A Comparison of Treatment Costs

For

Class I, Class II and Class III Malocclusions

by

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Dedication

This manuscript is dedicated to the memory of Dr. James D. Suver, Director of Health Administration, University of Kentucky College of Allied Health Professions, when he died in February 1995, soon after the beginning of this research project.

Dr. Suver held D.B.A. and C.M.A. degrees from Harvard University. He directed health administration programs at the University of Colorado, United States Air Force Academy and the University of North Carolina at Chapel Hill, prior to chairing the program at the University of Kentucky. He served on the Board of Examiners of the Healthcare Financial Management Association as well as holding several other positions with the American College of Healthcare Executives.

I met Jim during my masters degree program in health administration at the University of Colorado almost 20 years ago. He served as my advisor and taught me everything I know about the financial management of healthcare organizations. More importantly, he taught me by example the meaning and value of true friendship. Through the years, Jim was a constant source of support and encouragement to me through all endeavors, including the beginnings of this project. My hope is that he would have been pleased with the product, as his memory served as an inspiration to its completion.

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Abstract

This study was undertaken to determine if there was a difference in the cost of treatment for Class I, Class II and Class III malocclusions. Fifty patient charts were audited in each of three private practices for a total sample size of 150 patients. Total treatment cost was calculated by determination of the direct costs per patient plus an allocation of the indirect costs of the practice. Mean total treatment costs were found to be statistically significantly higher for Class III cases as compared to Class I cases. There was also a statistically significant difference in mean total treatment costs between Class II extraction and nonextraction cases, with the latter being more expensive to treat. Multiple regression analysis showed that the total number of appointments and type of appliance used during treatment were the two most important variables in predicting total treatment costs.

Acknowledgments

Many people were of great help to me in the research and preparation of this study. I owe special thanks to the three orthodontists, who will remain nameless, that made it all possible. They willingly shared their offices, patient records, staff and financial information with me, all the while patiently answering my many questions. Without them this project could not have been done.

Thanks to Richard Foster of the University of Colorado, School of Business, Division of Health Administration for all his advice in the areas of finance and cost accounting. I was pleased to be able to work with Richard on this project as he was one of Jim Suver's former colleagues and as such we could share memories of Jim while working on this study.

The data entry and statistical tests were completed in conjunction with Jonathan Fields, Director of the Office of Research, Development and Utilization, Oregon Health Sciences University (OHSU) and his staff. Jonathan spent many hours with me working through the study design, data base and statistical analysis. Just when I was getting tired of it all, his interest in the project gave me renewed energy.

I would also like to thank my new partner, Dr. Dale V. Rhoney, for giving me a quiet refuge in the use of his office for working long hours on this project. I guess I was there often enough that he finally decided to keep me around.

Lastly I would like to thank Jackie Edwards for transcribing this document. We laughed together right up to the very end.

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Introduction

As seen in the medical profession, the failure to control costs has led both government and business to impose more extensive regulations and fiscal constraints upon these health care providers. Public costs of health care as a percentage of the gross national product have risen from 8% in 1965 to over 13% in 1990. Predictions indicate that health care expenditures could rise to 17% of the GNP by the year 2000. This has occurred without a corresponding increase in the quality of life. See Figures 1 and 2. Medicine has moved from a health care system that has traditionally reimbursed for care already provided, to one of prospective payment based on diagnosis related groups or DRGS. Prospective reimbursement was introduced by the federal government in 1983 as an attempt to provide incentives to health care providers to contain costs. Although currently more insulated from government and business interference than our physician counterparts, we as orthodontists have many of the same incentives as the traditional medical profession has had. In general, we increase income by increasing services. As a group of professionals who place a high value on independence and autonomy, perhaps we would be well-advised to avoid the same pitfalls. This requires an appreciation and understanding of the costs required to provide orthodontic care.

Outcomes research focuses on the ability to quantify how a given treatment modality is effective in treatment of malocclusion, and its long-term impact on dental health. This should cause us to ask what the associated costs are for providing that care. We need the ability to look at both the clinical benefits and costs. Determination of the full cost of providing care can give us a body of knowledge that allows deliberate, conscious decision-making and provides a set of

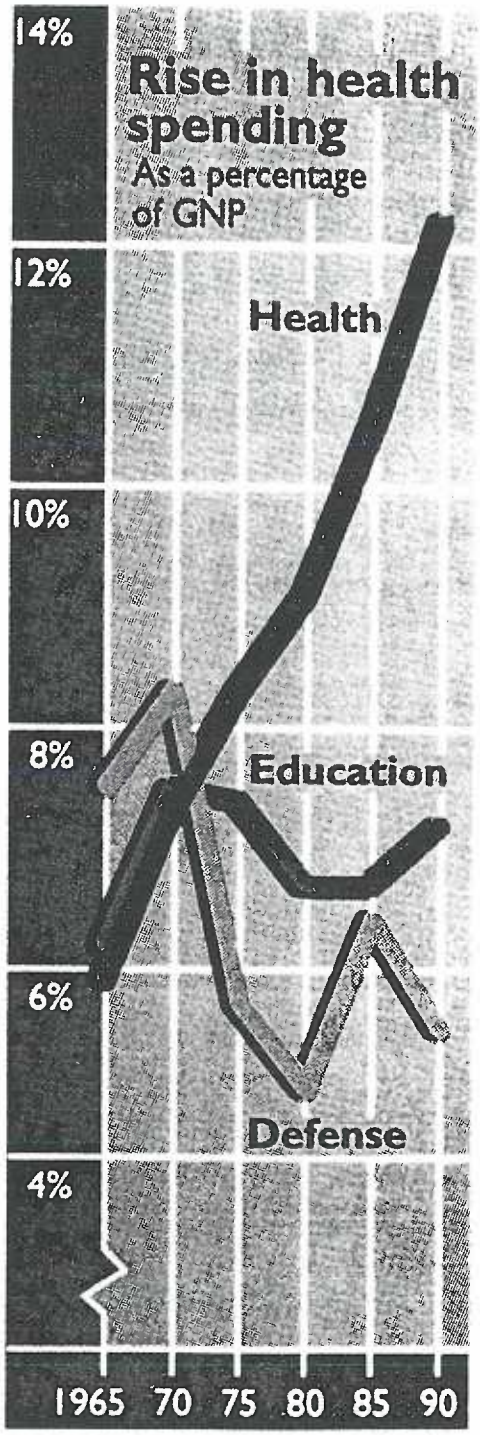

Figure 1. Health Care Spending as a Percent of the Gross National Product

	Health Spending per Capita	Infant Mortality per 1,000 Live Births	Life Expectancy (male)	
			at birth	at age 80
US	$ 2,354	10.0	71.5	6.9
CANADA	$ 1.683	7.2	73.0	6.9
GERMANY	$1.232	7.6	71.8	6.1
JAPAN	$1,035	4.8	75.5	6.9
BRITAIN	$ 836	9.0	72.4	6.4

Figure 2. US Health Care Spending and Health Indices Versus Other Countries

tools which can be used in the following ways:

- -- establishing fees for services
- -- evaluating treatment modalities from a cost/benefit perspective
- -- assessing the adequacy of existing fee structures
- -- development of pricing strategies
- -- analysis and control of resources needed to provide care
- -- provide information for use in management decisions such as participation in or competition with dental managed care programs
- -- evaluate the cost of providing discounted or charity care

With increasing competition and corresponding fiscal pressures, the professional interested in providing optimal care in the traditional mode of orthodontic fee-for-service practice will need cost data to maintain the ability to continually improve the efficiency of resources and thereby remain fiscally viable for the long term.

This study presents a cost accounting model used to evaluate the cost of providing full orthodontic treatment to all classes of malocclusion. Currently, there is no literature available regarding treatment costs expressed as a function of orthodontic diagnosis, Class I, Class II and Class III malocclusions. Once the full costs of care have been determined, a comparison of costs by type of malocclusion was done to see if there was a statistically significant difference in the costs of providing care for Class I, Class II and Class III patients.

Study Design

Three orthodontic practices were used in this study to provide data on the costs of treating Class I, II, and III malocclusions. Each practice was represented by a solo practitioner, board certified on orthodontics. All practitioners were active in their practice on a full-time basis.

Fifty (50) patient charts were audited from each of the three practices for a total of 150 patients. The 50 most recently completed, i.e., debanded, cases from each practice were used in the study as an attempt to accurately reflect both current costs and treatment modalities. In order to obtain an adequate sample size of Class III cases, it was necessary to go back further than the last 50 debands in all three offices. Current cost data and fees were used for these cases as well. There were no surgical cases included in this study as it was felt that these could not be considered routine orthodontic cases and therefore should not be used in comparing costs with non-surgical cases. No transfer cases were used in this study as adequate records for cost and treatment, even if available, would be inappropriate to use in comparing costs since treatment was not rendered by the same orthodontist throughout the case.

The distribution of sample size for the 150 patients can be seen by diagnosis (class of malocclusion) for the overall sample and by each office in Figures 3 and 4. Of the 150 patients, 54 patients or 36% had Class I malocclusions, 80 patients or 53.3% had Class II malocclusions, and 16 patients or 10.7% had Class III malocclusions. Diagnosis was recorded by class of malocclusion diagnosed and charted by the practitioner.

The three offices studied had a similar distribution of malocclusion types as seen in Figure 4. Of the 150 patients studied, 47% were male and 53% were female. The age at the start of treatment ranged from 8 years to 43 years with the median age equal to 12 years and the mean age equal to 13.5 years.

