority of orthodontic patients are adolescents with approximately 85% of patients under 18 years of age. In most orthodontic treatment situations, therefore, there are effectively *two* clients, with perceptions of quality and satisfaction being formulated simultaneously by both the patient and their parents/guardians. Although the patient will have a more intimate view of the service being provided, the parent will form his or her own view of the quality of the service being provided, based on the information, whether limited or not, that he/she gathers. The parental perspective is significant because the parent is a legitimate participant in the treatment experience and because the parental perception of service

quality is a potential contributor to parental decisions about satisfaction and future purchase intentions.

Assessment of service quality by child/parent dyads has not been published. The degree of congruity between the adolescent and the parental assessments of the quality of orthodontic care received; the nature of the differences between their perspectives; the need, or lack of need to measure both views of service quality; and the relationship between adolescent and parental receptions of quality, satisfaction and future purchase intentions, all appear to be relevant and important areas for study with implications far beyond the area of orthodontics.

3.2 Investigative Objectives

This pilot study was undertaken to develop a reliable and valid measurement instrument to quantify patients' expectations and perceptions of orthodontic service quality. The data derived from this instrument could be used to identify strategies for continued growth in the demands for specialist orthodontic services, and to provide important feedback with respect to patient satisfaction and service quality to the orthodontic practices involved in this study. Due to the pivotal importance of the SERVQUAL instrument to the current investigation, further consideration is provided in the **Materials and Methods** section.

Materials and Methods

Contents

4.0 Materials and Methods

This pilot study was undertaken to develop a reliable and valid measurement instrument to quantify patients' expectations and perceptions of orthodontic service quality.

4.1 Hypotheses To Be Evaluated by This Study

1. To evaluate the psychometric and diagnostic properties of the SERVQUAL instrument specifically related to the orthodontic context – in a specialty office and a University graduate orthodontic clinic.

2. To evaluate the relationship between 1) adolescent and parental; 2) private practice and University orthodontic clinic patients' expectations and perceptions of service quality and satisfaction.

3. To evaluate the nature of the relationship between a specific measure of overall perceived service quality and patient/parent expectations and perceptions.

4.2 The Customized SERVQUAL Instrument

In this investigation, service expectations and perceived performances were estimated using a *modified* version of the SERVQUAL questionnaire. The 15 item modification of SERVQUAL designed for a general dental clinic (McAlexander et al., 1994) was used as an initial matrix for instrument development, together with resources from the most recent refinement of the original SERVQUAL scale (Parasuraman et al., 1991) and two versions of SERVQUAL modified for the use in hospital clinics (Babakus & Mangold, 1992; Vandamme & Leunis, 1992), and modified by not weighting the scales (Cronin & Taylor, 1992; Teas, 1993; McAlexander et al., 1994). A 10-point Likert-type scale was used in the assessment portion of the survey anchored by the statements "strongly disagree" and "strongly agree".

The original version of SERVQUAL (Parasuraman et al., 1988) contained a number of negatively worded items. In their 1991 refinement of the instrument, Parasuraman and his colleagues acknowledged that these items created consumer confusion, a conclusion borne out by in a questionnaire pre-trial, and therefore they altered all items to a positive format. Similar concerns about the role of negatively worded SERVQUAL items have been voiced by other researchers (Babakus & Mangold, 1992; Babakus & Boller, 1992; Vandamme & Leunis, 1992) and supported by the evidence they presented. No negatively worded items were therefore used in the final questionnaire in this study.

A number of researchers (Cronin & Taylor, 1992; Teas, 1993; McAlexander et al., 1994) have examined the value of weighting the items of the SERVQUAL and SERVPERF scales. Two of these studies report superior performance by the unweighted scales and one study showed only marginal superiority for the weighted instruments. In view of the very limited evidence in support of weighting by perceived performance and the fact that this would require the respondents to complete an additional questionnaire, no attempts were made to incorporate issues of item importance into this study.

The questionnaire was then reviewed by working groups comprising the following:

- Senior Orthodontic and Basic Science faculty members of the University, an experienced medical biostatistician and the author, together with input from both patients and graduate orthodontic students;
- The principal investigator, other graduate orthodontic students and potential patients and/or parents;
- The Faculty of Dentistry, University of Manitoba, Committee on Research Involving Human Subjects (see Appendix).

The extent of these modifications is illustrated by listing the original Parasuraman et al., (1991) SERVQUAL items (Figure 3.1), the McAlexander et al. (1994) modifications for a general dental setting (Figure 3.2) and the definitive version used in the current investigation (Figure 3.3).

The major intent of this investigation was that completion of the definitive questionnaire should be undertaken anonymously and away from the vicinity of the actual provider (waiting room). The objective was to avoid the potential for either bias in the questionnaire responses or damage to the provider/patient relationship. In addition, when patients attended with their parents/guardians, copies of the questionnaire were given to each family member and were asked to complete a questionnaire independently. The questionnaires were presented to each individual by the receptionist, which included a letter (See Figures 3.3 and 3.4) stating the nature of the investigation, method of preserving anonymity of the responses and the voluntary nature of their participation. All questionnaires were identified by a unique code, known only to the principal investigator, and a box was provided to indicate whether completion was provided by a patient or parent/guardian.

4.3 Sampling

The Faculty of Dentistry at the University of Manitoba offers one of five graduate orthodontic programs in Canada and, with the University of Alberta, is one of only two orthodontic programs in western Canada. The University of Manitoba program graduates three orthodontists per year and has, at any given time, nine orthodontic residents participating in the three-year program. Each resident works with a patient list of approximately 50 to 100 patients and the participating patients receive a discounted orthodontic fee.

Twenty-two orthodontic specialists are currently practicing in Winnipeg, a mid-western Canadian city of approximately 667,000 (Statistics Canada 1996 census). There were ten such specialists in private practice in 1986 (Population = 594, 551, Statistics Canada 1986 census). While the population has increased a little over 12% there has been a 120% increase of specialists in the last 13 years (i.e. 1998). Each orthodontist has fees for orthodontic treatment typically ranging from $ 2000 to $ 5000.

In this investigation, copies of the questionnaire were presented to patients of the nine graduate orthodontic students although no indication of the specific graduate student was identified on the questionnaire. Copies of the questionnaire were also presented to patients attending the clinic of an established urban orthodontic specialist over a three-month period.

A package consisting of a covering letter outlining the objectives of the study, the orthodontic questionnaire (expectations and performance questions) was given to a random sample of patients aged 13 or older attending both clinics. Since patient confidentiality was central both to patient co-operation and honesty of response, telephone surveys and face-to-face interview approaches were rejected as unacceptable (Hall, 1995). The covering letter stressed the desire of the participating researchers to both improve the service quality of the respective practices and the development of improved methods of measuring service quality in the orthodontic context. It expressed the importance of hearing the patients' opinions on issues of service quality and emphasized that the responses were totally anonymous. To reinforce the point, it was

mentioned that the individual patient responses would not be identified and therefore would not be made available to the patients' orthodontic service provider. The questionnaires were distributed by the receptionists at both clinics for a period of 12 weeks. The total survey distribution targeted 400 patients.

Response rates in mail-out health-oriented studies using comparable sampling strategies have ranged from ~22% (Babakus & Mangold, 1992) to ~47% (Brown & Schwartz, 1989). It is for this reason that a mail-out type of distribution for the surveys was not used. It was felt that the response rate would be higher if the patients completed the surveys during one of their orthodontic visits. Based on the rule advocated by Hair et al. (1992) and utilized by Parasuraman et al. (1994b), of a minimum of 5 observations per variable, the sample collected in this study would be adequate for the multivariate analysis of a 19 item scale.

The issue of non-response bias was lessened using the direct type of distribution method described above. Babakus & Mangold (1992) argue that even in the presence of non-response bias, a sample which is adequate for scale development and testing could be collected. Such a philosophy is consistent with the service quality literature. In a context where patient anonymity is crucial, no perfect solution to the non-response problem is possible. Providing that the inherent limitations of such a sampling approach are clearly acknowledged, the results can still be highly meaningful. In view of the importance of maintaining patient anonymity, no re-sampling of the respondents and non-respondents was possible.

It should also be borne in mind, that the issue of voluntary participation also arose for the participating orthodontic residents and orthodontist. While the orthodontic providers were under no obligation or pressure to participate, indirect pressure to participate (whether actual or imagined) was a possibility. Ensuring that the clinicians had the opportunity to decline participation without penalty, and that any information related to their specific patients loads would not be identified nor used to assess them, was a high priority. In this case, participation was 100%, so these measures did not have to be undertaken.

As this was a pilot study, this split design was intended to evaluate potential differences between two types of specialty clinic (i.e. University versus private practice), parent/patient differences and indications for future research.

4.4 Data Analysis

The completed questionnaires were entered on a Windows 95 Excel spreadsheet, prior to their analysis with NCSS (Number Cruncher Statistical System®) software. The following analyses were then performed on the data in conjunction with the medical biostatistician:

1. Scale and sub-scale reliabilities were measure using Cronbach's alpha coefficient and correlated item-to-total correlations;

2. Scale dimensionality was examined using exploratory factor analysis, based on the Principal Axis factoring technique used by Parasuraman et al. (1988) in the original SERVQUAL development. Factors with Eigen values greater that 1.0 were also subjected to Varimax rotation (Vandamme & Leunis, 1993).
3. The predictive validity of the SERVQUAL scale was tested by regressing the respective scale scores against a measure of total service quality.
4. Relationships for patient demographics and service value perceptions, in addition to perceived service quality/customer satisfaction interaction constructs, were evaluated by multiple regression and analysis of variance techniques.

Since the current investigation was considered a pilot study, prior to initiating a more comprehensive evaluation of services derived from orthodontic specialists, great care was undertaken to confirm the validity of the SERVQUAL technique and to identify any component of the questionnaire that requires modification or changes prior to formulating the definitive questionnaire for future studies.

Figure 4.1a SERVQUAL items used by Parasuraman et al., 1991

Expectation Section

DIRECTIONS: Based on your experiences as a customer of telephone repair services, please think about the kind of telephone company that would deliver excellent quality of repair service. Think about the kind of telephone company with which you would be pleased to do business. Please show the extent to which you would be pleased to do business. Please show the extent to which you think such a telephone company would possess the feature described by each statement. If you feel a feature is *not at all essential* for excellent telephone companies such as the one you have in mind, circle the number "1". If you feel a feature is *absolutely essential* for excellent telephone companies, circle "7". If your feelings are less strong, circle one of the numbers in the middle. There are no right or wrong answers - all we are interested in is a number that truly reflects your feelings regarding telephone companies that would deliver excellent quality of service.

Note: Each of the statements was accompanied by a 7-point scale anchored at the ends by the labels. "Strongly Disagree" (= 1) and "Strongly Agree" (= 7). Intermediate scale points were not labeled. Also the headings (TANGIBLES, RELIABILITY, etc.) shown here to indicate which statements fall under each dimension, were not included in the actual questionnaire.

TANGIBLES

E1. Excellent telephone companies will have modern-looking equipment
E2. The physical facilities at excellent telephone companies will be visually appealing.
E3. Employees of excellent telephone companies will be neat-appearing.
E4. Materials associated with the service (such as pamphlets or statements) will be visually appealing in an excellent telephone company.

RELIABILITY

E5. When excellent telephone companies promise to do something by a certain time, they will do so.
E6. When customers have a problem, excellent telephone companies will show a sincere interest in solving it.
E7. Excellent telephone companies will perform the service right the first time.
E8. Excellent telephone companies will provide their services at the time they promise to do so.
E9. Excellent telephone companies will insist on error-free records.

RESPONSIVENESS

E10. Employees of excellent telephone companies will tell customers exactly when services will be performed.
E11. Employees of excellent telephone companies will give prompt service to customers.
E12. Employees of excellent telephone companies will always be willing to help customers.
E13. Employees of excellent telephone companies will never be too busy to respond to customer requests.

ASSURANCE

E14. The behavior of employees of excellent telephone companies will instill confidence in customers.
E15. Customers of excellent telephone companies will feel safe in their transactions.
E16. Employees of excellent telephone companies will be consistently courteous will customers.
E17. Employees of excellent telephone companies will have the knowledge to answer customer questions.

