Trends in dental treatment, 1992 to 2007

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ABSTRACT

Background. Reductions in U.S. dental caries levels have been noted since the 1970s. Reports indicate that dental treatment is changing accordingly. The author examined dental insurance claims to determine whether these changes in dental treatment trends of insured people have continued.

Methods. To measure the annual per capita use of dental services, the author used Delta Dental of Michigan, Ohio, and Indiana insurance claims for care provided by dentists in Michigan. The number of patients' claims assessed ranged from 1.25 million in 1992 to 1.84 million in 2007. Within each of these years, the number of each type of service provided was divided by the number of patients receiving treatment of any type, according to birth year.

Results. The author found that overall, the per capita number of restorative procedures continued to decline. Resin-based composite restorations continued to be placed instead of amalgam restorations. The number of extractions (except for third-molar extractions) and endodontic procedures continued to decrease slightly. As a result, prosthodontic procedures decreased overall. The use of implants continued to increase.

Conclusions. The patterns in the use of dental services by age of patients continue to change. These changes follow closely the reported changes in the oral health in the population.

Practice Implications. The number of restorative and prosthodontic services per person required by patients born more recently is not as great as in patients born earlier. Practitioners might need to adjust the number of patients they treat and the services they provide in the coming decades.

Key Words. Dental insurance; fixed prosthetics; removable prosthetics; oral surgical procedures; endodontics.

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Evidence of favorable oral health trends in the U.S. population goes back to at least the 1970s.[1-5] In a 1997 article,[6] my colleagues and I noted a trend of a decline in restorative procedures in privately insured children and adults in Michigan between 1980 and 1995 that was consistent with the underlying decline in dental caries.[1-5] A 2007 report from the National Center for Health Statistics of the Centers for Disease Control and Prevention (CDC) shows that, with few exceptions, these improvements in oral health have continued into the early 21st century in the United States.[7] This report also showed that the declines in the number of decayed, filled or missing permanent teeth in children seen in earlier national surveys[1-5] were evident in virtually all adult age groups. In the primary teeth of children in lower income categories, however, there were increases in the total number of decayed and filled teeth between 1988 and 1994 and 1999 and 2004; the difference principally was due to the number of filled teeth. Whether this increase was due to more carious

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teeth that had been restored rather than extracted is not known, as early loss of primary teeth was not included in the report. Some similar trends also are evident in the American Dental Association's 1990, 1999 and 2005-06 Survey of Dental Services Rendered,[8-10] although direct comparisons across time are not possible because the number of procedures included in the surveys is limited. In this article, I use insurance claims information from 1992 through 2007 to determine whether changes in dental treatment trends of insured people have continued.

METHODS AND MATERIALS

In this article, I look at insurance claims data from Delta Dental of Michigan, Ohio, and Indiana for treatment provided by dentists licensed to practice in Michigan from 1992 through 2007. These data represent all of the people covered by Delta Dental who were treated by dentists in Michigan during that period, except for those covered by the Michigan Department of Community Health Healthy Kids Dental, which is the name of the contract that the department has with Delta Dental of Michigan to administer the Medicaid dental benefit for Medicaid-eligible beneficiaries younger than 21 years. I also excluded data from Michigan's State Children's Health Insurance Program (SCHIP), which is administered by Delta Dental of Michigan. I excluded the data from these two groups from my analysis because the programs were added to the groups covered by Delta Dental of Michigan in 1998 (SCHIP) and 2000 (Healthy Kids Dental). Their inclusion would distort the comparisons with longer-term patterns seen in the children who are enrolled in Delta Dental's privately insured groups.

The total number of treated people included in this analysis increased steadily from approximately 1.25 million in 1992 to 1.84 million in 2007. Although the age mix shifted slightly along with this increase, I stratified all of the analyses by age, so any age trends would not influence the patterns I observed. The increase in the number of treated people followed an underlying similar proportional increase in the number of people enrolled in Delta Dental's privately insured groups, which meant that the percentage of the enrolled population who had a dental visit during each year changed little from 1992 through 2007. Benefit levels also changed little, as many of the covered groups were influenced strongly by the negotiated benefit levels of employees for whom fringe benefits are bargained for as a group.

Although data are available and I conducted analyses for all calendar years from 1992 to 2007, I show data from only 1992, 1997, 2002 and 2007 to make it easier to see any trends that might be present; including lines on the graphs for all 16 years would make it hard to follow any individual line. The graphs show the sum of each specific type of procedure, divided by the number of unique people with any type of visit to a dentist in the calendar year. I calculated these values for the people within each birth year and then converted the birth years into the appropriate age equivalent.