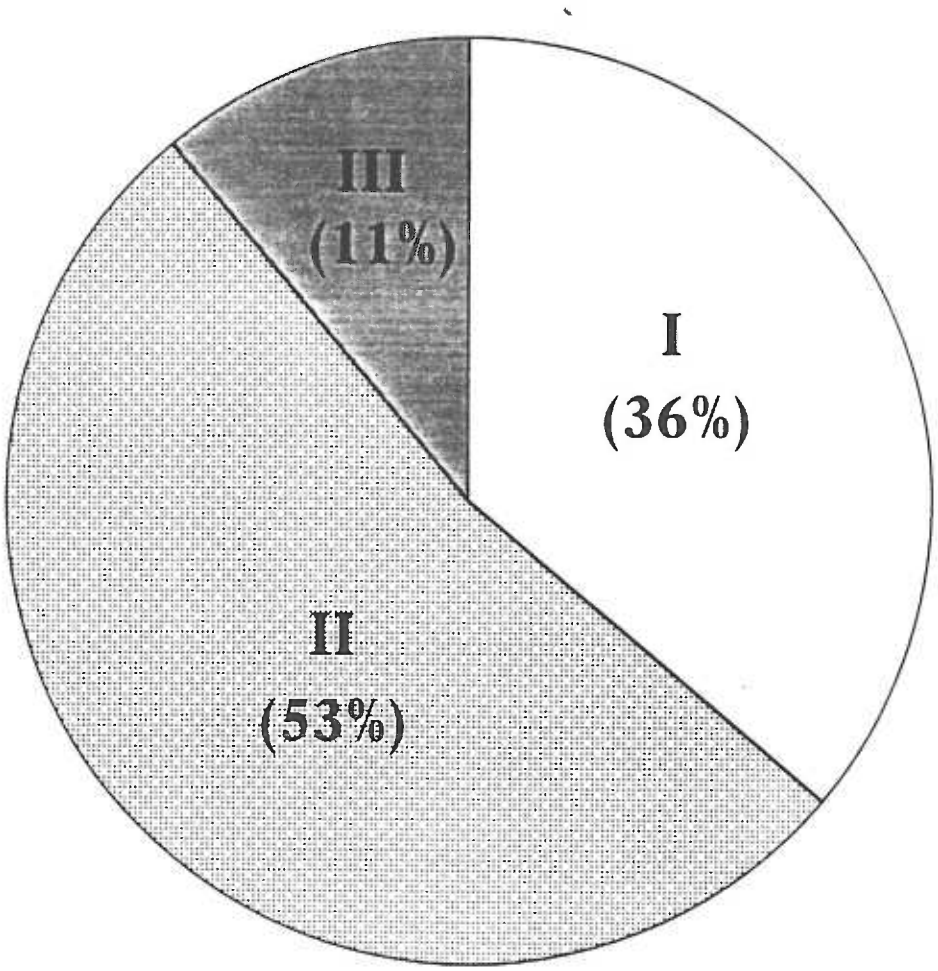

Figure 3. Sample Size by Class (n=150)

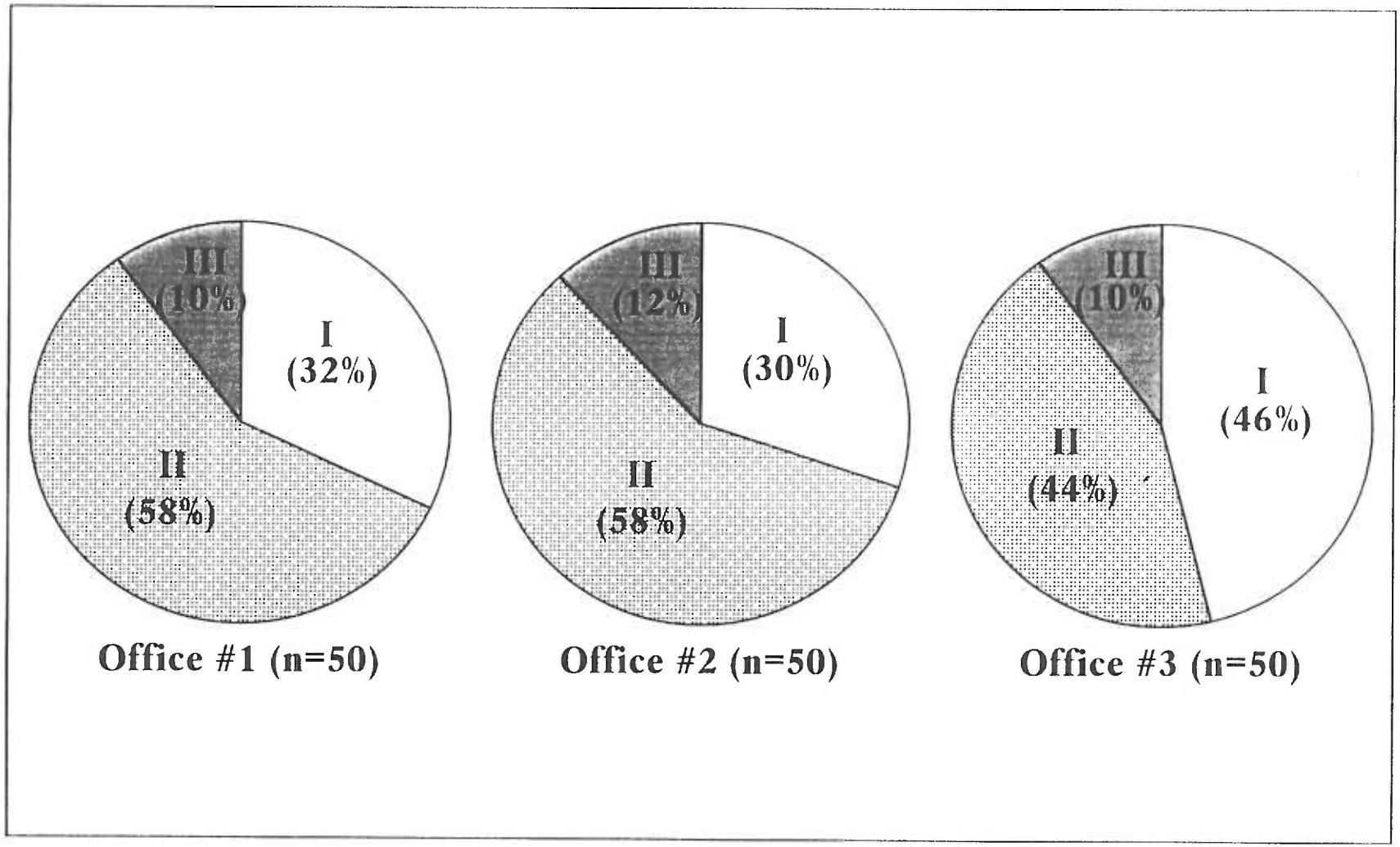

Figure 4. Sample Size by Class, by Office

For each of the 150 patients it was necessary to determine the full cost of providing care. Full cost is usually defined as the direct costs of providing a service plus a fair share of the indirect costs incurred by the practice. Direct costs are those costs that can be traced to a specific patient or procedure. In an orthodontic practice, direct cost items include the orthodontic appliance, wires, headgear, elastics, functional appliances, retainers, minutes of chair time and associated costs, etc. These items can be directly tracked to each patient via the chart audit. Each one is then costed out to determine the direct costs for that patient. Those costs items that cannot be traced to a specific patient or procedure are known as indirect costs. These include maintenance, rent, utilities, clerical salaries, etc. A complete breakdown of direct and indirect cost items can be seen in Figure 5. In considering the full costs of providing care, both the direct and indirect costs must be determined for each patient.

Direct costs for each patient were determined by completing a retrospective chart audit for each of the 150 patients studied. An example of the chart audit form used can be seen in Appendix A. Careful review of the form will illustrate the data collected for each patient. The office and patient's name were recorded. These were later coded by office number 1, 2 or 3, and patients were coded numbers 1-50 for each office. The age at the start of treatment and type of dentition, mixed or permanent, was recorded. The fees charged to the patient for the exam, records, Stage I and Stage II treatment were noted. Any additional fees for lost retainers, etc., were recorded under other fees. Diagnosis was recorded by class of malocclusion as diagnosed and charted by the orthodontist. The treatment plan was recorded as extraction or non-extraction, Stage I and II or Stage II only. When extractions were planned, the extraction formula was recorded. The estimated time of treatment and actual treatment times were noted. The orthodontic appliances used, by manufacturer and type of bracket were identified. Data was also collected

Direct Cost Items

- type of orthodontic appliance
- functional appliance
- laboratory fees
- upper retainer
- lower retainer
- headgear
- records
  - radiographs
  - photographs/slides
  - models
- elastics
- wires
- chair time cost
  - orthodontist salary
  - orthodontic assistants' salaries
  - orthodontic assistants' payroll taxes
  - orthodontic assistants' pension contributions
  - orthodontic assistants' benefits

Indirect Cost Items

- depreciation
- auto
- rent
- utilities
- maintenance
- laundry
- telephone
- insurance
- interest
- legal and accounting fees
- marketing
- continuing education
- meals and entertainment
- dues and subscriptions
- insurance, malpractice
- insurance, medical
- office supplies
- taxes and licenses
- clerical salaries
- clerical payroll taxes
- clerical benefits
- bank fees

Full cost = direct cost + fair share of indirect costs.

Figure 5. Direct and Indirect Cost Items

on the use of elastics, type and duration. Headgear use was noted with the type of headgear prescribed. The use of functional appliances and type was recorded. Laboratory requirements included RPE's, W-arches, quad helixes, positioners, mouthguards, cross-bite appliances, lingual holding arches, upper retainer type, lower retainer type, biteplanes, and tongue cribs. The use of any of these items was recorded for each patient. The type and number of wires used was also recorded. Oral hygiene was recorded as poor, fair, good, excellent or unknown, as that information was available in the chart. Cooperation was graded poor, fair, good or excellent based upon the number of missed appointments, broken appliances, headgear wear and elastic wear.

The number and types of appointments were recorded for each patient. For example, a patient may have a total of 30 visits to the practice. This was recorded by breaking these visits into type of appointment, i.e., new patient exam, consult, records, archwire change, retie, etc. The number of each type of visit was then recorded. Stage I and Stage II visits were recorded separately, so the costs for each stage of treatment could be determined later. A typical appointment record history is seen in Figure 6. Since the last 50 debands were used in the selection of charts for auditing, no retention information was recorded beyond placement of the retainers following treatment. It was also felt that retention reflects an individual practitioner's philosophy regarding the type and length of retention for his/her patients, therefore costs post-treatment can vary significantly based on these factors. For purposes of this study, then, cost data was collected through the placement of retainers, but not beyond.

Once the chart audit was completed for each patient, the direct cost items for each had been identified. An example of this can be seen in Figure 7. These items were costed out and the cost recorded for each patient. The accounts

Appointment Breakdown

Type of Appointment	Stage I	Stage II
Initial Exam	1	
Initial Exam/Records		
Consult		
Consult/Seps/Imp	1	
Seps	1	
Impressions		
Impressions/Retie		
Band		
Bond - Partial	1	
Bond Partial/Place TPA		
Bond - Full Arch x1		
Bond - Full Arch x 2		1
Band/Bond - Full Arch x 2/HG		
Band/Bond - Full Arch/HG		
Band Full + TPA		
Change AW		4
Adj AW		
Retie	1	9
Retie/HG	4	
RPE/Quad Helix/W-Arch/Other	1	
HG	1	
Records	1	
Records - Progress	1	
Records, Final		
Records, Final + Clear Retainer		
Missed Appointments		
Changed Appointments	2	3
Broken Appliances	0	1
Debonding Partial	1	
Debonding - Full		
Debonding Full x 2		
Debonding - Full x 2/Imp		1
Debonding - Full x2 Records/Retain		
Retainers		
Retainers/Records	1	1
Observation	2	
Total Number of Appointments	19	20
No. of Missed Appointments	0	0
No. of Changed Appointments	2	3

Figure 6. A Typical Appointment Record History with a Patient Having Both Stage I and Stage II Treatment

Direct Cost Items		Direct Cost
Type of Appliance:		
	A-Company	
Headgear, cervical		
Class II elastics, 5 months		
↓ bonded 2-2 retainer		
↑ active retainer		
↑ Hawley retainer		
Wires:		
.016 Niti ↑		
.016 Niti ↑		
.016 Niti ↓		
.018 Australian ↑		
.018 Australian ↓		
.019 x 025 SS ↑		
.019 x 025 SS ↓		
Appointments		
Initial Exam	1	
Consult	1	
Seps	2	
Impressions	1	
Band	1	
Bond full x2 + HG	1	
Retie	9	
AW Adj	4	
Records	1	
Missed Appt	1	
Broken Appliance	4	
Debond, Retainers, Records	1	
Retainers	1	

Figure 7. An Example of All Direct Costs Items for Patient 8, Office 2

payable records were reviewed for each office. When necessary, manufacturers were contacted directly to verify their prices for goods received.