EMPATHY

E18. Excellent telephone companies will give customers individual attention.
E19. Excellent telephone companies will have operating hours convenient to all their customers.
E20. Excellent telephone companies will have employees who give customers personal attention.
E21. Excellent telephone companies will have the customers' best interests at heart.
E22. The employees of excellent telephone companies will understand the specific needs of their customers.

Figure 4.1b SERVQUAL items used by Parasuraman et al., 1991.

Perceptions Section

DIRECTIONS: The following set of statements relate to your feelings about XYZ Telephone Company's repair service. For each statement, please show the extent to which you believe XYZ has the feature described by the statement. Once again, circling a "1" means that you strongly disagree that XYZ has that feature, and circling a "7" means that you strongly agree. You may circle any of the numbers in the middle that show how strong your feelings are. There are no right or wrong answers – all we are interested in is a number that best shows your perceptions about XYZ's repair service.

TANGIBLES

P1. XYZ has modern-looking equipment.
P2. XYZ's physical facilities are visually appealing.
P3. XYZ's employees are neat-appearing.
P4. Materials associated with the service (such as pamphlets or statements) are visually appealing at XYZ.

RELIABILITY

P5. When XYZ promises to do something by a certain time, it does so.
P6. When you do have a problem, XYZ shows a sincere interest in solving it.
P7. XYZ performs the service right the first time.
P8. XYZ provides its services at the time it promises to do so.
P9. XYZ insists on error-free records.

RESPONSIVENESS

P10. Employees of XYZ tell you exactly when services will be performed.
P11. Employees of XYZ give you prompt service.
P12. Employees of XYZ are always willing to help you.
P13. Employees of XYZ are never too busy to respond to your requests.

ASSURANCE

P14. The behavior of employees of XYZ instills confidence in customers.
P15. You feel safe in your transactions with XYZ.
P16. Employees of XYZ are consistently courteous to you.
P17. Employees of XYZ have the knowledge to answer your questions.

EMPATHY

P18. XYZ gives you individual attention.
P19. XYZ has operating hours convenient to all its customers.
P20. XYZ has employees who give you personal attention.
P21. XYZ has your best interests at heart.
P22. Employees of XYZ understand you specific needs.

Figure 4.2 SERVQUAL questionnaire used by McAlexander et al., 1994.

DENTAL STUDY QUESTIONNAIRE
EXPECTATION QUESTIONS

DIRECTIONS: Please show the extent to which you think dental practices, in general, should possess the following features. For each statement, please show the extent to which you believe dental practices should have the feature described in the statement. If you strongly agree that a dentist or a dental practice should possess a feature, circle number 7. If you strongly disagree circle number 1. If your feelings are not strong, circle one of the numbers in the middle. There are no right or wrong answers.

E1.	A dentist's physical facilities should be visually appealing	1	2	3	4	5	6	7
E2.	A dentist should be dependable.	1	2	3	4	5	6	7
E3.	A dentist's employees should be willing to help you.	1	2	3	4	5	6	7
E4.	You should feel safe in you transactions with a dentist.	1	2	3	4	5	6	7
E5.	A dentist should give you individual attention.	1	2	3	4	5	6	7
E6.	You should be able to schedule an appointment with a dentist for a time that is convenient.	1	2	3	4	5	6	7
E7.	A dentist should be competent.	1	2	3	4	5	6	7
E8.	A dentist should communicate well with patients.	1	2	3	4	5	6	7
E9.	A dentist should make dental treatments as painless as possible.	1	2	3	4	5	6	7
E10.	A dentist should treat you with respect.	1	2	3	4	5	6	7
E11.	A dentist's charges should not be too high.	1	2	3	4	5	6	7
E12.	You should be able to trust a dentist.	1	2	3	4	5	6	7
E13.	A dentist should provide service of the highest quality.	1	2	3	4	5	6	7
E14.	A dentist's office staff should always act in a professional manner.	1	2	3	4	5	6	7
E15.	Dentist's should take every precaution required to protect me from infectious diseases.	1	2	3	4	5	6	7

IMPORTANCE QUESTIONS

DIRECTIONS: Please rate the following in terms of their importance to you in your selection of a dentist. (7-point scale where 1 is least important and 7 is most important.

I1.	Visually appealing physical facilities.	1	2	3	4	5	6	7
I2.	A dependable dentist.	1	2	3	4	5	6	7
I3.	Helpful employees.	1	2	3	4	5	6	7
I4.	Safe transactions.	1	2	3	4	5	6	7
I5.	Individual attention.	1	2	3	4	5	6	7
I6.	Ability to schedule an appointment that is convenient.	1	2	3	4	5	6	7
I7.	A competent dentist.	1	2	3	4	5	6	7
I8.	A dentist who communicates well.	1	2	3	4	5	6	7
I9.	Painless dental treatments.	1	2	3	4	5	6	7
I10.	Being treated with respect.	1	2	3	4	5	6	7
I11.	Cost of treatment.	1	2	3	4	5	6	7
I12.	A dentist I can trust.	1	2	3	4	5	6	7
I13.	Service of the highest quality.	1	2	3	4	5	6	7
I14.	An office staff that acts in a professional manner.	1	2	3	4	5	6	7
I15.	Protection from infectious diseases.	1	2	3	4	5	6	7

PERFORMANCE QUESTIONS

DIRECTIONS: The following set of statements relates to your feelings about Dr. [Name]. For each statement, please show the extent to which you believe Dr. [Name] or his practice has the feature described in this statement. If you strongly agree, circle number 7. If you strongly disagree, circle number 1. If your feelings are not strong, circle one of the numbers in the middle.

P1.	Dr. [Name]'s physical facilities are visually appealing.	1	2	3	4	5	6	7
P2.	Dr. [Name] is not dependable.	1	2	3	4	5	6	7
P3.	Employees of Dr. [Name] are always willing to help you.	1	2	3	4	5	6	7
P4.	You feel safe in your transactions with Dr. [Name].	1	2	3	4	5	6	7
P5.	Dr. [Name] gives you individual attention.	1	2	3	4	5	6	7
P6.	I can usually schedule an appointment for a time that is good for me.	1	2	3	4	5	6	7
P7.	Dr. [Name] is very competent.	1	2	3	4	5	6	7
P8.	Dr. [Name] communicates well with me.	1	2	3	4	5	6	7
P9.	Dr. [Name] makes dental treatments as painless as possible.	1	2	3	4	5	6	7
P10.	Dr. [Name] always treats me with respect.	1	2	3	4	5	6	7
P11.	The fees Dr. [Name] charges are too high.	1	2	3	4	5	6	7
P12.	I trust Dr. [Name].	1	2	3	4	5	6	7
P13.	The service Dr. [Name] provides is of the highest quality.	1	2	3	4	5	6	7
P14.	Dr. [Name]'s office employees always act in a professional manner.	1	2	3	4	5	6	7
P15.	Dr. [Name] takes every precaution required to protect me from infectious diseases.	1	2	3	4	5	6	7

Figure 4.3a Modified SERVQUAL questionnaire used for the University sample

ORTHODONTIC SURVEY

Dear patient/parent,

My name is Dr. Jonathan Suzuki. I am a graduate orthodontic resident at the University of Manitoba, where you are receiving your orthodontic treatment. I am carrying out a study to analyze patients' perceptions of orthodontic dental services and the quality of service that they are receiving while undergoing treatment.

Knowing what you think about the care you're receiving is important if we are to respond to our patients' needs and get better at what we do here. Your answers to the questions in this survey will help us to identify strategies to continue to provide quality care here at the school.

To make this study worthwhile, I hope to get responses from ALL patients who are receiving orthodontic services at the University Of Manitoba, however you are under NO obligation to participate. If you don't want to fill out the questionnaire, it will in no way affect your treatment here at the school. Every questionnaire is VERY important, as it will provide meaningful information for this study. Please take 10 minutes to answer this questionnaire thoughtfully, and return it to the secretary at the end of your appointment.

I can assure you that your answers will remain completely confidential, as you will be identified by a code number only. The completed questionnaires will be forwarded directly to myself and will only be seen by me. The data collected from this study will be destroyed after statistical compilation. If you have any questions or concerns about this quality improvement project, please feel free to speak to me personally.

Many thanks for your cooperation,

Sincerely yours,

Dr. Jonathan Suzuki
Graduate Orthodontics
Department of Dental Diagnostic and Surgical Sciences
Faculty of Dentistry, University of Manitoba.

Figure 4.3b Modified SERVQUAL questionnaire used for the University sample

ORTHODONTIC SURVEY

This questionnaire is comprised of 2 parts. Please answer the questions in both parts and return to the secretary. **Parents/Guardians, please complete a questionnaire and allow your son/daughter to complete a questionnaire independently.**

Directions:

- PLEASE **READ** EACH STATEMENT CAREFULLY!
- For each statement, rate on a scale of 1 to 10 how much you agree or disagree with that statement.
- If we're doing something well tell us, if not, tell us also. Please be HONEST, we value your responses.
- If you **agree** strongly that an orthodontist or an orthodontic office should possess a feature, circle number 10.
- If you strongly **disagree**, circle number 1.
- There are no right or wrong answers.

FIRST QUESTION: (very important!!)

Are you a 1) Patient

or 2) Parent/Guardian (Please circle one)

Figure 4.3c Modified SERVQUAL questionnaire used for the University sample

Part 1: EXPECTATION QUESTIONS

		Strongly Disagree									Strongly Agree
E1.	An orthodontist's office should be visually appealing.	1	2	3	4	5	6	7	8	9	10
E2.	An orthodontist's office should be comfortable.	1	2	3	4	5	6	7	8	9	10
E3.	An orthodontist should clearly explain my orthodontic problems at my first (screening) appointment.	1	2	3	4	5	6	7	8	9	10
E4.	There should not be a long waiting period between my first appointment and when I start my treatment.	1	2	3	4	5	6	7	8	9	10
E5.	An orthodontist should keep up with the latest treatments and technologies.	1	2	3	4	5	6	7	8	9	10
E6.	An orthodontic staff should be very flexible in dealing with my individual needs and desires.	1	2	3	4	5	6	7	8	9	10
E7.	An orthodontist should carefully explain what I am expected to do.	1	2	3	4	5	6	7	8	9	10
E8.	An orthodontist should be available in an emergency.	1	2	3	4	5	6	7	8	9	10
E9.	You should be able to schedule an appointment with an orthodontist for a time that is convenient.	1	2	3	4	5	6	7	8	9	10
E10.	An orthodontist should rarely make me wait; s/he should be on time.	1	2	3	4	5	6	7	8	9	10
E11.	An orthodontist should communicate well with me using words that I can understand.	1	2	3	4	5	6	7	8	9	10
E12.	An orthodontist should explain procedures to me instead of the dental assistant or receptionist.	1	2	3	4	5	6	7	8	9	10
E13.	An orthodontist should be sincerely interested in me as a person.	1	2	3	4	5	6	7	8	9	10
E14.	An orthodontist's fees should be affordable.	1	2	3	4	5	6	7	8	9	10
E15.	You should be able to trust the skills of an orthodontist.	1	2	3	4	5	6	7	8	9	10
E16.	My treatment should be of high quality.	1	2	3	4	5	6	7	8	9	10
E17.	An orthodontic staff should always act in a professional manner.	1	2	3	4	5	6	7	8	9	10
E18.	An orthodontist should take every precaution required to protect me from infectious diseases.	1	2	3	4	5	6	7	8	9	10
E19.	A receptionist should always be organized, courteous and patient.	1	2	3	4	5	6	7	8	9	10