RESULTS

Restorative procedures. Figure 1 shows the total per capita average number of all types of restorative procedures, according to age, for 1992, 1997, 2002 and 2007. Beginning with children, there were peaks in the number of restorative procedures at the ages associated with the existence of the early primary dentition, especially in 1992 and 1997. There also were peaks that corresponded to the ages after which permanent first and second molars usually erupt. The data for people 18 to just older than 25 years were less clear. This is a difficult age range to study by using insurance claims data, because the people in it are a changing blend of dependent children—who by virtue of being students retain their parents' coverage—mixed with newly hired young workers and their spouses. The demographics of these two groups and, thus, their need for and use of dental care can be different. Because the relative size of these two groups can differ from year to year owing to such influences as economic conditions (and, thus, hiring patterns), it is difficult to evaluate the meaning of year-to-year changes.

After age 25 years, the patterns become clearer. For example, the pattern showing a decline through the years in the number of restorative procedures per user of any dental care across all adult ages was evident. In 1992, adults received about 1.1 restorations per person per year on average; the average had fallen below 0.9 restorations per person per year by 2007 at all ages, and below 0.8 restorations per person per year by 2007

ABBREVIATION KEY. CDC: Centers for Disease Control and Prevention. **SCHIP:** State Children's Health Insurance Program.

at around age 40 years.

Within the patterns shown in Figure 1 for all restorative procedures combined, the components of those numbers, according to specific type of restorative procedure, is noteworthy because of the large switch between the use of amalgam and resin-based composite restorations. I present Figures 2 through 4 on the same vertical scale as Figure 1, so their contributions to the total shown in Figure 1 can be seen, and all four figures can be compared with one another. Figure 2 shows the pattern for amalgam restorations. Compared with the number of amalgam restorations placed in 1992, in 2007, patients of comparable ages received approximately one-half as many amalgam restorations per capita. Figure 3 shows the per capita annual number of resin-based composite restorations and, when compared with Figure 2, indicates that resin-based composite restorations were being placed instead of amalgam restorations. In adolescents

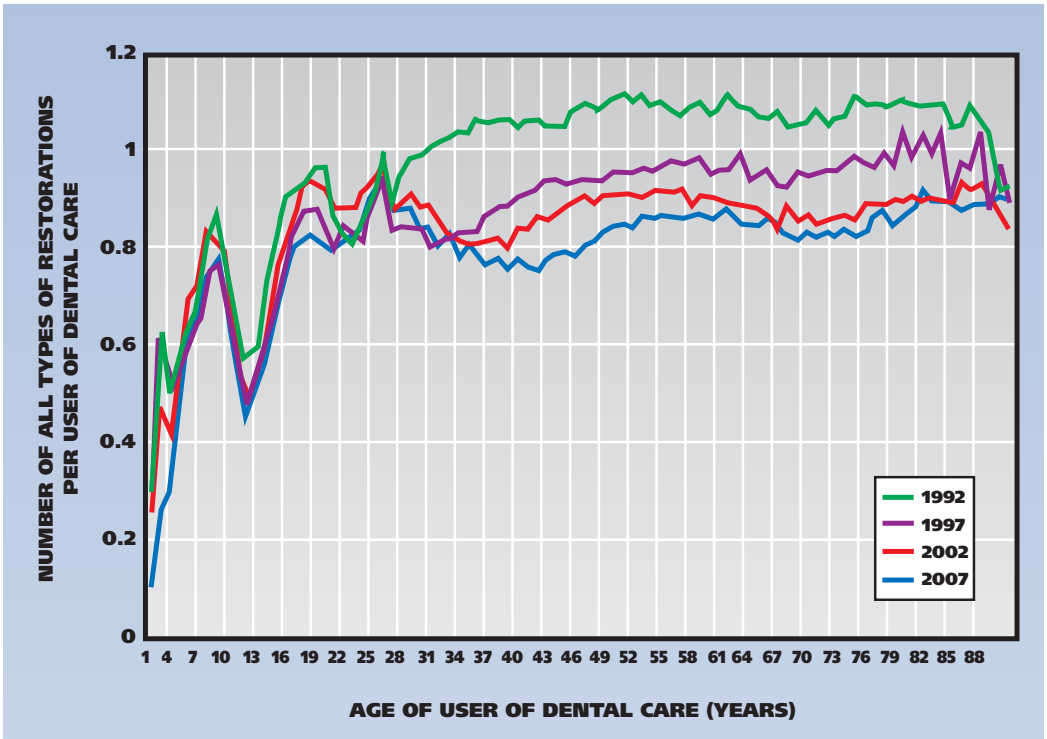

Figure 1. Changes in the number of all types of restorations per user of dental care, including crowns in fixed partial dentures from 1992 to 2007. The number of procedures shown is the average number of procedures per user per year.