To calculate the cost of the type of appliance used it was necessary to record the manufacturer and type of bracket, how many and which teeth were banded or bonded, and the use of ceramics. Careful note was made of extractions in calculating the cost of the appliance. Banding or bonding of second molars was noted during the chart audit so these costs could be included. In all, six orthodontic manufacturers were represented in the study. The cost of appliances ranged from a low of $53.36 up to $116.69. Items such as headgear, cervical, high-pull, straight, or J-hook, were costed out by using the accounts payable data or direct contact with the manufacturer. Wire costs, laboratory fees, cost of retainers, etc., could all be determined in the same manner.

The cost for records was a function of the composition of records for each office. The number and type of radiographs, slides, photographs and models was gathered for initial, progress and final records for each office. The cost of x-ray film, slide film, processing costs, impression material and lab model fees was applied to the record cost and recorded for each patient, according to the number and type of records they had done.

As stated earlier, the number and type of appointments, Stage I and Stage II, was recorded for each patient. To convert this information into a dollar figure it was necessary to obtain several other items of information. Each appointment represents the utilization of services provided by the orthodontist and the orthodontic assistant. For each appointment type, the average number of minutes spent by the orthodontist to provide this service was obtained by interview with the orthodontist and his office. The average number of minutes spent by the orthodontic assistant to complete the appointment type was also requested. Once the number of minutes for each type of appointment was determined by both the orthodontist and orthodontic assistant, the cost per minute was calculated. The cost per minute of the orthodontist's time was calculated by taking the total number of

minutes worked that year and dividing it into the annual salary. The resulting cost per minute was used as a multiplier against the number of minutes of orthodontist's time required for each appointment type. The cost per minute of the orthodontic assistant's time was calculated in a similar manner, with the exception that payroll taxes, benefits, and pension plan contributions were added to the annual salary before the cost per minute was calculated. An example to illustrate the methodology is seen in Figure 8. It should be noted that the benefits and pension plan contribution costs for the orthodontists were not included in calculating their per minute costs. These costs are highly variable by both practice and practice philosophy. They can be considered to be part of the profit portion in this study.

It was necessary to calculate the dollar cost for each type of appointment for each office. Once the cost was determined, the total cost for appointments for each patient was calculated based on the appointment record history obtained through the chart audit. The total direct costs for appointments, or chair time, were thereby determined. An example can be seen in Figure 9. This completed the compilation of direct costs attributable to each patient.

Up to this point only those items and associated costs that could be tracked to a specific patient were accounted for. These are all direct costs. Full costs for providing care must include a fair share of the indirect costs, as well as the direct costs. Indirect costs are usually also fixed costs, i.e., they do not change in response to changes in volume. Indirect costs are overhead expenses that are incurred to operate the practice. They continue even if no patients are seen. A portion of these expenses must be allocated to each patient to meet the financial requirements of the practice. An allocation methodology is used to allocate indirect overhead to patients.

Appointment Type: Initial Exam

1. Orthodontist time required = 20 minutes
2. Orthodontic assistant time required = 30 minutes
3. Orthodontist per minute cost =

$$\frac{48 \text{ weeks}}{\text{year}} \times \frac{32 \text{ hours}}{\text{week}} \times \frac{60 \text{ minutes}}{\text{hour}} = 92{,}160 \text{ minutes}$$

Annual Salary = $175,000

$175,000 ÷ 92,160 minutes = $1.90/minute

4. Orthodontic assistant per minute cost =

$$\frac{49 \text{ weeks}}{\text{year}} \times \frac{32 \text{ hours}}{\text{week}} \times \frac{60 \text{ minutes}}{\text{hour}} = 94{,}080 \text{ minutes}$$

Annual salary + benefits + pension plan contributions + payroll taxes = $29,435

$29,435 ÷ 94,080 minutes = .31/minute

Appointment cost for initial exam = #1 x #3 + #2 x #4

= 20 x 1.90 + 30 x .31

= 38.00 + 9.30

= **$47.30**

Figure 8. Appointment Cost Determination Example

Office #1
Patient #50

Appointment Breakdown

Type of Appointment	Stage I	Stage II	Cost of Appointment Type	Total
Initial Exam	1		88.00	88.00
Initial Exam/Records				
Consult				
Consult/Seps/Imp	1		103.15	103.15
Seps	1		15.70	15.70
Impressions				
Impressions/Retie				
Band				
Bond - Partial	1		32.95	32.95
Bond Partial/Place TPA				
Bond - Full Arch x1				
Bond - Full Arch x 2		1	158.55	158.55
Band/Bond - Full Arch x 2/HG				
Band/Bond - Full Arch/HG				
Band Full + TPA				
Change AW		4	36.79	147.16
Adj AW				
Retie	1	6	25.74	180.18
Retie/HG	4		32.95	131.80
RPE/Quad Helix/W-Arch/Other	1		94.20	94.20
HG	1		42.45	42.45
Records	1		100.19	100.19
Records - Progress	1		100.19	100.19
Records, Final				
Records, Final + Clear Retainer				
Missed Appointments				
Changed Appointments	2	3	0	
Broken Appliances	0	1	66.25	66.25
Debonding Partial	1		54.67	54.67
Debonding - Full				
Debonding Full x 2				
Debonding - Full x 2/Imp		1	159.55	159.55
Debonding - Full x2 Records/Retain				
Retainers				
Retainers/Records	1	1	76.08	152.16
Observation	2		45.55	91.10
			Total Appointment Cost	$ 1,718.25

Figure 9. Total Appointment Cost Determination Example

The indirect cost allocation for this study was done using two allocation methods; one based on the minutes of chair time required by the patient and one based on the number of new cases seen annually. See Figure 10.

Indirect cost items that were fixed costs, i.e., costs that do not vary with volume, were allocated based on the number of minutes of chair time consumed by the patient. The number of minutes of chair time was previously calculated through the chart audit performed to obtain the direct costs, so this figure was readily available. Chair time is typically a good methodology for allocating fixed equipment costs, etc.

Some indirect costs are more semivariable in nature than fixed, or have a semivariable component. Semivariable costs are a third type of cost category being neither fixed or variable. Semivariable costs vary in the same direction as volume but not proportionally. For example, if the number of new patients increased by 25%, the semivariable costs would also increase, but by a percentage less than 25%. Any indirect costs of the practice that could have a semivariable component were allocated using the number of new cases seen for that year. Using a combination of both allocation methodologies recognizes that while the total amount of indirect costs to be allocated is fixed, the average fixed cost per patient decreases with increasing volume. The total amount of indirect costs to be allocated for each practice was obtained from the corporate tax return or schedule C. When available, annual financial statements were reviewed. The indirect cost items were then divided into those items to be allocated by chair time and those to be allocated by the volume of new cases. See Figure 11 for an example of the indirect cost allocation methods used. Using two allocation methodologies resulted in two components of indirect costs. For patients within the same practice, the amount allocated based on case volume was the same for all patients. The amount allocated to the patient based on chair time varied with the amount of chair time required to

Indirect Cost Allocation Methodologies

1. Indirect cost items allocated by minutes of chair time:

   depreciation
   rent
   utilities
   maintenance
   laundry
   telephone

2. Indirect cost items allocated by the number of new cases annually

   insurance
   interest
   legal and accounting fees
   marketing
   continuing education
   meals and entertainment
   dues and subscriptions
   office supplies
   taxes and licenses
   clerical salaries
   clerical payroll taxes
   clerical benefits
   bank fees

Figure 10. Indirect Cost Allocation

Indirect Cost Allocation

Example: Office #3
Patient 12

1. Items allocated by minutes of chair time:

depreciation	$10,000
rent	18,000
utilities/telephone	6,000
laundry	850
maintenance	2,500
	$37,000 = Total amount of indirect cost to be allocated by this method

For Office 3, patient 12, 500 minutes of chair time were required.

The total number of minutes available = 72,000

The % of chair time annually = .71%

$37,000 x =.71% = $262.50

2. Items allocated by the number of new cases:

insurance	4,500
interest	50
legal and accounting	1,000
office supplies	10,000
taxes, license	1,200
clerical salaries	16,000
clerical payroll taxes	3,500
clerical pension benefits	4,000
dues and subscriptions	2,000
continuing education	1,500
	$44,250 = Total amount of indirect cost to be allocated by this method

New case volume = 200

Amount to be allocated to each patient = $\frac{\$44,250}{200}$ = $221.25

The total indirect costs for patient 12, Office 3 are $262.50 + $221.25 = $483.75

Figure 11. Indirect Cost Allocation Example

treat that patient. As can be seen in Figure 11, the percentage of the orthodontist's annual chair time available used by the patient was multiplied by the total amount of indirect costs to be allocated in that category. Indirect costs were thus figured for each of the 150 patients studied.

The full cost of care for the patients studied were arrived at by totaling their direct costs and their portion of indirect costs, both determined by cost accounting as described. Once the full costs were known, they could be used to answer the question, "Is the cost of providing care the same for all classes of malocclusion?"

Results

For the 150 patients in this study, all data collected on the chart audit form, Appendix A, was entered into the computer. Costs for each patient, as determined by the cost accounting methods described, were entered next. Each patient name was given an identification number. The practice in which the patient had been treated was coded by office number 1, 2 or 3. Once data entry and cost calculations were completed, the data could be sorted by office, diagnosis, individual patient profile and so on. An example of this is seen in Table 1 which shows the average cost per case by office.

The dependent variable of interest in this study was the mean total cost of treatment. When looked at by mean total cost of treatment by class of malocclusion, the means for each group are seen in Table 2 and Figure 12. Analysis of variance was used to test whether the means of the three groups, Class I, Class II and Class III malocclusions were identical. At $p < .05$, the conclusion was that the mean total costs for treatment of Class I, II and III malocclusions were not identical.