Figure 4.3d Modified SERVQUAL questionnaire used for the University sample

Part 2: PERFORMANCE QUESTIONS

		Strongly Disagree									Strongly Agree
P1.	The facilities at the U of M are visually appealing.	1	2	3	4	5	6	7	8	9	10
P2.	The facilities at the U of M are comfortable.	1	2	3	4	5	6	7	8	9	10
P3.	My orthodontist clearly explained my orthodontic problems at my first (screening) appointment.	1	2	3	4	5	6	7	8	9	10
P4.	The waiting period between my first appointment and when I started my treatment was not too long.	1	2	3	4	5	6	7	8	9	10
P5.	My orthodontist keeps up with the latest treatments and technologies.	1	2	3	4	5	6	7	8	9	10
P6.	The orthodontic staff is very flexible in dealing with my individual needs and desires.	1	2	3	4	5	6	7	8	9	10
P7.	My orthodontist carefully explains what I am expected to do.	1	2	3	4	5	6	7	8	9	10
P8.	My orthodontist is available in an emergency.	1	2	3	4	5	6	7	8	9	10
P9.	I am able to schedule an appointment with my orthodontist at a time that is convenient.	1	2	3	4	5	6	7	8	9	10
P10.	My orthodontist rarely makes me wait; s/he should is on time.	1	2	3	4	5	6	7	8	9	10
P11.	My orthodontist communicates well with me using words that I can understand.	1	2	3	4	5	6	7	8	9	10
P12.	My orthodontist explains procedures to me, instead of the dental assistant or receptionist.	1	2	3	4	5	6	7	8	9	10
P13.	My orthodontist is sincerely interested in me as a person.	1	2	3	4	5	6	7	8	9	10
P14.	The fees at the U of M are affordable.	1	2	3	4	5	6	7	8	9	10
P15.	I trust the skills of my orthodontist.	1	2	3	4	5	6	7	8	9	10
P16.	My treatment is of high quality.	1	2	3	4	5	6	7	8	9	10
P17.	The orthodontic staff always acts in a professional manner.	1	2	3	4	5	6	7	8	9	10
P18.	My orthodontist takes every precaution required to protect me from infectious diseases.	1	2	3	4	5	6	7	8	9	10
P19.	The receptionist at the U of M is always organized, courteous and patient.	1	2	3	4	5	6	7	8	9	10

Figure 4.4a Modified SERVQUAL questionnaire used for Private Practice sample.

ORTHODONTIC SURVEY

Dear patient/parent,

My name is Dr. Jonathan Suzuki. I am a graduate orthodontic resident at the University of Manitoba's Faculty of Dentistry. I am carrying out a study to analyze patients' perceptions of orthodontic dental services and the quality of service that they are receiving while undergoing treatment.

Knowing what patients think about the care they're receiving is important if orthodontists are to respond to their patients' needs and get better at what they do. Your answers to the questions in this survey will help identify strategies to continue to provide quality care here at Dr. [name omitted]'s office.

To make this study worthwhile, I hope to get responses from many patients who are receiving orthodontic services at Dr. [name omitted]'s office, however you are under NO obligation to participate. If you don't want to fill out the questionnaire, it will in no way affect your treatment. Every questionnaire is VERY important, as it will provide meaningful information for my study. Please take 10 minutes to answer this questionnaire thoughtfully, and return it to the secretary once finished.

I can assure you that your answers will remain completely confidential, as you will be identified by a code number only. The completed questionnaires will be forwarded directly to myself and will only be seen by me. The data collected from this study (the surveys) will be destroyed after statistical compilation. If you have any questions or concerns about this quality improvement project, please feel free to speak to me personally.

Many thanks for your cooperation,

Sincerely yours,

Dr. Jonathan Suzuki
Graduate Orthodontics
Department of Dental Diagnostic and Surgical Sciences
Faculty of Dentistry, University of Manitoba.

Figure 4.4b Modified SERVQUAL questionnaire used for Private Practice sample.

ORTHODONTIC SURVEY

- PLEASE **READ** EACH STATEMENT CAREFULLY!
- For each statement, rate on a scale of 1 to 10 how much you agree or disagree with that statement.
- If we're doing something well tell us, if not, tell us also. Please be HONEST, we value your responses.
- If you **agree** strongly that an orthodontist or an orthodontic office should possess a feature, circle number 10.
- If you strongly **disagree**, circle number 1.
- There are no right or wrong answers.

FIRST QUESTION: (very important!!)

Are you a 1) Patient

or 2) Parent/Guardian (Please circle one)

Figure 4.4c Modified SERVQUAL questionnaire used for Private Practice sample.

Part 1: EXPECTATION QUESTIONS

		Strongly Disagree									Strongly Agree
E1.	An orthodontist's office should be visually appealing.	1	2	3	4	5	6	7	8	9	10
E2.	An orthodontist's office should be comfortable.	1	2	3	4	5	6	7	8	9	10
E3.	An orthodontist should clearly explain my orthodontic problems at my first (screening) appointment.	1	2	3	4	5	6	7	8	9	10
E4.	There should not be a long waiting period between my first appointment and when I start my treatment.	1	2	3	4	5	6	7	8	9	10
E5.	An orthodontist should keep up with the latest treatments and technologies.	1	2	3	4	5	6	7	8	9	10
E6.	An orthodontic staff should be very flexible in dealing with my individual needs and desires.	1	2	3	4	5	6	7	8	9	10
E7.	An orthodontist should carefully explain what I am expected to do.	1	2	3	4	5	6	7	8	9	10
E8.	An orthodontist should be available in an emergency.	1	2	3	4	5	6	7	8	9	10
E9.	You should be able to schedule an appointment with an orthodontist for a time that is convenient.	1	2	3	4	5	6	7	8	9	10
E10.	An orthodontist should rarely make me wait; s/he should be on time.	1	2	3	4	5	6	7	8	9	10
E11.	An orthodontist should communicate well with me using words that I can understand.	1	2	3	4	5	6	7	8	9	10
E12.	An orthodontist should explain procedures to me instead of the dental assistant or receptionist.	1	2	3	4	5	6	7	8	9	10
E13.	An orthodontist should be sincerely interested in me as a person.	1	2	3	4	5	6	7	8	9	10
E14.	An orthodontist's fees should be affordable.	1	2	3	4	5	6	7	8	9	10
E15.	You should be able to trust the skills of an orthodontist.	1	2	3	4	5	6	7	8	9	10
E16.	My treatment should be of high quality.	1	2	3	4	5	6	7	8	9	10
E17.	An orthodontic staff should always act in a professional manner.	1	2	3	4	5	6	7	8	9	10
E18.	An orthodontist should take every precaution required to protect me from infectious diseases.	1	2	3	4	5	6	7	8	9	10
E19.	A receptionist should always be organized, courteous and patient.	1	2	3	4	5	6	7	8	9	10

Figure 4.4d Modified SERVQUAL questionnaire used for Private Practice sample.

Part 2: PERFORMANCE QUESTIONS

		Strongly Disagree									Strongly Agree
P1.	The facilities at Dr. [name omitted]'s office are visually appealing.	1	2	3	4	5	6	7	8	9	10
P2.	The facilities at Dr. [name omitted]'s office are comfortable.	1	2	3	4	5	6	7	8	9	10
P3.	My orthodontist clearly explained my orthodontic problems during my first (screening) appointment.	1	2	3	4	5	6	7	8	9	10
P4.	The waiting period between my first appointment and when I started my treatment, was not too long.	1	2	3	4	5	6	7	8	9	10
P5.	My orthodontist keeps up with the latest treatments and technologies.	1	2	3	4	5	6	7	8	9	10
P6.	The orthodontic staff are very flexible in dealing with my individual needs and desires.	1	2	3	4	5	6	7	8	9	10
P7.	My orthodontist carefully explains what I am expected to do.	1	2	3	4	5	6	7	8	9	10
P8.	My orthodontist is available in an emergency.	1	2	3	4	5	6	7	8	9	10
P9.	I am able to schedule an appointment with my orthodontist at a time that is convenient.	1	2	3	4	5	6	7	8	9	10
P10.	My orthodontist rarely makes me wait; s/he should is on time.	1	2	3	4	5	6	7	8	9	10
P11.	My orthodontist communicates well with me using words that I can understand.	1	2	3	4	5	6	7	8	9	10
P12.	My orthodontist explains procedures to me, instead of the dental assistant or receptionist.	1	2	3	4	5	6	7	8	9	10
P13.	My orthodontist is sincerely interested in me as a person.	1	2	3	4	5	6	7	8	9	10
P14.	The fees at Dr. [name omitted]'s office are affordable.	1	2	3	4	5	6	7	8	9	10
P15.	I trust the skills of my orthodontist.	1	2	3	4	5	6	7	8	9	10
P16.	My treatment is of high quality.	1	2	3	4	5	6	7	8	9	10
P17.	The orthodontic staff always acts in a professional manner.	1	2	3	4	5	6	7	8	9	10
P18.	My orthodontist takes every precaution required to protect me from infectious diseases.	1	2	3	4	5	6	7	8	9	10
P19.	The receptionists at Dr. [name omitted]'s office is always organized, courteous and patient.	1	2	3	4	5	6	7	8	9	10

Figure 4.4e Modified SERVQUAL questionnaire used for Private Practice sample.

Additional Questions:

1. What aspects of your orthodontic experience do you feel Dr. [name omitted] and his staff perform really well?

_____

_____

_____

2. What areas could they improve upon?

_____

_____

_____

_____

3. How do you feel about the technology used in the office?

_____

_____

_____

_____

4. Is there a particular staff member that stands out in your mind? Who is it, please and why?

_____

_____

_____

_____

5. From a low of one to a high of ten, please rate your overall level of satisfaction with your experience at this office.

1 2 3 4 5 6 7 8 9 10

Statistical and Investigative Techniques

Contents

5.0 Statistical and Investigative Techniques

The responses to the customized SERVQUAL questionnaire used in this investigation were subjected to a battery of univariate and multivariate statistical analyses with the primary intent to evaluate the reliability and validity of this instrument for the analysis of this orthodontic market. Reliability can simply be defined as the *degree of consistency* with which a scale measures a specific attribute. There are three types of validity: convergent, discriminant and predictive. *Convergent validity* is the degree to which those items on a scale which relate to the *same* construct correlate strongly with one another. *Discriminant* validity is the degree to which those items on a scale which relate to *different* constructs are uncorrelated with one another. *Predictive validity* is the degree to which *an individual's score* on a scale is predictive of his/her performance on some criterion measure. The reliability and validity of this instrument will thus be tested using the appropriate statistical measures described above.

5.1 Item Analysis:

Item analysis was intended to calculate the internal reliability of the instrument. As this instrument was comprised of several questions (items), answered by a group of respondents, the issues that arise include: does the instrument measure what was intended (does a particular survey accurately measure an individual's expectations and perceptions?); does it yield the same results when it is administered repeatedly; does it contain biases, and so on. Item analysis is a particular methodology developed to assess

the accuracy of measurements obtained in the social sciences, whose precision is difficult to obtain. The accuracy of such measurements is divided into two dimensions: validity and reliability. The validity of an instrument refers to whether it accurately measures the attribute of interest whereas the reliability of an instrument concerns whether it effectively produces identical results in repeated applications. Several methods have been proposed to assess the reliability of such an instrument, including the retest method, alternative-form method, split-halves method and the internal consistency method. Cronbach's alpha (coefficient alpha) is the most popular of the internal consistency coefficients used to evaluate these forms of data (Hintze, 1997).

5.2 Cronbach's Alpha Coefficient:

This test estimates the reliability of a composite (a total score based on two or more subtest scores), when the composite score's variance and all covariances among all its components are known. In other words it is a useful method for defining the reliability of a composite in terms of the statistical properties of its internal components. (Crocker & Algina, 1986). Cronbach's alpha is a correlation coefficient that ranges between –1 and 1. In most cases it is positive, although negative values can also occur. As a rule, alpha values of at least 0.8 are considered indicative of the reliability of an instrument such as that used in this study (Hintze, 1997). The minimum reliability that is acceptable is difficult to specify. If reliability is low, such as below 0.60, one is faced with the choice of investing time and money in additional research in an attempt to develop a revised measure with greater reliability, or using the measure, recognizing

that fluctuations in measured quality may be due only to measurement rather than a change in quality (Asubonteng, 1996).