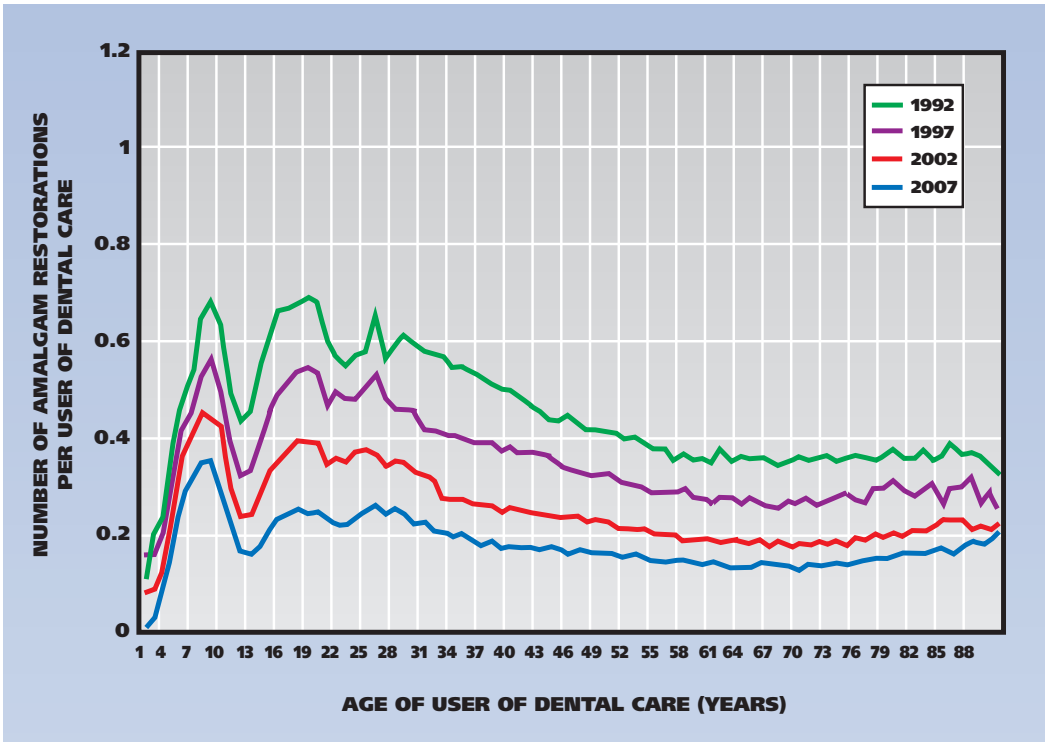

Figure 2. Changes in the number of amalgam restorations per user of dental care, from 1992 to 2007. The number of procedures shown is the average number of procedures per user per year.

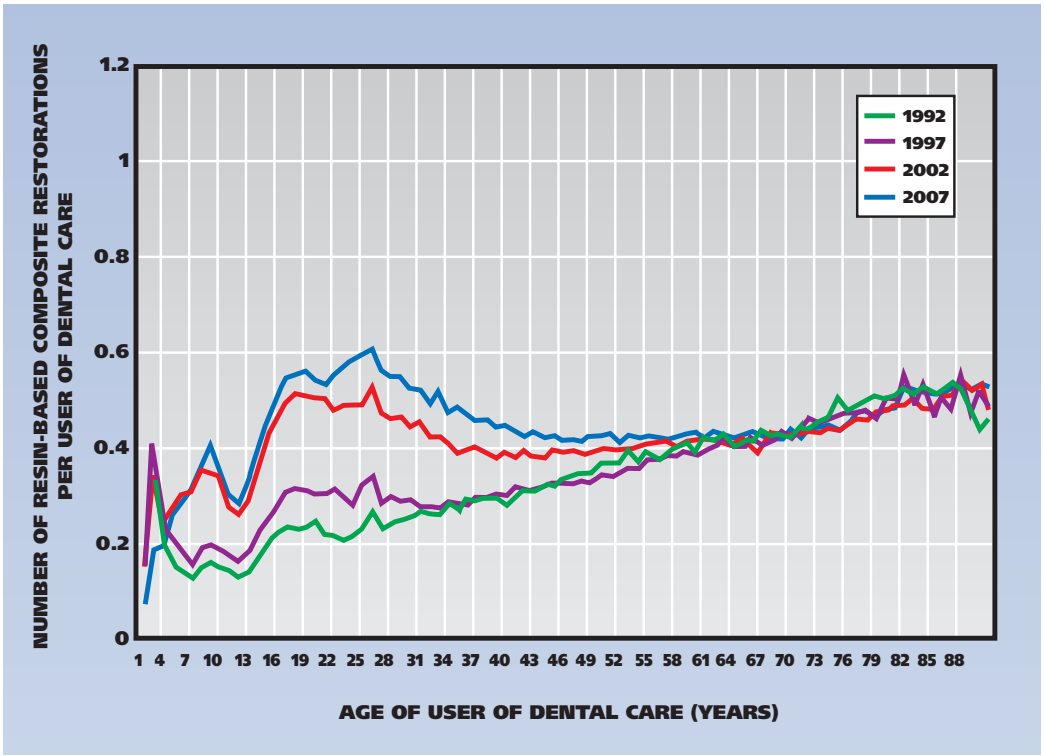

Figure 3. Changes in the number of resin-based composite restorations per user of dental care, from 1992 to 2007. The number of procedures shown is the average number of procedures per user per year.