Additional statistical tests were run to identify whether all of the means were different from one another or if only some of them were different See Table 3. Pairwise comparison using two-sample t-tests showed the mean total costs for treatment of Class I and Class II cases, and Class I and Class III cases, were statistically different at the $p < .05$ level. Since performing multiple t-tests increases the chance of a Type I error, the Bonferroni correction was used to ensure the overall level of significance at $p = .05$. This confirmed that the mean total treatment costs for Class I and Class III cases were statistically different at $p < 0.5$, but did not reflect the t-test's cost differences between Class I and II cases. It should be kept in mind that the Bonferroni modification is very conservative in nature, can lack power, and may fail to detect a difference in means that actually

Table 1. Average Cost per Case by Office

Module: MEANS, Descriptive Statistics
File: MALOCC, ADDED FILE MALOCC1, 2, 3 COST

Dependent variables:

APPTCOST, Total cost of appointments
PG1COST, Appliance plus headgear, etc., cost
WIRECOST, Total cost of wires
DIRECT, APPTCOST + PG1COST + WIRECOST
TIMECOST, Case's % of DR time x indirect time cost
INDIRECT, Timecost + per case indirect add-on
TOTCOST, Total cost: Direct + Indirect
FEES, Total charges, sum of fee variables
PROFIT

Office = 1

Variable	N	Mean
DIRECT	50	1674.84
INDIRECT	50	386.97
TOTCOST	50	2061.82
FEES	50	3733.98
PROFIT	50	1672.15

Office = 2

Variable	N	Mean
DIRECT	50	1188.39
INDIRECT	50	537.28
TOTCOST	50	1725.67
FEES	50	3448.00
PROFIT	50	1722.33

Office = 3

Variable	N	Mean
DIRECT	50	1156.74
INDIRECT	50	695.18
TOTCOST	50	1859.13
FEES	50	3745.00
PROFIT	50	1893.06

Table 2. Analysis of Variance Mean Total Cost Comparison of Class I, Class II and Class III Malocclusions

ANOVA: Analysis of Variance

Dependent variables: TOTCOST, TOTAL COST: DIRECT + INDIRECT

	D	N	Mean	SD
Overall	*	150	1879.81	401.15
Class I	1	54	1768.91	323.54
Class II	2	80	1917.37	403.08
Class III	3	16	2066.33	533.00

* Indicates values have been collapsed over this factor

Observations with missing dependent variables: 0
Observations wtih incompatible level codes: 0

Analysis of Variance — Sums of squares based on unique variance

Source	DF	SS (U)	MSS	F	P
Between Subjects	149	23978373.35158			
D (DENTALDX)	2	1333650.43112	666825.21556	4.329	0.0149
Error 1	147	22644722.92046	154045.73415		

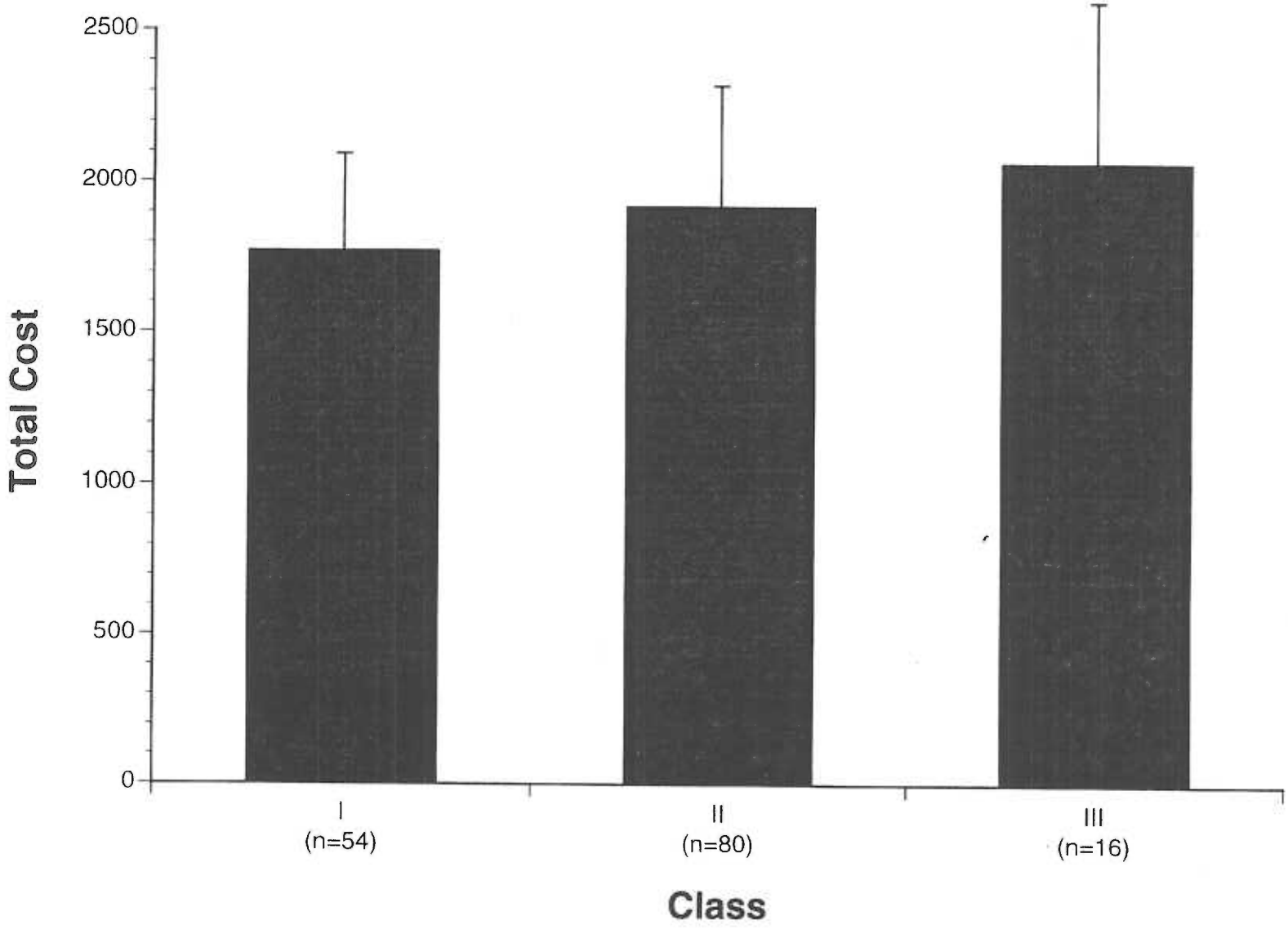

Figure 12. Total Cost: Mean and Standard Deviation, by Cost

Table 3. Pairwise Comparisons of Mean Total Treatment Costs by Class of Malocclusion

Pairwise Comparisons of Means for Factor D (DENTALDX)

Group	Level Code	Label	N	Mean
1	1	Class I	54	1768.91
2	2	Class II	80	1917.37
3	3	Class III	16	2066.33

P-values for pairwise comparisons (not shown if P > 0.0500)

Groups Compared	Bonferroni	T-test
1 < 2		0.0334
1 < 3	0.0259	0.0086
2 < 3		

With the data that was available, it was possible to go beyond looking at mean total treatment costs by malocclusion alone. The cost data was sorted by class of malocclusion and treatment plan, extraction or nonextraction. The mean total treatment costs for Class I extraction cases, Class I nonextraction cases, etc., can be found in Table 4, arranged in ascending order of mean total treatment costs. Figure 13 also illustrates this data.

A two-factor analysis of variance test was used to test whether there was a difference between extraction and nonextraction treatment plans for each class of malocclusion when considering total treatment costs. As seen in Table 5, there was a statistically significant difference in means at $p < .05$. Further statistical tests showed that for Class I and Class III malocclusions, the mean total costs for treatment were not statistically different for nonextraction versus extraction treatment. In Class II cases, there was a statistically significant difference in mean total costs between the nonextraction group and the extraction group at $p < .05$. The mean total cost for Class II extraction cases was $1797 versus $1986 for nonextraction treatment.

When nonextraction cases were looked at, the mean total cost by class of malocclusion was statistically significant at $p < .05$. For extraction cases, there was no statistically significant difference in mean total treatment costs by class.

Result of analysis of variance tests can also be used to compare costs by class for each treatment plan, extraction verse nonextraction, separately. Looking at nonextraction cases, the mean total cost by class of malocclusion was statistically significant at $p < .05$. In other words the total cost of treatment for nonextraction cases depended on the class of malocclusion. On the other hand, for extraction cases, there was no statistically significant difference in mean total costs by class. It should be noted that the given data for extraction cases was about half the sample size as for nonextraction cases. This could have influenced the strength of the

Table 4. Mean Total Costs by Class of Malocclusion and Treatment Plan

Mean Total Cost of Treatment In Ascending Order	Class of Malocclusion and Treatment Plan
$ 1721.74	Class I, nonextraction cases
$ 1796.94	Class II, extraction cases
$ 1903.67	Class I, extraction cases
$ 1985.84	Class II, nonextraction cases
$ 2061.28	Class III, nonextraction cases
$ 2068.62	Class III, extraction cases