5.3 Discriminant Analysis:

Discriminant analysis finds a set of prediction equations based on independent variables used to classify individuals into pre-existing groups. The two possible objectives of discriminant analysis include: finding a predictive equation for classifying new individuals or interpreting the predictive equation to better understand the variable relationships that best distinguish between groups of individuals. In this study discriminant analysis was intended to identify those questions which were significantly different between the University and Private Practice respondents according to the differences or 'gaps' that were created in the survey responses. The primary intent was to ascertain which gap questions differentiated between the two sample groups.

5.4 Factor Analysis: Principal Component Factoring of the Variables

Factor analysis is a technique which may be applied to a set of observed variables in order to find the underlying factors (subsets of variables) from which the observed variables were generated. For example, an individual's response to the questions on this survey were undoubtedly influenced by such underlying variables as intelligence, age, emotional state on the day of the survey. The answers to the questions are considered the observed variables, thus the underlying, influential variables may be

defined as the factors. This factor analysis then defines the correlations between all the questions on a correlation matrix of the observed variables and finds groups of questions that are related by some common theme. A key goal of factor analysis is to aid data interpretation by determining the number and nature of these common themes (variable groups).

In this investigation, the principal varimax axis rotation method of factor analysis was used. In this method factors are defined as orthogonal sets of variable weights or coordinates. The hope is that rotating the axes will improve one's ability to interpret the meaning of each factor, just as axes on a graph could be rotated, while maintaining their ability to define special locations.

5.5 The Mann-Whitney U Test

In this study, the Mann-Whitney 'U' test (a non-parametric equivalent of the *t* test) was utilized. It compares two groups in terms of their median performance, and is used if the assumptions of normality cannot be justified. In the Mann-Whitney 'U' test all the results are pooled and ranked from lowest to highest, ignoring the group to which they belong. The rankings are then tagged with the identity of the group from which they originated, and the sum of the ranks for each group is obtained. If the null hypothesis is true, then there should be no clear patterns among the groups; the two groups should be randomly scattered among the rankings.

5.6 Multiple Regression Analysis to Check Predictive Validity

In this test, all of the questions were multiply regressed on question P16 ('My orthodontic treatment is of high quality'), to rate the overall assessment of patients' and parents' satisfaction. Predictive validity shows how well the questionnaire can predict or agree with a key patient statement of satisfaction, in this case question P16, a benchmark assessment of the quality of service delivery.

5.7 Stepwise Multiple Regression:

Stepwise multiple regression was used to relate patient satisfaction (question P16) to the subset of variables which best predict it. More specifically, this test takes the numerous variables that are present (19 in this study), and identifies the key variable (or question) that describes the entity being tested for best (in this case service quality). The test then goes back to the list of variables (except for the key variable identified in the first examination), and identifies the next variable that best describes service quality and so on. The variables are weighted as they are identified, and those with the greatest significance are then pooled together.

5.8 Gap Analysis

If the key to ensuring good orthodontic service delivery is meeting or exceeding patient expectations, judgements of high and low service quality will depend on how

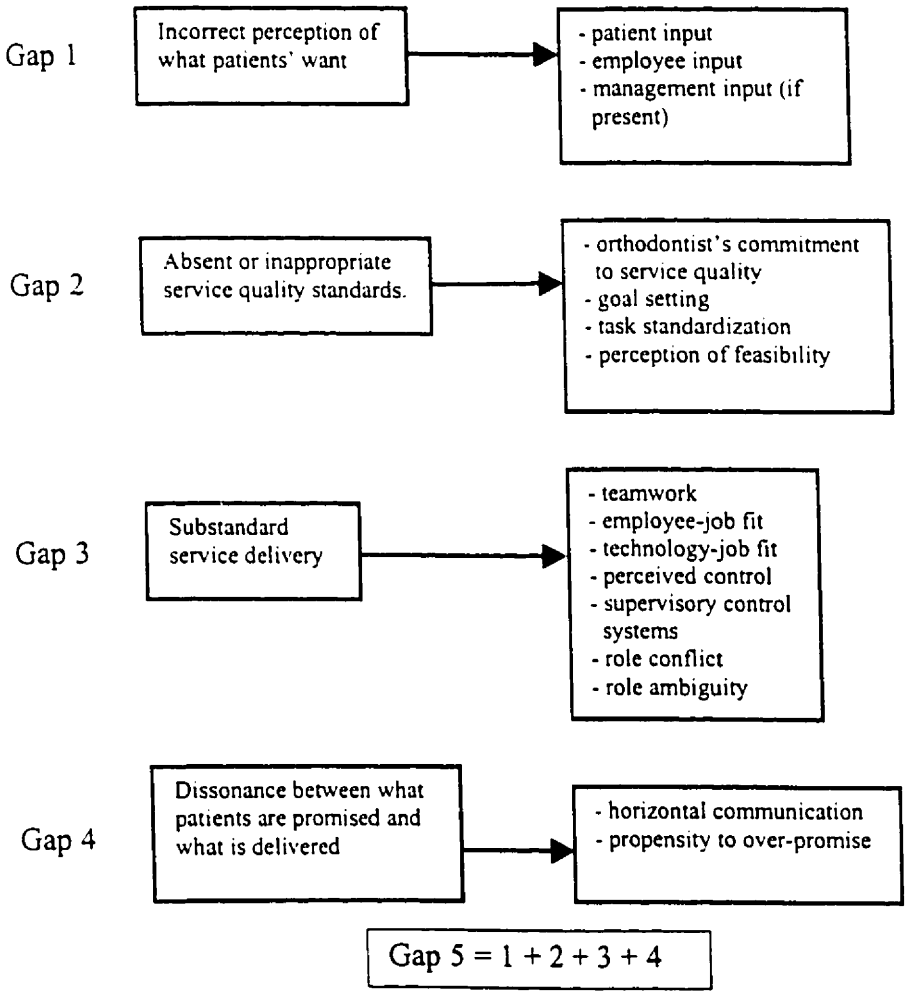
patients perceive the actual service performance in the context of what they expected. **Figure 5.1** is a summary of reasons why gaps exist and areas to investigate when closing the gaps. Consumer (patients, parents/guardians) perceptions of orthodontic service quality are altered when there are gaps between:

- the consumer's expectations and the orthodontist's perception of those expectations of orthodontic service quality (see Gap 1 on **Figures 2.5 and Figure 5.1**).
- the orthodontist's perceptions of patient expectations and the specifications of orthodontic service quality under which the services are governed (see Gap 2 on **Figures 2.5 and Figure 5.1**).
- the specifications of orthodontic service quality and the actual service that is delivered (see Gap 3 on **Figures 2.5 and Figure 5.1**).
- the actual orthodontic service that is delivered and what the orthodontist communicates to their patients about what will be delivered (see Gap 4 on **Figures 2.5 and Figure 5.1**).
- the consumer's expected level of service quality and their perception of what level of service quality they actually received (Gap 5 **Figures 2.5 and Figure 5.1**).

Gaps 1 and 2 are mainly managerial gaps. Gap 1 stems from lack of orthodontist understanding of customer expectations. Gap 2 represents the orthodontist's failure to set appropriate service qualifications. Gaps 3 and 4 are front line gaps that pertain to

front line employees (receptionists/orthodontic assistants/orthodontist). Front line employees' service delivery performance may fall short of service specifications (Gap 3) and/or promises made through external communications (Gap 4). Gap 5 results from Gaps 1 though 4.

Figure 5.1 Reasons why gaps exist and areas to investigate (Dyck, 1996)



Gap 1. Patient Expectations / Orthodontic Office – Perceptions Gap

This is the gap between the patient's expectations and the orthodontist's perception of those expectations. Knowing what patients expect is the first and most critical step in the delivery of high quality services. A gap may sometimes occur because orthodontists miss the mark by thinking in a self-centered way i.e. they think they know what patients should want and deliver service according to that perception. When this happens, services may not match patient's expectations i.e. important features maybe omitted, and levels of performance on provided features maybe inadequate. Similarly, whoever manages the office, be it the orthodontist, in-house manager or dental school, may be unaware of the characteristics or service features that are valued by patients. Thus they may make decisions and resource allocations that result in patient perceptions of poor service quality. Contributing factors accounting for this gap include: insufficient market research; inadequate use of the market research findings; insufficient communication between the patient and the reception personnel and/or orthodontic service provider and/or too many levels between reception personnel/staff and management (the orthodontist, office manager or department head).

The first step to reduce this gap and improve the quality of service is for orthodontists to acquire accurate, reliable and valid information about patient expectations. Without it, poor performance will be inevitable.

Gap 2_ Management Perception / Service Quality Specifications Gap

This is the gap between the orthodontic service provider's perception of patient expectations and the specifications of orthodontic service quality under which the services are governed. Once orthodontists accurately understand what patients expect, they face a second critical challenge of using this knowledge to set appropriate service quality standards. Factors contributing to this gap include: inadequate commitment to service quality; perception of unfeasibility (i.e. "we can't possibly do what the patients expect us to do"); inadequate standardization of tasks; and absence of goal setting. Another prerequisite for providing high orthodontic service quality is the presence of performance standards for the office staff as a whole, including the orthodontist. However, it must be noted that management may not be willing or able to meet these expectations or the actual specifications established for orthodontic service delivery for various reasons.

Gap 3: Service Quality Specifications / Service Quality Gap

This is the gap between the specifications of service quality and the actual service delivered: the service performance gap. Instances may occur when the orthodontist understands client expectations, sets appropriate service specifications, either formally or informally, but service delivery falls short of what patients expect. Opportunities for mistakes and misunderstandings exist when orthodontic service providers and patients/parents interact. Both patients and providers experience and respond to each other's mannerisms, attitudes, competencies, moods, and language.

Orthodontic service providers may be unable and/or unwilling to perform the service at the desired level due to: inadequate or ambiguous employee role clarity; employee role conflict; poor employee-job fit; poor employee-technology fit; inappropriate measurement/reward systems; lack of empowerment and/or lack of teamwork. Maintaining service quality depends on maintaining a work force willing and able to perform service at specified levels. Clearly the role of each member of the office staff should be carefully delineated and monitored to reduce this gap.

Gap 4: Service Delivery / External Communications Gap

This is the gap between the actual service delivered to the patient and what the orthodontist communicates to his/her patients about what he/she will deliver. Promises made by an orthodontist e.g. total treatment time, may become one of the major standards against which patients/parents assess service quality. As discrepancies between actual and promised services and service outcomes may adversely effect patient perceptions of service quality, care must be taken to avoid promising services or service outcomes that cannot be delivered. To the consumer, these discrepancies reflect an underlying breakdown in coordination between those responsible for the delivering the service and those charged with describing/promoting the service.

Another way that internal marketing can influence patient expectations is when orthodontists neglect to inform patients of all the behind-the-scenes activities performed to protect them. By making patients aware of his/her commitment to quality service,

improvements in patient service perceptions are realized. Patients who believe an orthodontist is acting to serve their best interests are more likely to perceive service delivery favourably. Service perceptions can be enhanced by educating patients to be better consumers and services users. By closing Gaps 1 through 4, Gap 5 is eliminated.

Gap 5

This is the gap between the patients'/parents' expected level of service quality and their perception of the level of service quality actually received. A gap in any one of the four areas listed above is the root cause of a gap between what patients expect to receive and patient perception of orthodontic service quality actually received. The key to eliminating this last gap is to close Gaps 1 through 4 and work to keep them closed.

Results

Contents

6.0 Results

In this section, the results of this investigation will be evaluated to:

- Assess the ability of the pilot survey to measure the delivery of quality care in an orthodontic setting.
- Assess the responses of patients attending a University orthodontic clinic in terms of their expectations and perceptions, and the differences between the two response categories (gaps).
- Assess the responses of parents whose children are attending the University program in terms of their expectations and perceptions.
- Assess the responses of patients attending a private-practice orthodontic clinic in terms of their expectations and perceptions, and the differences between these two response categories (gaps).
- Assess the responses of parents whose children are attending the Private Practice in terms of their expectations and perceptions.
- Compare the responses of the patients attending the University clinic and the Private Practice clinic.
- Compare the responses of parents from the University and the Private Practice.
- Identify which questions in the survey that had the highest reliability and validity.
- Identify any common themes which may exist between the significant questions.

- Assess the most reliable and valid questions in both University and Private Practice groups and how good they are in predicting overall service quality.
- Assess the overall quality of service delivery in both the University and Private Practice settings.

6.1 Response Rates:

Of the 400 surveys (200 each clinic) that were distributed, 150 from the University sample were returned (75% response rate), and 42 from the Private Practice were returned (21% response rate). It was felt that the lower response rate at the Private Practice may be due to a higher volume of patients per hour than the University sample, decreasing the available time for completion of the questionnaire. Another reason for the lower response rate at the Private Practice may be due to the method of distribution, i.e. by the receptionist, because the receptionist may have had insufficient time and motivation to distribute and collect surveys. The third possible reason may be due to the length of the survey, and the time required for completion (i.e. the questionnaire may have been excessively long for use in an orthodontic setting with short appointments).

6.2 Basic Statistical Analysis of the SERVQUAL Data Derived from the University Clinic Patients.

As summarized in **Figure 6.1**, the mean scores derived from the SERVQUAL expectation/ perception component questions derived from the Graduate orthodontic

clinic patients exhibited marked differences in their ratings (scores) of service quality. For instance, **Table 6.1** showed that the expectation response scores ranged from 9.86 (E15: 'You should be able to trust the skills of the orthodontist') to 7.87 (E13: An orthodontist should be sincerely interested in me as a person'). By contrast, the range of mean perception scores was narrower (**Table 6.1**), and extended from 9.35 (P18: 'My orthodontist takes every precaution required to protect me from infectious diseases') to 8.28 (P13: 'My orthodontist is sincerely interested in me as a person). The variation in the response scores tended to be greater for service perceptions than those for expectations. For instance, the standard deviations for the expectation response scores ranged from 2.15 (E13: 'An orthodontist should be interested in me as a person') to 0.39 (E15: You should be able to trust the skills of the orthodontist), whereas those for the perception responses ranged from 2.72 (P4: 'The waiting period between my first appointment and when I started my treatment was not too long') to 1.20 (P18: 'My orthodontist takes every precaution required to protect me from infectious diseases). The Cronbach's alpha (α) test showed that the response items were reliable for expectation ($\alpha = 0.85$) and perception ($\alpha = 0.92$) parameters.

As illustrated in **Table 6.2**, a Wilcoxon's test confirmed significant differences between these expectation/perception response scores, i.e. E&P 2-9, 13-16 and 18-19, whereas there was no significant difference for questions E&P 1, 10-13 and 17.

6.3 Basic Statistical Analyses of the SERVQUAL Data Derived from Private Practice Patients.

The average expectation response scores from Private Practice patients (**Table 6.3** and **Figure 6.2**) ranged from 9.64 (E15: 'You should be able to trust the skills of an orthodontist') to 7.91 (E13: 'An orthodontist should be sincerely interested in me as a person). By contrast, their standard deviations ranged from 1.97 (E4: 'There should not be a long waiting period between my first appointment and when I start my treatment') to 0.85 (E16: 'My treatment should be of high quality').

There was however, a more extensive range in average perception scores (**Table 6.3**), that extended from 9.55 (P19: 'The receptionist is always organized, courteous and patient) to 6.29 (P15: 'I trust the skills of my orthodontist'). Similarly, the standard deviations ranged from 2.26 (P14: 'The fees are affordable') to 0.71 (P19: 'The receptionist is always organized, courteous and patient').

As illustrated in **Table 6.4**, a Wilcoxon's test confirmed significant differences between the expectation/perception response scores. Specific items i.e. E/P 4, 5, 14 and 19 were significantly different for the two groups. The remainder of the response comparisons were however statistically insignificant. In addition the Cronbach's alpha (α) test showed that the response items from the Private Practice were reliable for expectation ($\alpha = 0.89$) and perception ($\alpha = 0.87$) parameters.

6.4 Inter-group Comparison of Expectations and Perceptions Responses Between University Versus Private Practice Respondents

The differences in expectation and perception scores between University and Private Practice patients are summarized in **Table 6.5**. Comparison of the respective expectation response scores by a Mann-Whitney U-test showed significant differences only for the following items (E2, 8, 12, 15 and 19) between the two groups. Similarly, evaluations on the perception response scores (**Table 6.5**) proved significantly different only for P4, 12 and 14.

6.5 Inter-group Gap Comparisons Derived from University and Private Practice Samples

The expectation and perception response scores by the combined University and Private Practice samples (**Table 6.6**) were reliable (Cronbach's α=0.86 and 0.91 respectively). They ranged from 9.79 ± 0.54 (E15) to 8.34 ± 2.02 (E4) for the expectation scores and 9.35 ± 1.134 (P18) to 7.78 ± 2.60 (P4) for the perception responses. The differences between the respective expectation/perception scores (**Table 6.6**) were further evaluated using their gap (i.e. perception minus expectation) scores (**Table 6.6**). The Cronbach's Alpha test (α = 0.845) again proved that the gaps created from the entire sample (University & Private Practice) were reliable, and their mean scores (**Table 6.6**) ranged from –0.45 (G13) to +1.37 (G4) whereas their standard deviations ranged from 1.17 (G18) to 2.39 (G10).

6.6 Comparisons of SERVQUAL Responses Scores Between Patients and Parent/Guardians

An important aspect of the current investigation is centered on comparisons between patients' and their parents/guardians in the University and Private Practice patient assessments of service satisfaction (**Table 6.7**). When the data was subjected to the Mann-Whitney U test, no clear patterns between the two samples should have been apparent for the null hypothesis to be true. As summarized in **Tables 6.7 & 6.8**, no significant differences emerged between patients and their patients/guardians of the University and Private Practice group in their expectation, perception and gap scores. This result implies that the overall assessments of expectations, perceptions and the gaps derived from them were similar between patients and parents, although some non-significant minor discrepancies were apparent.

Differences between University and Private Practice patient gap responses were subsequently evaluated by discriminant analysis (**Table 6.9**), where significant differences between the two patient samples were identified for G1, 2, 4, 14 and 19. Comparisons of their standardized canonical discriminant function coefficients showed that G2, 4, 14 and 19 were the key discriminators between the University and Private Practice responses (**Table 6.10**). Since the gaps tended to be greater for the University than Private Practice samples, they suggested that there were problems between expectations and perceptions for service delivery in the University patient sample. By contrast, G14 proved the greatest concern for the Private Practice sample, and primarily

reflected differences between the expectations and perceptions of orthodontic service fees.

6.7 Predictive Validity of the SERVQUAL Instrument for the Specialty Orthodontic Service Market Domain

Multiple regression analysis was used to evaluate the relative significance of the component SERVQUAL items. For instance, when the expectation, perception and gap scores were regressed on question P16 ('My orthodontic treatment is of high quality'), the predictive validity in terms of the assessment of service quality (viewed from the perspective of the patient and parent/guardian) proved very high, with the perception questions (P1-P19) accounting for approximately 78.7 percent of the variation found in question P16 (**Table 6.11**), whereas the expectation and gap questions explained only 26.3% and 58.6% of the variation respectively. By contrast, stepwise regression analysis (**Tables 6.12, 6.13 & 6.14**) showed that questions E6, 7, 10 and 17 together explained only 18 percent of the variation in question P16, whereas P5, 7, 15, 18 and 19 and G2, 5, 15 and 19 together explained approximately 77 percent and 55 percent of the variation in P16 respectively. These statistical data therefore suggested that items 2, 5, 7, 15, 16, 18 and 19 provided the most significant information measured by the SERVQUAL instrument.

In other words the overall sense of satisfaction of the respondents was best described by the expectation/perception/gap scores of questions 2, 5, 7, 15, 16, 18 and 19, which indicates that the number of questions can be reduced in future applications.

6.8 Application of the SERVQUAL Instrument to the Specialty Orthodontic Service Market Domain

The interpretation of the data derived from the SERVQUAL instrument used in this investigation was not a simple challenge, since the measured responses reflect a number of underlying themes. In other words, the responses are observed variables whereas the influential variables may be considered factors. In order to facilitate their interpretation, therefore, the response data were subjected to Factor Analysis using varimax rotation to maximize the separation between the component groups of variables. As illustrated in **Table 6.15**, this analysis identifies four component item groups (or themes) of expectation items:

- Professionalism of the orthodontist (E5, 7, 15, 16, 18 & 19)
- Availability/affordability of orthodontic treatment (E8, 9, 11 & 14)
- Chairside manner of the orthodontist (E6, 10, 12, 13 & 17)
- First impressions of the office (E1, 2 & 4)

Similar groupings were then derived from the perception questions (**Table 6.16**):

- Professionalism of the orthodontist (P7, 15, 16, 17 & 18)
- Availability of the orthodontist and affordability of treatment (P1, 2, 3 & 4)

- Chairside manner of the orthodontist (P11, 12 & 14)
- Access in emergency/exceptional circumstances (P8 & 18)

and from the gap values (**Table 6.17**):

- Professionalism of the orthodontist (G7, 15, 16 & 18)
- Chairside manner of the orthodontist (G6, 8, 9, 12 & 18)
- First impressions of the office (G1 & 2)
- Communication of the orthodontist and the affordability of treatment (G3, 11 & 14)
- Professionalism of the receptionist (G4 & 19)

When the impact of these component item groups or 'themes' were evaluated with respect to the responses from the University versus Private Practice patient samples, the derived data underscored the potential insights provided by the SERVQUAL instruments. For instance, a two-tailed Wilcoxon's test comparison showed that the availability and affordability theme was significantly different between the two patient samples, i.e. the patients and/or parents/guardians expected the University clinic to provide more affordable services than the Private Practice (**Table 6.18**). Similar analyses of the perception scores identified major differences between two major themes (**Table 6.19**) which indicated that perceptions of professionalism of the orthodontist were higher for the Private Practice than University patients. By

contrast, the University patients perceived that they received better communication and more affordable services that the Private Practice patients.

It has to be remembered that a higher absolute gap score means a poorer performance by the office. As illustrated in **Table 6.20**, first impressions of the office (Theme 3) and Professionalism of the receptionist (Theme 5) was considered significantly inferior for the University than Private Practice patients, whereas service accessibility and affordability of treatment (Theme 2) were considered superior for the University than Private Practice patients.

Similar patterns were also apparent from analysis of response scores between patients and their parents/guardians. For instance, analyses of the expectation scores (**Table 6.21**) showed that the parent/guardian group had higher expectations in terms of orthodontist professionalism than the patient group. By contrast, analyses of the perception scores (**Table 6.22**) showed that parents/guardians had more favourable perceptions of orthodontist professionalism than the patients (Theme 1), whereas patients perceived they had received better emergency service than their parents/guardians (Theme 4). Finally, analyses of the gap scores of patients versus parents/guardians (**Table 6.23**) showed that patients had a better impression of the chairside manner of the orthodontist than the parents/guardians (Theme 2), whereas first impressions of the facilities proved to be more impressive to the parents/guardians than patients (Theme 3).

6.9 Summary

1. The survey used in this study was shown to be a reliable and valid measure of service quality in University and Private Practice orthodontic clinics.

2. The University Clinic patients exhibited marked differences in their scores of service quality. The variation in the responses scores tended to be greater for service perceptions than for expectation response scores. Gap Analysis of the University respondents revealed that there was a poorer performance (than the private practice office) with respect to first impressions of the office, and professionalism of the receptionist. It is worth noting that at the time of the study the school was using a new receptionist. Accessibility and affordability were rated highly.

3. There were no differences in expectations/perceptions/gaps of the parent/guardian group of either study group. The parents/guardians of the patients generally had higher expectations of professionalism of the doctors and staff than the patient group. First impressions of the facilities were more favourable for this group. They had less positive impressions of the service delivery and chairside manner than the patient groups.

4. The private practice group had higher impressions of professionalism of the doctor and staff than the University group. Fees were perceived more negatively in the Private Practice group.
5. Overall service quality in both groups was considered to be satisfactory.

6. Questions 2, 5, 7, 15, 16 and 18 provided the most information regarding the overall assessment of service quality, as measured by this modified SERVQUAL instrument. This finding suggests that a shorter, more concise survey may be used in future studies.