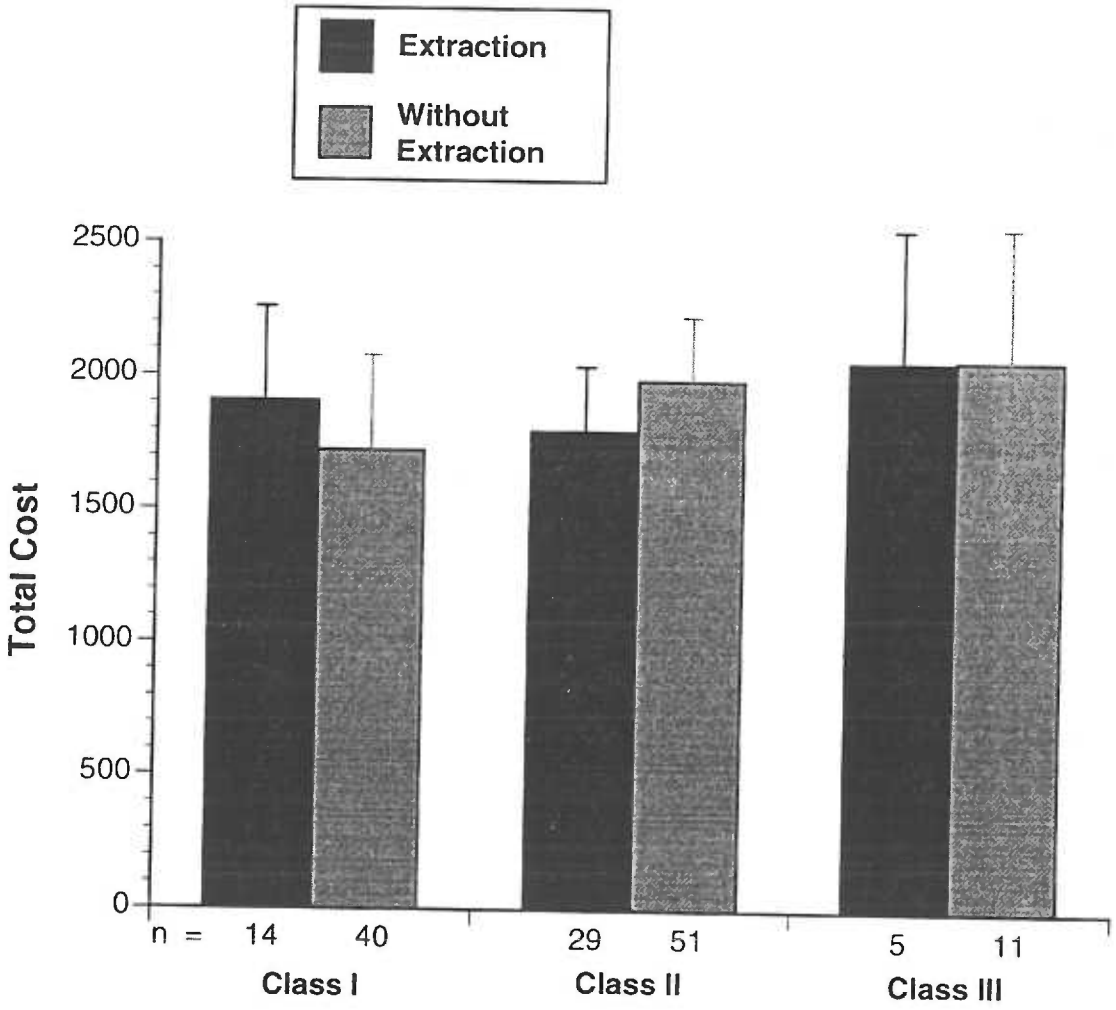

Figure 13. Total Cost: Mean and Standard Deviation by Class and Treatment Plan

Table 5. Analysis of Variance Mean Total Cost Comparison by Class of Malocclusion and Treatment Plan

ANOVA: Analysis of Variance

Dependent variables: TOTCOST, TOTAL COST: DIRECT + INDIRECT

		D	T	N	Mean
Overall		*	*	150	1879.81
D	Class I	1	*	54	1768.91
	Class II	2	*	80	1917.37
	Class III	3	*	16	2066.33
T	Extraction	*	1	48	1855.61
	Nonextraction	*	2	102	1891.20
DT		1	1	14	1903.67
		1	2	40	1721.74
		2	1	29	1796.94
		2	2	51	1985.84
		3	1	5	2061.28
		3	2	11	2068.62

Analysis of Variance — Sums of squares based on unique variance

Source	DF	SS (U)	MSS	F	P
Between Subjects	149	23978373.35158			
D (DENTALDX)	2	665075.43794	332537.71897	2.213	0.1131
T (TXPLAN)	1	463.39329	463.39329	0.003	0.9558
DT	2	920774.02072	460387.01036	3.063	0.0498
Error 1	144	21641605.43213	150288.92661		

Simple Main Effects

Source	DF	SS (U)	MSS	F	P
D at T1	2	343656.55995	171828.27998	1.143	0.3216
D at T2	2	1951767.29600	975883.64800	6.493	0.0020
Error	144	21641605.43213	150288.92661		
D at D1	1	343259.30912	343259.30912	2.284	0.1329
D at D2	1	659673.01987	659673.01987	4.389	0.0379
D at D3	1	185.15933	185.15933	0.001	0.9720
Error	144	21641605.43213	150288.92661		

evidence, preventing us from concluding that class was not a cost factor in extraction cases.

Once the analysis of variance showed there was a difference in mean total treatment costs between the three classes of malocclusion, the question was raised as to whether there was a statistically significant difference in the amount of time required, as expressed by doctor minutes, between the classes of malocclusion. In other words did the total cost vary as a reflection of doctor time required? While Table 6 shows an increasing number of mean doctor minutes required from Class I to Class II to Class III cases, this was not significant at the $p = .05$ level. This would suggest that the practices' cost per minute was a larger factor than the number of minutes themselves in determining total costs. A look at the standard deviations may also lead one to conclude that extended treatment times on one or two cases may have resulted in the fact that there was no statistical difference in mean treatment times by class of malocclusion.

Since information regarding the fees charged for each case was recorded during the chart audit process, it was possible to look at profitability in a number of different ways. The obvious first question asked was whether there was a corresponding difference in mean total profit by class of malocclusion, as a reflection of the difference in mean total <u>costs</u> that we saw. An analysis of variance test was done using the dependent variable of profit. With a p level $> .05$, the difference in mean profit by class was shown not to be statistically significant. See Table 7. This result was not particularly surprising in light of the fact that pricing of orthodontic cases is typically done based on the need for Stage I and Stage II treatment versus Stage II treatment alone, rather than fees being based on the underlying costs involved in providing the care. This illustrates clearly the difference between market driven pricing and cost based pricing. The cost based

Table 6. Mean Doctor Minutes by Class of Malocclusion

ANOVA: Analysis of Variance

Dependent variables: APPTMINS, ST1MINS + ST2MINS

		D	N	Mean	SD
Overall		*	150	271.86	177.44
D	Class I	1	54	243.25	165.43
	Class II	2	80	284.92	182.86
	Class III	3	16	303.16	187.21

Analysis of Variance — Sums of squares based on unique variance

Source	DF	SS (U)	MSS	F	P
Between Subjects	149	4691195.44833			
D (DENTALDX)	2	73514.49208	36757.24604	1.170	0.3132
Error 1	147	4617680.95625	31412.79562		

Table 7. Analysis of Variance, Mean Total Profit by Class of Malocclusion

ANOVA: Analysis of Variance

Dependent variable: PROFIT

		D	N	Mean
Overall		*	150	1762.52
D	Class I	1	54	1741.35
	Class II	2	80	1791.70
	Class III	3	16	1688.05

Analysis of Variance — Sums of squares based on unique variance

Source	DF	SS (U)	MSS	F	P
Between Subjects	149	38222179.53776			
D (DENTALDX)	2	181038.14759	90519.07379	0.350	0.7054
Error 1	147	38041141.39017	258783.27476		

approach is usually the starting point for most health care providers. Orthodontists, however, have traditionally used the market driven approach.

Next the sample of 150 patients was divided into two groups. Group 1 had Stage II treatment only while Group 2 had both Stage I and Stage II treatment. Group 1 consisted of 121 patients while Group 2 had 29 patients. Using a t-test for independent groups, the mean total cost was compared as shown in Table 8. Findings showed a very statistically significant difference in mean total costs for the two groups with $p < .01$. In dollar amounts, Group 2, those having both Stage I and Stage II treatment, averaged an additional $508.88 in costs.

Using a t-test for independent groups again, Group 1 and Group 2 were compared based on the mean total fees charged. See Table 9. Again, there was a statistically significant difference in means for the two groups. Those patients in Group 2, receiving both Stage I and Stage II treatment, were charged an average of $369.81 more for their treatment. A quick look at the mean fees charged versus the mean total cost shows that although these cases were, on average $508.88 more expensive to treat, the fees charged for the treatment were less than the margin of incremental costs at $369.81. On average then, Stage I and II cases were $149.07 less profitable than their Stage II counterparts. This does not take into account the variability among practitioner philosophies regarding the comprehensiveness of Stage I care and associated costs. In other words, for some orthodontists, Stage I means a headgear and bite plate, while for others, Stage I may include numerous observation appointments, headgear, biteplate and upper and lower partial appliances. Clearly the profitability of doing Stage I treatment is impacted by the level of service provided. As can be seen by the data above, it is important to charge appropriately for this level of care to cover the costs associated with it. It is highly likely that some individual patients within the Group 2 sample were provided Stage I care without the practitioner recouping the costs for providing that care.

Table 8. Mean Total Costs for Stage I and Stage II Treatment Vs. Stage II Only Treatment Groups

TTEST. Independent Groups t-tests

TOTCOST, TOTAL COST: Direct + Indirect

	N	Mean	SD		Separate Variances	Pooled Variances
Group 1:	121	1781.426	274.718	L95% :	-727.989	-651.054
Group 2:	29	2290.309	562.646	U95% :	-289.797	-366.712
Difference:		-508.883	71.944			
				T :	-4.737	-7.073
Test of Group 1 ± > = Group 2 ± >				DF :	31.3	148
F (28, 120) = 4.195 P < 0.0000				P :	0.0000	0.000

Group 1 = Stage II Treatment Only
Group 2 = Stage I and Stage II Treatment

Table 9. Mean Total Fees for Stage I and Stage II Treatment Vs. Stage II Only Treatment Groups

TTEST. Independent Groups t-tests

FEES, TOTAL CHARGES, SUM OF FEE VARIABLES

	N	Mean	SD		Separate Variances	Pooled Variances
Group 1:	121	3570.818	407.023	L95% :	-613.181	-555.068
Group 2:	29	3940.690	613.189	U95% :	-126.561	-184.675
Difference:		-369.871	93.717			
				T :	-3.089	-3.947
Test of Group 1 ± > Group 2 ± >				DF :	34.1	148
F (28, 120) = 2.270 P < 0.0024				P :	0.0040	0.0001

Group 1 = Stage II Treatment Only
Group 2 = Stage I and Stage II Treatment

This deficit is often made up by fees incurred for Stage II treatment, however, it assumes that the patient stays in the practice for Stage II care. We know that this does not always occur.

Using the same groups once more, the costs of providing Stage II treatment appointments was identified. The mean total Stage II appointment costs for Group 2, those having Stage I treatment prior to Stage II, were $410.58 less than those having Stage II treatment only. This was statistically significant at the $p < .01$ level. See Table 10. This would tend to support those who maintain that Stage II treatment following Stage I care makes for an "easier" case. It would also follow that perhaps it is appropriate to charge the Stage I/Stage II patient less for Stage II care than those having Stage II alone, keeping in mind that the fees for Stage I need to be high enough to cover the costs incurred, as noted above.

Multiple regression analysis was used to determine if there were any known variables that could help predict the total treatment cost per case. The single most important variable in predicting total cost was the total number of appointments. This variable alone explains 56.4% of the total costs. See Table 11. The second most important variable in predicting total cost was the type of appliance used during treatment. With the addition of this variable, the multiple regression model was able to predict 67% of the total costs. See Table 12.