7. Common themes in expectations and perceptions identified by this investigation related to: professionalism of the orthodontist; availability of the orthodontist; communication skills of the orthodontist; affordability of treatment; chairside manner; and first impressions of the office.

University of Manitoba respondents:

Table 6.1 Expectation and perception question summary

Variable	Expectation Values Mean ± S.D.	Perception Values Mean ± S.D.
1	8.38 ± 1.884	8.69 ± 1.695
2	8.66 ± 1.544	9.36 ± 1.115
3	8.81 ± 1.758	9.32 ± 1.383
4	7.47 ± 2.716	8.42 ± 2.041
5	8.82 ± 1.497	9.27 ± 1.220
6	8.79 ± 1.743	8.48 ± 1.608
7	9.11 ± 1.499	9.55 ± 0.856
8	8.56 ± 1.603	9.12 ± 1.362
9	8.40 ± 2.288	9.21 ± 1.150
10	8.58 ± 2.004	8.59 ± 1.457
11	9.11 ± 1.426	9.40 ± 1.062
12	9.29 ± 1.313	8.90 ± 1.786
13	8.28 ± 2.235	7.86 ± 2.148
14	8.37 ± 1.950	9.35 ± 1.205
15	9.30 ± 1.389	9.86 ± 0.385
16	9.19 ± 1.230	9.72 ± 0.684
17	9.18 ± 1.395	8.90 ± 1.547
18	9.34 ± 1.204	9.80 ± 0.662
19	9.21 ± 1.256	9.52 ± 0.841
Cronbach's Alpha	0.85	0.92

Figure 6.1 University of Manitoba Respondents: Expectation and Perception Values

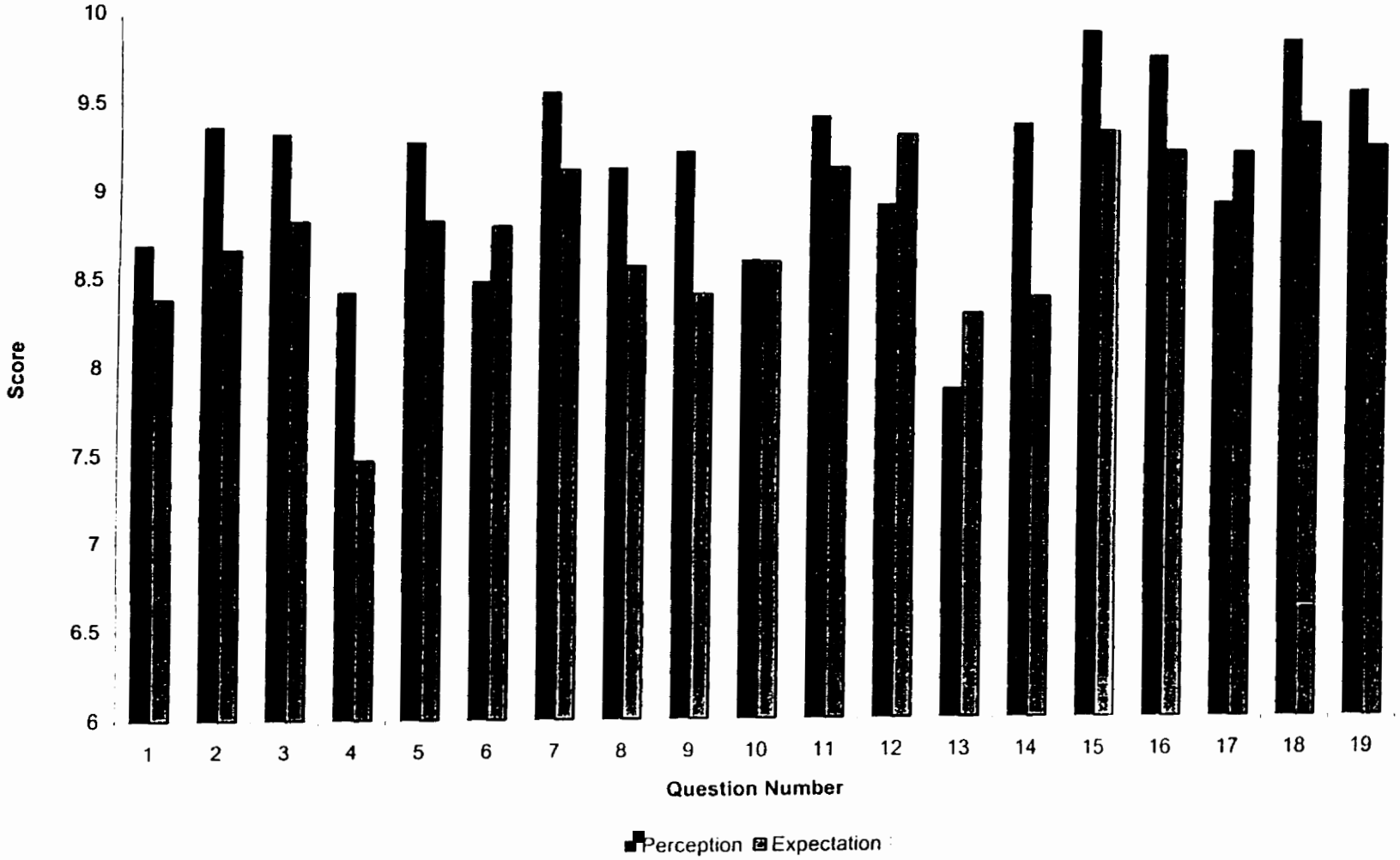


Table 6.2: Two-tailed (Wilcoxon's test) comparison of 'expectation' vs. 'perception' responses in the University sample.

Questions	T- test results
E1 vs. P1	N.S.
E2 vs. P2	$\rho < .00001$**
E3 vs. P3	$\rho = .0001$**
E4 vs. P4	$\rho < .003$*
E5 vs. P5	$\rho = .0001$*
E6 vs. P6	$\rho = .002$*
E7 vs. P7	$\rho < .002$*
E8 vs. P8	$\rho < .00001$**
E9 vs. P9	$\rho < .0003$**
E10 vs. P10	N.S.
E11 vs. P11	$\rho < .04$
E12 vs. P12	$\rho < .01$
E13 vs. P13	$\rho < .001$*
E14 vs. P14	$\rho < .00001$**
E15 vs. P15	$\rho < .00001$**
E16 vs. P16	$\rho < .00001$**
E17 vs. P17	$\rho < .02$
E18 vs. P18	$\rho < .00001$**
E19 vs. P19	$\rho < .007$*

* = significant difference ** = very significant difference

Private Practice respondents:

Table 6.3: Expectation and perception question summary:

Variable	Expectation Values Mean ± S.D.	Perception Values Mean ± S.D.
1	8.66 ± 1.262	9.14 ± 0.871
2	8.85 ± 1.117	9.11 ± 0.889
3	9.54 ± 0.889	9.16 ± 1.544
4	8.04 ± 1.937	8.85 ± 1.761
5	9.35 ± 0.983	8.69 ± 1.239
6	8.69 ± 1.179	9.00 ± 1.249
7	9.35 ± 0.932	9.07 ± 0.921
8	8.64 ± 1.100	8.30 ± 1.239
9	8.95 ± 1.034	8.88 ± 1.310
10	8.21 ± 1.523	8.88 ± 1.040
11	9.23 ± 1.007	9.21 ± 0.976
12	8.23 ± 1.884	8.04 ± 1.962
13	7.90 ± 1.376	8.50 ± 1.401
14	9.04 ± 1.146	6.28 ± 2.255
15	9.52 ± 0.862	9.28 ± 1.019
16	9.64 ± 0.850	9.42 ± 0.887
17	9.11 ± 0.889	9.50 ± 0.740
18	9.57 ± 0.966	9.35 ± 0.850
19	8.88 ± 1.017	9.54 ± 0.705
Cronbach's Alpha	**0.892**	**0.867**

Figure 6.2 Private Practice Respondents: Expectation and Perception Scores

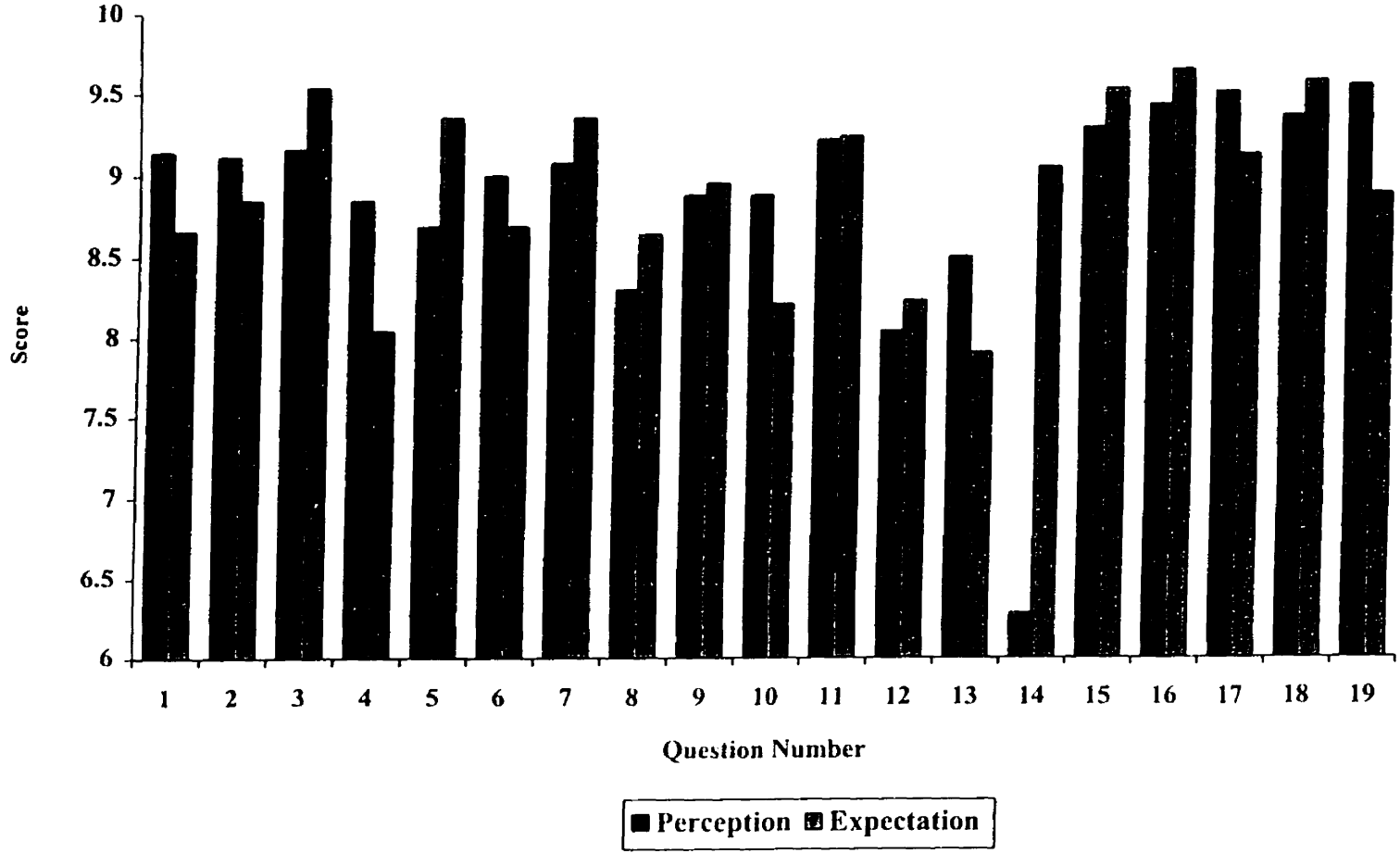


Table 6.4: Two-tailed (Wilcoxon's test) comparison of 'expectation' vs. 'perception' responses in the Private Practice sample

Questions	T- test results
E1 vs. P1	$\rho < .05$
E2 vs. P2	N.S.
E3 vs. P3	N.S.
E4 vs. P4	$\rho < .004$*
E5 vs. P5	$\rho < .004$*
E6 vs. P6	$\rho < .025$
E7 vs. P7	N.S.
E8 vs. P8	N.S.
E9 vs. P9	N.S.
E10 vs. P10	$\rho < .04$
E11 vs. P11	N.S.
E12 vs. P12	N.S.
E13 vs. P13	$\rho < .05$
E14 vs. P14	$\rho < .00001$*
E15 vs. P15	N.S.
E16 vs. P16	N.S.
E17 vs. P17	$\rho < .02$
E18 vs. P18	N.S.
E19 vs. P19	$\rho < .00001$*

University of Manitoba (U) vs. Private Practice (P) respondents

Table 6.5: Two tailed (Mann-Whitney U test) comparison of expectation (E_U and E_P) and perception (P_U and P_P) responses

E_U vs. E_P	*t*	P_U vs. P_P	*t*
E1	N.S.	P1	$\rho < .05$
E2	$\rho < .001$*	P2	N.S.
E3	N.S.	P3	N.S.
E4	N.S.	P4	$\rho < .002$*
E5	N.S.	P5	N.S.
E6	N.S.	P6	N.S.
E7	N.S.	P7	N.S.
E8	$\rho < .002$*	P8	N.S.
E9	$\rho < .05$	P9	N.S.
E10	N.S.	P10	N.S.
E11	N.S.	P11	N.S.
E12	$\rho \leq .003$	P12	$\rho < .00001$*
E13	N.S.	P13	N.S.
E14	$\rho = .026$	P14	$\rho < .00001$*
E15	$\rho < .008$*	P15	N.S.
E16	N.S.	P16	N.S.
E17	N.S.	P17	N.S.
E18	N.S.	P18	N.S.
E19	$\rho < .00001$*	P19	N.S.