With this data the variable of type of appliance was more closely examined. As noted earlier, there were six types of appliances used in this study. Three types of appliances, A-Company, GAC and Ormco, represented 92% of the sample size, or 137 cases. Table 13 illustrates the mean total cost of treatment by type of appliance. Mean total costs of treatment were lowest with A-Company applicances at about $100 less per case than GAC, and $370 less per case than Ormco. Analysis of variance was used to test whether the means of the three groups

Table 10. Mean Stage II Appointment Costs by Those Patients Having Stage I and Stage II Treatment Versus Those Having Stage II Treatment Only

TTEST. Independent Groups t-tests

STAGE II COST

	N	Mean	SD		Separate Variances	Pooled Variances
Group 1:	121	1135.010	335.332	L95% :	257.366	270.499
Group 2:	29	724.426	373.441	U95% :	563.803	550.670
Difference:		410.584	70.889			
				T :	5.420	5.792
Test of Group 1 ± > = Group 2 ± >				DF :	39.5	148
F (28, 120) = 1.889 P < 0.0197				P :	0.0000	0.0000

Group 1 = Stage II Treatment Only
Group 2 = Stage I and Stage II Treatment

Table 11. Multiple Regression Analysis of Total Costs: Total Number of Appointments

MULTIPLE REGRESSION ANALYSIS

Step 1

Dependent variable: TOTCOST, TOTAL COST: Direct + Indirect

Variable entered: TOTAPPTS, Total Number of Appointments

Multiple R	0.7512
R-square	0.5643
Adjusted R-square	0.5613
Standard Error	268.8524
Standard Error	268.8524

Analysis of Variance

Source	DF	SS	MSS	F	P
Regression	1	13388089.67	13388089.7	185.221	0.0000
Residual	143	10336268.48	72281.598		

Variables in the model

Variable	B	Standard Error	Beta	Squared Partial	Squared Semi-Partial	F-to-Remove	P
TOTAPPTS	27.57794	2.02636	0.751	0.5643	0.5643	185.221	0.0000
Const.	971.78839	70.15417	0			191.883	0.0000

Table 12. Multiple Regression Analysis of Total Costs: Total Number of Appointments and Type of Appliance

MULTIPLE REGRESSION ANALYSIS

Step 2

Dependent variable: TOTCOST, TOTAL COST: Direct + Indirect

Variable entered: Type of Appliance

Note: Maximum P-to-enter: .1
Minimum P-to-remove: .1

Multiple R	0.8186
R-square	0.6701
Adjusted R-square	0.6651
Standard Error	235.8906

Analysis of Variance

Source	DF	SS	MSS	F	P
Regression	2	14695477.38	7347738.69	132.048	0.0000
Residual	130	7233769.080	55644.378		

Variables in the model

Variable	B	Standard Error	Beta	Squared Partial	Squared Semi-Partial	F-to-Remove	P
TOTAPPTS	27.65639	1.90949	0.731	0.6174	0.5323	209.777	0.0000
ORMCOAPL	306.87802	47.44581	0.326	0.2435	0.1062	41.835	0.0000
Const.	892.94403	65.26725	0			187.179	0.0000

Table 13. Mean Total Cost of Treatment by Type of Appliance

Dependent variable: TOTCOST, TOTAL COST: Direct + Indirect

	T	N	Mean	SD
Overall	*	137	1860.98	401.64
A COMPANY	3	50	1725.67	248.18
T GAC OR GAC OMNI	1	50	1823.04	426.54
ORMCO/ORMCO MINI	2	37	2095.10	440.66

were identical. See Table 14. At $p < .01$, the conclusion was that the mean total costs for treatment were different based on the type of appliance used.

Pairwise comparison using two-sample t-tests showed that the mean total costs for treatment by A-Company and Ormco appliances were statistically significant at $p < .01$. See Table 15. Likewise, GAC and Ormco appliances showed statistically significant differences in mean total treatment costs at $p < .01$. Since performing multiple t-tests increases the likelihood of making a Type I error, the Bonferroni correction was used to ensure overall significance at $p < .05$. This confirmed the results as stated.

It should be noted that while there was overlap between offices in the type of appliances used, a prospective study designed to control for this variability between practitioners would be ideal to look at this variable closer, particularly in light of the fact that type of applicance was second only to number of appointments in predicting total treatment costs. This should illustrate clearly that examining only the acquisition price of brackets and bands outside of the context of total treatment cost is shortsighted. Appliance selection must also look at the clinical benefits, such as efficiency of use, comfort of the practitioner with the appliance, and repeatedly reliable results. This study shows that cost, and ultimately profitability, is tied to the number of appointments, i.e., the doctor time necessary to complete the case. An appliance that works well for a given orthodontist is much better than a number of different appliances purchased simply on the basis of initial cost.

Returning back to our multiple regression model, two other variables, cooperation and age, increased our ability to predict costs to 69.4%. See Table 16. While not nearly as important as the total number of appointments or type of appliance, the age variable was interesting as it showed a decrease of $9.65 in cost for every one year increase in age. This would mean a 10-year-old would cost

Table 14. Analysis of Variance of Mean Total Cost by Type of Appliance

ANOVA, Analysis of Variance

Dependent variable: TOTCOST, TOTAL COST: Direct + Indirect

	T	N	Mean	SD
Overall	*	137	1860.98	401.64
T GAC OR GAC OMNI	1	50	1823.04	426.54
ORMCO/ORMCO MINI	2	37	2095.10	440.66
A COMPANY	3	50	1725.67	248.18

* Indicates values have been collapsed over this factor

Observations with missing dependent variables: 0
Observations with incompatible level codes: 13

Analysis of Variance — Sums of squares based on unique variance

Source	DF	SS (U)	MSS	F	P
Between subjects	136	21939042.16991			
T (TYPEAPPL)	2	3015491.72702	1507745.86351	10.677	0.0000
Error 1	134	18923550.44289	141220.52569		

Table 15. Pairwise Comparison of Mean Total Cost by Type of Appliance

Pairwise Comparisons of Means for Factor T (TYPEAPPL)

Group	Level Code	Label	N	Mean
1	1	GAC OR GAC OMNI	50	1823.04
2	2	ORMCO/ORMCO MINI	37	2095.10
3	3	A COMPANY	50	1725.67

P-values for pairwise comparisons (not shown if P > 0.0500)

Groups Compared	Bonferroni	T-test
1 < 2	0.0033	0.0011
1 > 3		
2 > 3	0.0000	0.0000

Table 16. Multiple Regression Analysis of Total Costs: Total Number of Appointments, Type of Appliance, Age and Cooperation

MULTIPLE REGRESSION ANALYSIS

Step 4

Dependent variable: TOTCOST, TOTAL COST: Direct + Indirect

Variable entered: AGEYR, AGE: YEARS

Note: Maximum P-to-enter: .1
Minimum P-to-remove: .1

Multiple R	0.8330
R-square	0.6940
Adjusted R-square	0.6844
Standard Error	228.9796

Analysis of Variance

Source	DF	SS	MSS	F	P
Regression	4	15217994.15	3804498.54	72.561	0.0000
Residual	128	6711252.307	52431.659		

Variables in the model

Variable	B	Standard Error	Beta	Squared Partial	Squared Semi-Partial	F-to-Remove	P
TOTAPPTS	28.90272	2.02160	0.764	0.6149	0.6149	204.403	0.0000
AGEYR	-9.65630	4.18212	-0.115	0.0400	0.0400	5.331	0.0225
COOPERAT	51.50580	21.83395	0.126	0.0417	0.0417	5.565	0.0198
TYPE APPL	300.44981	46.10565	0.320	0.0320	0.1015	42.465	0.0000
Const.	871.59100	110.97802	0			61.681	0.0000

$289.50 more to treat than a 40-year-old. No other factors were found to be statistically helpful in predicting total treatment costs.

Discussion

Why should we be concerned about treatment costs?

As orthodontists, we are a part of a larger health care environment which has seen rapid changes in the last 30 years. We are increasingly being impacted by those changes and, as a group used to traditional fee-for-service practice, we need to be aware of how these changes are likely to impact our practices. A brief historical review is important to our understanding of how we got where we are today.

Health and dental insurance benefits received through employers is the most common mode of gaining health and dental coverage for the majority of Americans under the age of 65. What now is commonplace did not exist before the 1930s when insurance companies first began offering these types of coverage to employer groups. Started by hospital associations during the Depression, Blue Cross was the pioneer in providing coverage to employer groups. This helps explain their continued dominance in the health care insurance market in many regions of the country. Commercial insurers entered the health insurance market by the late 1930s.

National health insurance plans, also known as universal health insurance, were proposed during the New Deal and Truman years, but failed to pass Congress. During World War II, wage and price controls were in place, however, these exempted employer-paid health insurance premiums. The federal tax code at that time excluded employers' contributions for health insurance from taxable income to the employee. These factors along with the strength of the unions in collective bargaining combined to dramatically increase the provision of health insurance by employers. The trend of employer-provided insurance continued to grow through the late 1970s.

In 1965, Medicare and Medicaid legislation was passed by the federal government. The passage of this legislation reflected the increasingly popular public view of access to health care as a right of citizenship. The financial result of this was seen in the dramatic increase in the percentage of our gross national product being spent on health care, from 8% in 1965 to over 13% in 1990. This represents over $800 billion dollars per year, of which approximately 20% is spent on pharmaceuticals, corrective lenses and dental services. Medicare and Medicaid reimbursement, based on fee-for-service, retrospective payment, accelerated the demand and growth of hospitals, medical research, and medical/dental education. Suddenly there was more of everything; more technology, more hospitals, more teaching programs, more patients, more physicians, more dentists and more spending. Throughout the health care industry a common body of beliefs, known as "conventional wisdom," prevailed. See Figure 14. These beliefs helped accelerate costs. Providing the highest quality of care did not often include consideration of the cost of that care. As a result, new facilities and technologies were routinely acquired, with increasing numbers of services provided. Increasing numbers of services were, in turn, a means of receiving increased income through the existing retrospective reimbursement payment system. Both hospitals and physicians profited during this period of time. By the mid-1970s, the uncontrolled growth in costs for health care expenditures became a major concern for business and government, as these two sectors were burdened with many of the costs associated with the system. At that time, 40% of health care expenses were paid by the government. Business bore the majority of costs for health insurance premiums. Corporate and government concerns led to both new modes of providing care and new legislation.

Rather than attempting to overhaul the existing health care system, the government chose to try to control runaway costs through additional regulation. In

1. The number one goal should always be the highest quality of patient care

2. Hospitals do not exist to generate profit, rather their rates should reflect current operating expenses.

3. There is no competition amongst health care providers.

4. Expenses will be reimbursed by insurance by insurance, government or private payers.

5. Increased expenses will be covered by increased reimbursement for care.

Figure 14. The "Conventional Wisdom" of Healthcare

1972, the federal government established utilization review through Professional Standard Review Organizations, or PSROs. These were designed to limit costs of a provider based on a comparison of their costs with their peers. Utilization review examiners looked at practice patterns and clinical decisions retrospectively, both at the hospital and physician levels. Payment could be denied based on their findings. This system ignored any cost/benefit analysis of treatment modalities. While it was effective in curbing expenses in the case of outliers, it was ineffective at addressing routine clinical decisions that made up the bulk of expenses. Besides the existing peer groups, all consisted of hospitals and physicians who were entrenched in a system exemplified by "conventional wisdom."