* = significant

Reliability of the 'Expectation', 'Perception' and 'Gap' responses (U of M & PP):

Table 6.6: Expectation/perception/gap score reliability:

	Mean ± S.D.		Mean ± S.D.		Mean ± S.D.
E1	8.68 ± 1.607	P1	8.54 ± 1.741	G1	-0.14 ± 2.037
E2	9.25 ± 1.163	P2	8.76 ± 1.437	G2	-0.48 ± 1.624
E3	9.37 ± 1.292	P3	8.89 ± 1.716	G3	-0.48 ± 1.867
E4	8.33 ± 2.019	P4	7.77 ± 2.598	G4	-0.56 ± 3.014
E5	9.29 ± 1.170	P5	8.79 ± 1.442	G5	-0.5 ± 1.517
E6	8.53 ± 1.524	P6	8.83 ± 1.646	G6	+0.30 ± 1.912
E7	9.51 ± 0.874	P7	9.10 ± 1.391	G7	-0.40 ± 1.396
E8	9.02 ± 1.322	P8	8.50 ± 1.531	G8	-0.51 ± 1.690
E9	9.15 ± 1.128	P9	8.50 ± 2.119	G9	-0.65 ± 2.201
E10	8.51 ± 1.475	P10	8.64 ± 1.838	G10	+0.13 ± 2.385
E11	9.36 ± 1.050	P11	9.13 ± 1.339	G11	-0.23 ± 1.599
E12	8.75 ± 1.824	P12	9.02 ± 1.561	G12	+0.26 ± 1.905
E13	7.87 ± 2.001	P13	8.32 ± 2.079	G13	+0.45 ± 2.210
E14	9.28 ± 1.196	P14	7.91 ± 2.193	G14	-1.36 ± 2.358
E15	9.78 ± 0.542	P15	9.29 ± 1.314	G15	-0.48 ± 1.290
E16	9.70 ± 0.722	P16	9.24 ± 1.165	G16	-0.46 ± 1.214
E17	8.95 ± 1.430	P17	9.25 ± 1.286	G17	+0.29 ± 1.605
E18	9.75 ± 0.743	P18	9.34 ± 1.134	G18	-0.40 ± 1.167
E19	9.38 ± 0.918	P19	9.28 ± 1.165	G19	-0.09 ± 1.258
α	**0.861**		**0.909**		**0.845**

Table 6.7: Comparison of 'patients' and 'parents' responses in whole sample

'Expectation' Totals:			
Mean:	Patients = 172.0 (n = 155) Parents = 175.0 (n = 37)	Z Value **0.7101**	Prob. Level **0.477** (no difference)
'Perception' Totals:			
Mean	Patients = 166.2 (n = 155) Parents = 171.4 (n = 37)	Z Value **1.018**	Prob. Level **0.309** (no difference)
'Gap' Totals:			
Mean	Patients = -5.8 (n = 155) Parents = -3.6 (n = 37)	Z Value **-0.461**	Prob. Level **0.644** (no difference)

Table 6.8: Comparison of University respondents and Private Practice respondents

'Expectation' Totals:			
Mean	University = 173.4 (n = 150) Private Practice = 169.5 (n = 42)	Z Value **-1.933**	Prob. Level **0.053** (no difference)
'Perception' Totals:			
Mean	University = 166.9 (n = 150) Private Practice = 168.3 (n = 42)	Z Value **-0.504**	Prob. Level **0.614** (no difference)
'Gap Totals:			
Mean	University = -6.5 (n = 150) **Private Practice = -1.2 (n = 42)**	Z Value **-1.565**	Prob. Level **0.117** (no difference)

Table 6.9: Discriminant Function Analysis (University vs. Private Practice) of Gap Data

	Wilks' Lambda	F	Sig.
G1	0.974	5.029	0.026*
G2	0.940	12.179	0.001*
G3	0.999	0.164	0.686
G4	0.942	110767	0.001*
G5	0.997	0.647	0.422
G6	1.000	0.000	0.993
G7	0.998	0.399	0.528
G8	0.997	0.624	0.431
G9	0.980	3.781	0.053
G10	0.986	2.691	0.103
G11	0.995	0.932	0.336
G12	0.984	3.114	0.079
G13	0.999	0.221	0.639
G14	0.902	20.651	0.000*
G15	0.989	2.054	0.153
G16	0.988	2.279	0.133
G17	0.999	0.147	0.702
G18	0.992	1.457	0.229
G19	0.897	210776	0.000*

Wilks' Lambda

Wilks' Lambda	Chi-square	Sig.
0.651	77.563	**0.000***

* = significant

Table 6.10: Standardized canonical discriminant function coefficients

	Weights
G1	-0.124
G2	0.380*
G3	0.107
G4	0.400*
G5	-0.289
G6	-0.214
G7	0.027
G8	0.065
G9	0.127
G10	0.172
G11	0.296
G12	-0.245
G13	-0.024
G14	-0.872*
G15	-0.092
G16	0.154
G17	0.050
G18	0.057
G19	0.418*

* = significant

Table 6.11 Multiple regression analysis to assess predictive validity

Questions	F-Ratio	R-squared value	Probability Level
E1-E19	3.430	0.263	0.0000
P1-P19	34.484	0.787	0.0000
G1-G19	13.628	0.5864	0.0000

Table 6.12: Stepwise regression analysis of 'expectation' questions

Variable Selected	Standard Coefficient	R-squared increment
E6	0.260	0.055
E7	0.162	0.020
E10	-0.194	0.032
E15	0.1822	0.025

R-Squared = **0.183**

Table 6.13: Stepwise regression analysis of 'perception' questions

Variable Selected	Standard Coefficient	R-squared increment
P5	0.170	0.020
P7	0.127	0.008
P15	0.549	0.180
P18	0.112	0.007
P19	0.160	0.019

R-Squared = **0.772**

Table 6.14: Stepwise regression analysis of 'gap' values:

Variable Selected	Standard Coefficient	R-squared increment
G2	-0.124	0.014
G5	-0.126	0.013
G15	-0.555	0.228
G18	-0.174	0.022

R-squared = **0.554**

Table 6.15: Factor analysis of expectation variables:

	Factor Weightings			
Variable	Component 1	Component 2	Component 3	Component 4
E1	9.758E-02	6.538E-03	8.605E-02	0.831
E2	6.478E-02	0.400	9.332E-02	0.689
E3	0.489	0.128	-4.7E-02	0.303
E4	0.159	0.123	0.245	0.544
E5	0.534	-7.0E-02	0.264	0.382
E6	0.196	0.191	0.565	0.282
E7	0.630	0.284	0.178	0.214
E8	9.986E-02	0.707	0.127	8.803E-02
E9	0.191	0.716	0.213	0.192
E10	7.393E-02	0.194	0.518	0.229
E11	0.374	0.561	0.183	0.136
E12	0.122	0.312	0.526	0.228
E13	-0.130	0.397	0.611	3.812E-02
E14	0.372	0.580	0.311	5.212E-02
E15	0.753	0.300	6.260E-02	5.5865E-02
E16	0.761	-1.2E-02	0.322	-1.3E-02
E17	0.273	-2.8E-02	0.770	-6.2E-02
E18	0.815	0.201	5.84E-03	10144E-02
E19	0.500	0.361	0.418	0.147

Themes identified:

1) Professionalism of orthodontist (E5, 7, 15, 16, 18, 19)

2) Availability of orthodontist and affordability of treatment (E8, 9, 11, 14)

3) Chairside manner (E6, 10, 12, 13, 17)

4) 1st impressions (E1, 2, 4)

Table 6.16: Factor analysis of perception variables:

Variables	Component 1	Component 2	Component 3	Component 4
P1	0.172	0.728	5.834E-02	0.306
P2	0.270	0.652	4.870E-02	0.453
P3	0.311	0.655	0.247	-1.8E-02
P4	6.422E-02	0.708	3.160E-02	-7.8E-03
P5	0.431	0.182	0.191	0.455
P6	0.406	0.413	0.294	0.377
P7	0.539	0.215	0.474	0.330
P8	8.382E-02	0.136	0.155	0.862
P9	0.189	0.498	0.341	0.425
P10	0.447	0.472	0.276	0.141
P11	0.457	0.329	0.624	9.484E-02
P12	0.121	-4.2E-02	0.809	0.187
P13	0.242	0.148	0.305	0.486
P14	0.135	0.178	0.709	0.150
P15	0.799	0.258	0.278	-1.5E-02
P16	0.824	0.223	0.230	0.190
P17	0.632	0.278	0.277	0.139
P18	0.694	-8.6E-02	8.526E-02	0.502
P19	0.571	0.345	-0.198	0.285

Themes identified:

1) Professionalism of orthodontist (P7, 15, 16, 17, 18)

2) 1st impressions (P1, 2, 3, 4)

3) Communication and affordability (P11, 12, 14)

4) Access in emergency/exceptional circumstances (P8, 18)

Table 6.17: Factor analysis of gap variables:

Variable	Component 1	Component 2	Component 3	Component 4	Component 5
G1	0.136	2.407E-02	0.817	4.753E-02	0.157
G2	0.106	0.120	0.839	3.051E-02	6.673E-02
G3	0.198	-0.106	-1.8E-02	0.594	0.479
G4	3.511E-02	0.128	0.105	0.147	0.727
G5	0.442	4.165E-02	3.619E-02	0.194	0.411
G6	6.140E-02	0.495	0.172	0.321	0.313
G7	0.613	0.310	0.104	0.249	5.692E-02
G8	4.127E-02	0.597	0.139	5.705E-02	0.252
G9	9.257E-02	0.544	0.399	0.240	0.183
G10	0.356	0.224	0.361	0.388	5.182E-02
G11	0.289	0.356	0.165	0.602	-1.2E-02
G12	0.118	0.566	-0.187	0.193	-0.195
G13	0.150	0.725	-5.4E-02	6.530E-02	0.145
G14	0.147	0.240	6.679E-02	0.680	4.008E-02
G15	0.754	2.928E-02	0.239	0.297	5.019E-02
G16	0.819	7.686E-02	0.194	0.207	9.231E-02
G17	0.273	0.576	0.262	3.063E-02	-6.4E-02
G18	0.767	0.257	-7.6E-02	-9.0E-02	0.180
G19	0.318	0.222	0.213	-0.255	0.583

Themes Identified:

1) Professionalism of the orthodontist (G7, 15, 16, 18)

2) Chairside manner of the orthodontist (G6, 8, 9, 12, 18)

3) 1st impressions of the office (G1, 2)