A second attempt to control costs by the government came in 1974 with the creation of area wide health planning agencies known as Health System Agencies or HSAs. A certificate of need, CON, was required to be approved by the HSA for capital expenditures greater than $150,000. The HSA would advise the state government, after a hearing on the applicant's CON, whether to approve or deny the capital spending program. HSAs sought to curb capital expenses but did not address routine operating expenses. Both utilization review and HSAs added an additional layer of bureaucracy, with minimal effect on total healthcare costs. HSAs and CONs were phased out by the government in 1981.

Businesses, initially concerned with providing benefits to their employees, became increasingly concerned with the costs of those benefits. See Figure 15. Early group health plans were established in the 1930s and 1940s to provide health care services to employees. These group health plans included Kaiser Foundation Health Plan and the Group Health Cooperative of Puget Sound. By the 1950s and 1960s it was reported that these types of plans produced cost savings for health care expenditures as compared to their fee-for-service health insurance counterparts. The group health plan idea was unpopular with many in health care who believed

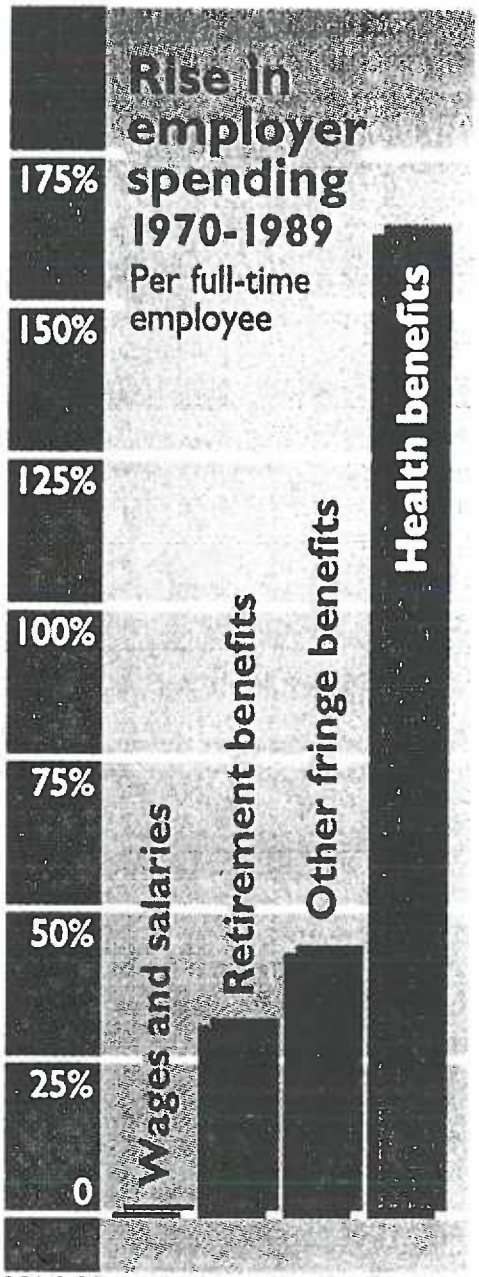

Figure 15. Rise in Employer Spending 1970-1989

group health plans held costs by (1) providing poorer quality of care, (2) forcing members to purchase additional services not provided by the plan elsewhere, and (3) attracting members that were healthier to begin with. Rand Corporation from 1976-1980, conducted a randomly controlled study of health insurance in Seattle, finding a savings of 28% in prepaid group practices as compared to fee-for-service care. No adverse effects on health outcomes were seen. However, it should be noted that prepaid group practice plans are not easy to start. They require a multi-specialty medical/dental group to be established along with a management group to oversee the group practice plan. In the early 1970s, over 30 states had laws that effectively barred prepaid group practice plans, hence few employers offered these services.

With the Nixon administration in 1970, a new approach to the increasing costs of health care was sought. This was the beginning of a national policy supporting the development of prepaid plans, this time in the form of a health maintenance organization, or HMO. This term came from Paul Ellwood, a Minnesota physician who promoted the HMO concept. At that time, the term HMO referred to prepaid group practice plans. A new form of organization, the IPA, or independent practice association, also developed. The IPA was designed to appeal to the traditional fee-for-service provider who contracted with an employer group to provide care. This was paid for by fee-for-service, but at a discounted rate from their usual rate. The employer, or employee, was charged a capitated (fixed) rate for all services, but was required to be seen by an IPA physician or dentist. As compared to HMOs (prepaid group health plans), IPAs are easier to set up but lack central organization and management.

In 1973 the federal government passed legislation to provide start-up grants to HMOs. This legislation also required employers with more than 25 employees to offer at least one HMO to their employees as part of their health insurance plan

choices. Medicare enrollees were encouraged to enroll in HMOs. The results were less than spectacular. Medicare patients simply prefer traditional fee-for-service medicine. The grants program was slow to encourage HMO growth and was eliminated in 1981. The requirement of employers of greater than 25 employees to provide an HMO alternative to employees still exists today. Expansion of the HMO market has resulted, particularly in the western region of the country. The presence of HMOs in the market, initially a response to increasing costs, is probably the single most significant organizational change in healthcare over the past 20 years.

The face of HMOs has changed over that same period of time. HMOs are now generally lumped together with other health care organizational types under the term "managed care." The term managed care includes the HMOs and IPAs previously described. It also includes the gatekeeper plans, those medical and dental plans that use a primary care physician and/or general dentist to control the patients use and selection of specialists, including orthodontists. Another organizational entity is the PPI or PPO, preferred provider insurance or organization. PPIs/PPOs give some selective control to patients regarding providers and give partial out-of-plan payment to enrollees for these services. In some circles, the term managed care also includes any fee-for-service insurance plans that have utilization review. To summarize then, managed care includes HMOs, PPOs, IPAs, and gatekeeper plans. In short, managed care refers to any health plan that limits the choice of providers and regulates their providers regarding treatment decisions in an effort to eliminate "unnecessary" care and reduce costs.

Why doesn't this really happen?

As can be seen, the current concept of managed care is much different from just the prepaid group health plans described earlier. Legislative changes and

provider groups themselves encouraged the development of the alternative plans, IPAs, PPOs, etcetera. This was done as competition for patients increased. "Conventional wisdom" would say that providers do not compete. The truth is that the beliefs held by those in health care 20 and 30 years ago have slowly given way to the reality of the present system. Increasing runaway costs have caught up to us through legislation and a changing marketplace. The present health care system does not provide adequate reimbursement for the highest quality of care if that care is provided regardless of costs. The financial incentives of the past to produce more are no longer reimbursed based on after-the-fact-payment. In 1983, with the introduction of prospective payment by the federal government, hospitals were reimbursed based on diagnosis related groups or DRGs. This put the pressure of cost containment on hospitals as their reimbursement for any one patient was determined by their diagnosis, not the cost incurred. If there were costs incurred beyond reimbursement levels, the hospital absorbed these costs. To maintain profitability, these costs were shifted to other payer groups, particularly commercial insurers. In reality, cost shifting had been occurring for years, as government tried to continually reduce reimbursement prior to DRGs. Cost shifting contributed to rising health insurance premiums in the market with premiums rising as much as 20% per year. Some hospitals developed sophisticated cost accounting systems to enable them to track costs of providing care. Case mix analysis, the ability to compare costs and reimbursement by the type of case, or DRG, gave hospitals the ability to determine what type of patients were most profitable. Based on this information, marketing programs could be developed to (1) attract physicians with those types of patients and (2) market services to discrete niches in the marketplace. Both the ideas of profit and marketing were in direct conflict with the conventional wisdom held by many. For-profit health and hospital corporations flourished during this period as their corporate ideology was

well-suited to taking advantage of the changes in the marketplace. We see a similar pattern occurring in orthodontics today as for-profit corporations continue to come into our market.

As one part of their marketing plan, hospitals and other provider groups continued to develop IPAs, PPOs and other managed care products to capture greater market-share. The variety of plans seen today are a reflection of the attempts to appeal to a greater percentage of the market, with plans designed to appeal to a variety of preference and circumstances.

Dental health care plans, added in employer benefit programs as an additional benefit to employees during the health care expansion period, are also affected by the changes in the larger health care environment. We have seen an expansion of managed care in dentistry, as well. This change often does not sit well with providers. While initially designed based on the prepaid group health plan model described earlier, with the accompanying cost savings for the consumer, managed care is far from it. The term managed care is confusing and often generates negative emotion from many groups, healthcare executives and providers alike. Part of that is due to the fact that managed care seeks to manage costs through demanding discounts from health care providers, including orthodontists. The managed care plan is able to do this because of its patient pool. The plan is sold to employees via their employer. The managed care option is most often slightly less expensive to the employee as opposed to the traditional fee-for-service insurance plan. It is also billed as being "all-inclusive," with minimal copayments for many services, as opposed to the traditional 80/20 split of private insurance. This is also appealing to the consumer. Older and less healthy employees tend to remain in traditional fee-for-service plans for at least three reasons: (1) they are familiar and comfortable with it (2) they have an established doctor/patient relationship they are not willing to change (3) they fear a change in insurance

companies will disqualify them for benefits by pre-existing condition clauses. This phenomenon tends to raise traditional fee-for-service insurance costs and premiums. The managed care plan can then shadow-price, or raise their rates to just below the traditional insurance plan. This allows the managed care company to offer improved benefits, thereby increasing their patient pool and giving them more clout in negotiating discounts from providers. It also gives them the ability to generate tremendous profits. In the end, they control their costs by controlling the income of health care providers, including orthodontists. The problem is not with the concept of prepaid health plans, rather with the other varieties of plans known as managed care. These plans are able to escape the responsibility of high cost patients and maintain lower prices. This is done not by providing the same high quality of care for a lower price, rather by attracting healthy subscribers first of all, then discounting payments to providers. Arguably their profit is derived at the expense of the provider. Managed care plans can, therefore, not only be hugely profitable, but also serve to contribute to healthcare cost inflation by driving up the costs of traditional fee-for-service insurance. Meanwhile the competition in the marketplace grows, with the provider having less profit and therefore less ability to attract patients and position themselves in the market.

In addition to the managed care aspect of health care, for-profit corporations compete for a share of the market. In recent years we have seen for-profit groups established in orthodontics. An example of this is Orthodontic Centers of America, or OCA. OCA is the largest provider of orthodontic services in the estimated $3.6 billion orthodontic industry. Started in 1989, OCA has grown to 153 offices in 24 states, primarily in the eastern half of the country. Recent expansion has been in the west, including Arizona, California and Washington. OCAs marketing and operating strategies are based on (1) aggressive marketing (2) maximizing efficiency of resources and (3) maximizing capacity. OCA begins with an

aggressive marketing campaign for each facility they open. This consists of local television, radio and print advertising, as well as internal marketing promotions. These are aimed at stimulating the market for orthodontic services, a market OCA perceives as vastly untapped. The patient is then presented with a payment plan differing from that seen in the traditional orthodontic practice. There is no 25% down payment, rather the patient makes monthly payments of $98 per month for each month of care, with a final payment of $398 just prior to completion of treatment. On average, OCA patients pay total fees of $3,045 which is about 15% lower than the national average of $3,600. OCAs pricing strategy is to be 10-15% below the traditional orthodontists fees.

In addition to heavy marketing and a unique fee payment plan, OCA utilizes their orthodontists for patient care only, with no administrative or management duties. A business manager is utilized in this capacity instead, with the central corporate office overseeing operating and financial performance.

OCA centers are designed to bring the patient to the orthodontist, rather than the orthodontist rotating through an open bay facility. Patients wait in the reception room until called for treatment. They go directly to the orthodontist's chair who reviews their care and "prescribes" the necessary adjustments. The patient then proceeds on to one of the orthodontic assistants who makes the adjustments. The orthodontists themselves are involved in the initial consult, banding and debanding. The orthodontic assistant does virtually all adjustments in between. While the average orthodontist to orthodontic assistant ratio is 1:3, OCA runs at a ratio of 1:5. This allows the average orthodontist working for OCA to see 77 patients per day, as opposed to the average of 42 patients per day seen in the more traditional practice. Case starts for OCA centers average 506 per year compared to 170 for the average orthodontist in private practice. See Table 17. Obviously, any difference in fees charged initially is made up for by the volume

Table 17. Differences Between OCA and Traditional Fee-for-Service Practices

Operating & Marketing Differences	Traditional Practice	Orthodontic Centers
Orthodontist training	Graduates of accredited programs	Graduates of accredited programs
Orthodontist's responsibilities	Administration Public relations Patient care	Patient care
Office design	Orthodontist and staff rotate to the patient	Patients rotate to the orthodontist
Scheduling system	Schedule new patient days and regular treatment days together	Group appointments by type of procedure and dedicate certain days exclusively to new patients
Orthodontic assistants to orthodontists	3:1	5:1
Marketing	Referral system	Direct to potential patients through television, radio and print
Patient fees	$3,612 ($903 down payment)	$3,085 (no down payment)
Advertising budget per orthodontist	$4,400 in 1992	$72,200 in 1995
Effect on Operations and Profitability (the figures below are per orthodontist)		
Patients per day	42	77
New case starts (annually)	170	506
Gross revenues per operating day	$2,000	$5,000

generated. Volume drives the system, allowing OCA and other for-profit centers like them, to generate profit, acquire existing practices, open new facilities and attract orthodontists. Arguably this is done at the cost of quality care, as increases in volume are most often associated with decreased quality of care. For-profit companies in health care are often accused of "cream skimming" the market. This refers to the practice of accepting a case mix that allows for the greatest profit potential, leaving the less desirable cases, from a profit perspective, for others in the market to serve. The results of this study illustrate clearly that there are differences in the profitability of cases and that these differences can be determined. Marketing and screening techniques can be used to skim the market for these cases.

One might ask how OCA attracts orthodontists. One successful method has been by seeking new orthodontic graduates. Often these individuals have a high debt load from school loans and no business experience. Many see orthodontics as a job, not a profession. They are attracted to the ease at which OCA and other for-profit groups can put them into practice, with no management responsibilities and no increase in debt for the acquisition of a practice. Another source of orthodontists is the group of practicing orthodontists who are willing to sell their existing practices to a for-profit company, then continue practicing for the group.

All of this leads us to where we are today. The present health care system is highly fragmented with both managed care and for-profit ownership arrangements effecting the market place by driving down the reimbursement for services. Managed care focuses on controlling costs by controlling income, including orthodontists' income. For-profit companies price their services 10-15% below market and utilize volume to generate adequate profits. This helps deplete the market of patients available to the traditional orthodontist in private practice. Add to this the increased number of general practitioners providing orthodontic care and you have many different groups competing for the same patients and income.

This is why it is imperative for the private practice orthodontist to understand costs to survive. As we face increasing competition in an environment of decreased reimbursement, this will become even more important to assure our future as a profession. Cost data is critical to making informed decisions on fees, treatment modalities and their cost/benefit, management of resources necessary to provide care, and maintaining the role of traditional fee-for-service care in the market. This study presents one cost accounting model for identifying costs but, more importantly, should serve as a stimulus for thinking and discussion regarding the present market and future of our profession.

What changes are likely for the health care system in the near future?

The failure of the Clinton administration to effectively deal with the health care system on a national basis should come as no surprise to those of us in health care. E. J. Dionne of the "Washington Post" described health care as the 'issue from hell,' both too complex and too costly to be well understood by most voters. Others believe that health care is an issue way behind the economy, education, drugs, the budget deficit, etc. in the minds and priorities of the voters. To be sure, there are other factors at work as well. At least three things drive the inability to accomplish a universal health insurance program including:

1. The complexity of understanding the present system in terms of number of providers and financing mechanisms already in place.

2. The basic ideologic conflicts strongly rooted in our society. The question often debated is whether access to health care is a right that should be extended to all citizens or whether it is a service provided based on one's ability to pay for care.

3. The strength of special interest groups such as insurance companies, for profit hospitals and health care corporations, pharmaceutical companies, etc. These groups are heavily invested in the present system through which they derive profit and are unlikely to sit by the sidelines during any effort that could impact on that position.

The last factor alone has been effective in defeating universal health insurance. Ideologic conflicts further muddy the water. In the short term, then, it is likely that the present fragmented system will continue to prevail. As providers we must be prepared to learn to survive in that system. This will demand a more sophisticated approach to the management of our practices including, but not limited to, an understanding of our treatment costs.

Summary

As a result of federal government policy and increased competition in the marketplace, the health care system that we as orthodontists function in has seen dramatic changes in the last 20-30 years. Some of those changes, such as managed care and an increasing number of competitors, are just now beginning to make an impact on the traditional fee-for-service practice. As we continue to feel fiscal pressures from the marketplace, this will make the efficient operation of our practices become more critical. An understanding of the costs of providing orthodontic care is just one piece of information necessary to improving the management function. Based on the results of this study and observations of the larger health care system, we can make the following conclusions:

1. There will continue to be an increased number of groups competing for the same patients and practice income.

2. Managed care will continue to demand discounts from providers in the marketplace.

3. For-profit companies entering the orthodontic market will continue to try to expand into those urban markets where fees are high enough to generate adequate profits. Aggressive marketing techniques will continue to be used to generate a high volume of patients.

4. The mean total costs by class of malocclusion and treatment plan were determined and ranked in order of cost. Case-mix analysis can be used to evaluate profitability by class of malocclusion and treatment plan.

5. There is a statistically significant difference in the mean treatment costs between Class I and Class III malocclusion cases, and there may be a difference in treatment costs between Class I and Class II malocclusion cases.

6. There is a statistically significant difference in the mean treatment costs between Class II extraction cases and Class II nonextraction cases, with the latter being more expensive to treat.

7. The total cost of treatment for nonextraction cases depends on the class of malocclusion. This may also be true for extraction cases, but the smaller sample size prevented making this conclusion.

8. Patients receiving Stage I and Stage II treatment had statistically more mean treatment costs than those having Stage II treatment only, by greater than $500 per case. The mean fees charged were not adequate to provide the same profit margin for these cases as opposed to those treated with Stage II only. It is important to know the Stage I costs and charge appropriately for that care.

9. Patients treated with Stage I prior to Stage II had statistically significant lower mean appointment costs than those treated with Stage II treatment only. Pricing for Stage II treatment following Stage I treatment should reflect these differences.

10. Multiple regression analysis was used to determine those factors that predicted total treatment costs. The most important predictor of total treatment costs was the total number of appointments. The second most important predictor of total

treatment costs was the type of appliance used in treatment. Age and cooperation were minor cost predictors.

Further research topics, such as a revenue enhancement model, can be pursued with the data already collected. This study may also serve as a model for a prospective study of costs that would allow us to better evaluate some of the variables examined herein. At the minimum, it provides food for thought.

Appendix A

Chart Audit

Office _____
Referral _____

Patient Name:

Age at the start of tx: _____ DOB: _____

Sex: _____

Fees: Exam _____ Stage I _____
Records _____ Stage II _____
Other

Mixed Dentition _____ Permanent Dentition _____

Diagnosis:

Tx Plan:

Estimated time of tx:

Actual tx time: Stage I _____ Stage II _____ Total _____
Total # of Appts: _____
During appliance wear _____

Frequency of appts:

Type of Appliance: Elastics:

Functional Appliance _____ Type:

Headgear _____ HP _____ Combi _____ Cervical _____
LHA _____ RPE _____ Other _____

Lab requirements:
Upper retainer type:
Lower retainer type:

Oral hygeine: poor____ fair ____ good ____ excellent ____ not noted ____

Cooperation: poor____ fair ____ good ____ excellent ____ not noted ____

Appointment Breakdown

Type of Appointment	Stage I	Stage II
Initial exam		
Initial exam/records		
Consult		
Consult/seps/imp		
Seps		
Impressions		
Impressions/Retie		
Band		
Bond - Partial		
Bond Partial/Place TPA		
Bond - Full Arch x1		
Bond - Full Arch x2		
Band/Bond - Full Arch x2/HG		
Band/Bond - Full Arch/HG		
Band Full + TPA		
Change AW		
Adj AW		
Retie		
Retie/HG		
RPE/Quad Helix/W-Arch/Other		
HG		
Records		
Records - Progress		
Records, Final		
Records, Final + Clear Retainer		
Missed Appointments		
Changed Appointments		
Broken Appliances		
Debonding Partial		
Debonding - Full		
Debonding - Full x2		
Debonding - Full x2/Imp		
Debonding - Full x2 Records/Retain		
Retainers		
Retainers/Records		
Observation		
Total Number of Appointments	_____	_____
No. of Missed Appointments	_____	_____
No. Of Changed Appointments	_____	_____
	_____	_____

	Stage I	Stage II

Wires

0175 U WC
0175 L WC
0195 U RCS
0195 L RCS
014 NITI U
014 NITI L
016 SEN U
016 SEN L
018 NITI U
018 NITI L
014 SS U
014 SS L
016 SS U
016 SS L
018 SS U
018 SS L
020 SS U
020 SS L
20 X 20 NITI U
20 X 20 NITI L
19 X 25 SS U
19 X 25 SS L
19 X 25 NITI U
19 X 25 NITI L
21 X 25 NITI U
21 X 25 TMA U
21 X 25 TMA L
.045 SS AUXILIARY
.018 AUST U
.018 AUST L

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