4) Communication of orthodontist and affordability of treatment (G3, 11, 14)

5) Professionalism of receptionist (G4, 19)

Table 6.18: 2 tailed Wilcoxon's test of the University sample vs. the Private Practice sample with respect to the themes identified in the 'expectation' factors

Theme	Means		T	Sig. (2-tailed)
1	U of M (n = 150):	5.04E-02	1.323	0.187
	PP (n = 42):	–0.180		
2	U of M (n = 150)	0.111	2.976	0.003
	PP (n = 42)	-0.0398		
3	U of M (n = 150)	-2.2E-02	-0.587	0.558
	PP (n = 42)	8.01E-02		
4	U of M (n = 150)	1.16E-02	0.304	0.761
	PP (n=42)	-4.2E-02		

Table 6.19: 2 tailed Wilcoxon's test of the University sample vs. the Private Practice sample with respect to the themes identified in the 'perception' factors

Theme	Means		T	Sig. (2-tailed)
1	U of M (n = 150):	-5.9E-02	-1.549	0.123
	PP (n = 42):	0.210		
2	U of M (n = 150)	-0.144	-3.903	0.000
	PP (n = 42)	0.514		
3	U of M (n = 150)	0.193	5.408	0.000
	PP (n = 42)	-0.688		
4	U of M (n = 150)	1.84E-02	0.480	0.632
	PP (n=42)	-6.6E-02		

Table 6.20: 2 tailed Wilcoxon's test of the University sample vs. the Private Practice sample with respect to the themes identified in the 'gap' factors

Theme	Means		T	Sig. (2-tailed)
1	U of M (n = 150):	4.65E-02	1.219	0.224
	PP (n = 42):	-0.166		
2	U of M (n = 150)	1.13E-03	0.030	0.976
	PP (n = 42)	-4.0E-02		
3	U of M (n = 150)	0.137	3.723	0.000
	PP (n = 42)	-0.491		
4	U of M (n = 150)	-0.124	-3.334	0.001
	PP (n=42)	0.443		
5	U of M (n = 150)	0.124	3.327	0.001
	PP (n=42)	-0.442		

Table 6.21: 2 tailed Wilcoxon's test of the Patient sample vs. the Parent sample with respect to the themes identified in the 'expectation' factors

Theme	Means		T	Sig. (2-tailed)
1	Patients (n = 155):	-8.5E-02	-2.444	0.015
	Parents (n = 37):	0.356		
2	Patients (n = 155)	2.35E-02	-0.665	0.507
	Parent (n = 37)	-9.8E-02		
3	Patients (n = 155)	-7.3E-02	-2.085	0.038
	Parents (n = 37)	0.305		
4	Patients (n = 155)	6.60E-02	1.884	0.061
	Parents (n = 37)	-0.276		

Table 6.22: 2 tailed Wilcoxon's test of the Patient sample vs. the Parent sample with respect to the themes identified in the 'perception' factors

Theme	Means		T	Sig. (2-tailed)
1	Patients (n = 155):	-0.134	-3.959	0.000*
	Parents (n = 37):	0.563		
2	Patients (n = 155)	6.8E-02	-1.942	0.054
	Parent (n = 37)	0.284		
3	Patients (n = 155)	3.63E-02	1.029	0.305
	Parents (n = 37)	-0.152		
4	Patients (n = 155)	9.93E-02	2.868	0.005*
	Parents (n = 37)	-0.416		

Table 6.23: 2 tailed Wilcoxon's test of the Patient sample vs. the Parent sample with respect to the themes identified in the 'gap' factors

Theme	Means		T	Sig. (2-tailed)
1	Patients (n = 155):	-4.49E-02	1.274	0.204
	Parents (n = 37):	-0.188		
2	Patients (n = 155)	-8.4E-02	-2.399	0.017*
	Parent (n = 37)	0.350		
3	Patients (n = 155)	0.122	3.557	0.000*
	Parents (n = 37)	-0.513		
4	Patients (n = 155)	-1.2E-03	-.035	0.972
	Parents (n = 37)	-5.15E-03		
5	Patients (n = 155)	2.44E-03	0.069	0.945
	Parents (n = 37)	-1.0E-02		

Discussion

Contents

7.0 Discussion

7.1 Interpretation of the Results Relative to the Literature and Analysis of Their Impact

In this study the 'expectation', 'perception' and 'gap' variables showed good reliability and validity, however it is evident that performance evaluations alone have demonstrated superior predictive validity than on combined of the SERVQUAL instrument. However, an argument can be made that the availability of information on both customer expectations *and* perceptions offers the unique capacity to more accurately pinpoint areas of excellence and deficiency. In addition, this knowledge is crucial if one is to improve the quality of service delivery to their patients, so that they not only leave with an esthetically pleasing and functionally sound dentition, but that the patient feels as if they have received superlative care.

Strategic internal marketing is imperative for elective services such as orthodontics. Differential determinants that distinguish the perceived quality of, and patient satisfaction with, orthodontic services provided by *specialists* need to be identified.

This study has demonstrated distinct differences in perception of service quality between two small sample groups. It appears that both groups are generally satisfied, but many areas have been uncovered which warrant further internal investigation, to further

improve the delivery of care. The University sample showed improvements are needed in the areas of office appearance, timetable flexibility, fees, promptness of initial treatment commencement and perceptions of professionalism and competence among the orthodontic residents and staff. It is apparent that further attention to setting appropriate service standards is recommended.

The Private Practice sample showed that improvement is necessary in promptness of initial treatment commencement, and more importantly the fee charged for orthodontic treatment. Similar to the University group, it is apparent that further attention to, and monitoring of appropriate service standards is warranted.

There did not appear to be any major differences between the perceptions of satisfaction of patients and parents in either group, but each group showed unique differences with respect to what they felt was important. Perhaps delineation of these groups will still be necessary in future studies to more easily recognize these distinct and unique perceptions.

One of the great difficulties of orthodontics is patient compliance. It has been demonstrated that compliance is largely related to patient satisfaction. Is compliance a problem because patients are unsatisfied? And if they are unsatisfied, what priority will they place to orthodontic treatment in their lives? These are questions that can only be answered when the key factors to patients' perceptions to orthodontic treatment have

been identified. In order to identify these key factors, further investigation is therefore justified.

Carman (1990) advocates the testing of SERVQUAL's measurement properties prior to accepting it as a valid measure of perceived service quality in a specific service situation. There is clear evidence in this study that the prerequisite of acceptable levels of reliability and validity have been demonstrated with respect to the modified SERVQUAL instrument.

7.2 Modifications Required to Improve the Questionnaire Based on Results

As with any pilot study, modifications were anticipated. In light of some of the problems encountered with this investigation the following improvements are put forward for future research:

1. a larger sample size to see if there are differences in patients' opinions of service quality among demographic groups and further improve the universal application of this instrument to the orthodontic marketplace;
2. investigation of local, national and international differences in patient perceptions to orthodontic service delivery to develop a more concise and universally applicable SERVQUAL instrument;
3. a shorter, more definitive and powerful survey i.e. elimination of non-reliable and non-valid SERVQUAL questions, that takes less time for responsdents to

answer with the option of adding questions that address areas of care delivery not found in the current investigation. This should allow a greater participation rate in a private practice setting.

4. dedicated involvement of the distributor of the survey (i.e. the reception staff) to get better response rates, or utilization of a third party to distribute and collect the surveys;
5. a more concise investigation of opinions regarding overall assessment of service delivery to improve the estimation of predictive validity of this instrument;
6. a smaller range Likert-type scale to see if there are differences created by modifying the assessment scale;

7.3 Limitations of This Study

Since this is a pilot study, the results must be interpreted with a certain amount of caution, due to the relatively small sample size, the demographics of the particular population and the fact that this was a pioneering type of investigation. Certainly modifications are required to improve the universal applicability of this instrument for the orthodontic market.

In terms of limitations, the SERVQUAL instrument does not provide an opportunity for patient commentary, may lack the sensitivity to pick up deficits in occupational health servicing, and tends to focus more on business aspects and less on the

human aspects of orthodontic service delivery. However, by adding "comment sections" as was done for the Private Practice sample, elicited responses can be valuable for understanding the presence of problems and the nature of the gaps identified.

Summary and Future Investigations

8.0 Summary and Future Investigations

This project was primarily designed to develop and evaluate a SERVQUAL instrument to assess orthodontic service delivery by orthodontic residents in a University Graduate Orthodontic Clinic and a private practice office. Good reliability and validity of this instrument has been demonstrated. This study has emphasized the importance of patient satisfaction in an increasingly competitive market and its relation to the perception of overall service quality. To remain competitive in the current orthodontic market, patient satisfaction is key to successful, high-quality service delivery. For orthodontics, the SERVQUAL instrument is a powerful method with which to evaluate patient satisfaction. The strengths of using this instrument are that it identifies service quality gaps, provides suggestions for closing those gaps, and allows for service quality analysis while retaining excellent patient/parent/doctor relationships intact. In other service markets, it has been well researched, clinically tested, and has good reliability and validity.

Since patient demographics and perceptions vary widely, further investigation in the orthodontic context will be mandated to modify this instrument to be universally applicable, examine its limitations, and make appropriate modifications to the pilot survey used in this study.

Future investigations should include the following:

1. Distribution and Testing of a revised questionnaire. The revised questionnaire should be more applicable (i.e. shorter and more concise) to the private practice market to improve response rates, as this was a major shortcoming of the pilot study. Perhaps the questions relating to the significant 'themes' identified in the current study could be expanded to more thoroughly evaluate the indicators of total service quality. As well, the revised questionnaire should include a separate question for the assessment of total service quality at the end of the survey. This question could then be used in multiple regression analysis for the assessment of predictive validity of the questions.

2. Distribution and testing of this revised questionnaire in different orthodontic markets in Canada (urban, rural) and the United States, as orthodontic practice in both countries is similar, to develop a more universal instrument of service quality assessment.

3. Testing of response rates using different distribution methods (e.g. mail-out).

Appendix A: Ethics Approval

The University of Manitoba
Faculty of Dentistry

COMMITTEE ON RESEARCH INVOLVING HUMAN SUBJECTS

Date: November 20, 1997

Committee Reference EC 57/97P

Name of investigator: Dr. Jonathan Suzuki

Your project entitled: An Analysis of Patients' Perceptions of Orthodontic Dental Services Provided by the Graduate Orthodontic Clinic of the University of Manitoba,

revised on November 19, 1997, has been approved by the Committee.

PLEASE NOTE

Any significant changes in the approved protocol must be reported to the Chair of the committee for the Committee's consideration and decision, prior to the implementation of the changes in the protocol.

Yours sincerely,

Colin Dawes B.Sc., B.D.S., Ph.D.
Chair, Committee on Research
Involving Human Subjects

Appendix B: Abstract submitted to the IADR, Vancouver March 1999

An Analysis of Patients' Perceptions of Orthodontic Dental Service Quality.

J. Suzuki*, C. Lavelle, T. Hassard & R. Baker
(University of Manitoba, Canada)

Since orthodontists share substantial commonalities in their delivery of technical services, it is surprising that few monitor the non-technical aspects of orthodontic treatment that are so integral to patient satisfaction. This pilot study was therefore undertaken to develop a reliable and valid measurement instrument to quantify patients' perceptions of orthodontic service quality. An instrument used to evaluate services in the financial industry was modified for orthodontics. Patients receiving orthodontic services from a University graduate clinic (n=150) and a private-practice clinic (n=42) completed a customized questionnaire collected over a 6 week period. The responses to these questionnaires were analyzed with a 2-tailed statistical analysis (Mann-Whitney U test). Significant differences have been identified between the two data groups: 1) the University clinic group had higher expectations with respect to office comfort, emergency treatment, doctor's responsibilities and skills, affordability of treatment, and receptionist performance; 2) the performance of the University clinic was lower with respect to office appeal and waiting periods; 3) the performance of the University clinic was higher with respect to doctor responsibilities and fees; and 4) the response rate from patients attending the private practice clinic was significantly lower. The reliability of the responses was tested using Cronbach's Alpha Test and the values ranged from 0.85 to 0.92.

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