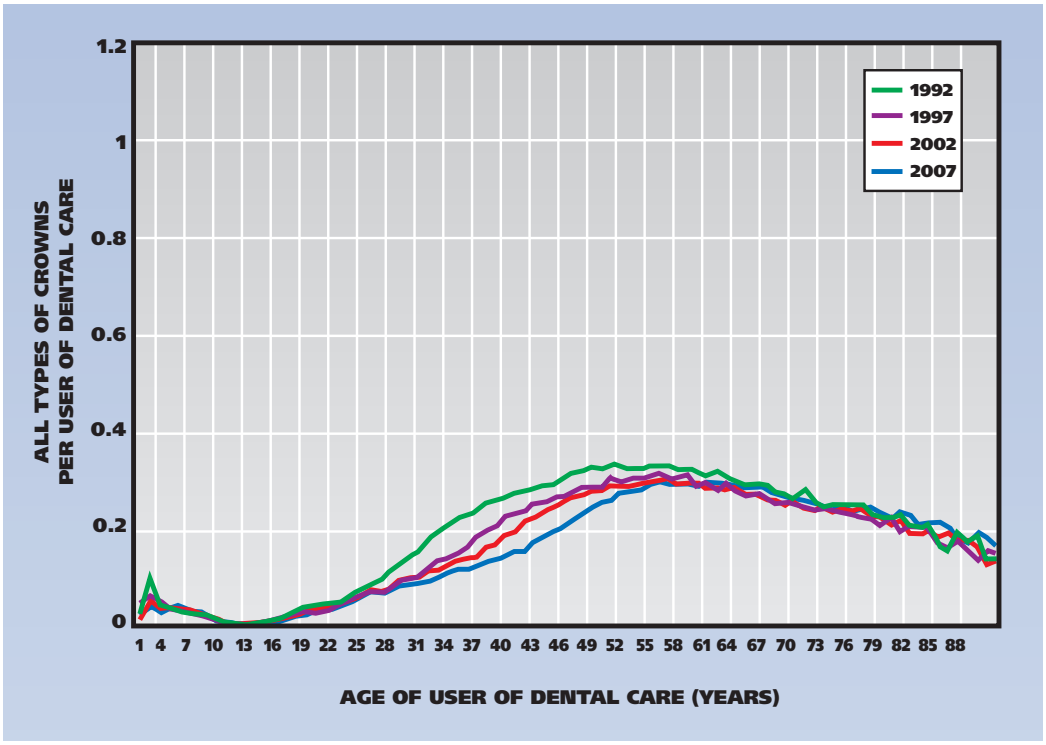

Figure 4. Changes in the number of all types of crowns (metal, composite, ceramic and stainless steel in children) per user of dental care, from 1992 to 2007. The number of procedures shown is the average number of procedures per user per year.

and adults at least up to age 40 years, the number of resin-based composite restorations doubled, and at some ages nearly tripled between 1992 and 2007.

The annual per capita number of all types of crowns, including stainless steel crowns in young children, crowns on implants and fixed bridges, and common restorative crowns on individual teeth is the final part of the restorative procedure component. Figure 4 shows an increase in the per capita number of all types of crowns in patients from about age 25 years to a peak between 55 and 60 years of age. It also shows a relative decrease in the per capita number of crowns at any age in that range between 1992 and 2007. Some of these decreases were substantial. For example, at about age 45 years, the per capita annual number of crowns decreased from about 0.3 in 1992 to about 0.2 in 2007, a relative decrease of about one-third. The intermediate years (not shown) had intermediate values.

Extractions and endodontic procedures. To a large extent, extrac-

tions and endodontic procedures are substitutes for each other. When a damaged tooth progresses to the point of pulpal involvement, dentists and patients often need to decide whether to extract the tooth or undergo an endodontic procedure. Therefore, I assessed the trends for both extractions and endodontic procedures together. Figure 5 shows the patterns in the number of extractions. Although the overall pattern relative to age was highly correlated from year to year, some notable patterns were evident. First, two of the highest peaks were at 12 and 18 years of age. The first of these peaks, according to analysis details (not shown), involved primary molars' being removed at around age 12, the age at which permanent premolars usually erupt. The second and highest peak was at age 18 years. More than 95 percent of the extractions that contributed to that peak were due to third-molar extraction. There also was a smaller peak at age 2 years that was related to early childhood caries. Because relatively few very young children have dental visits, a high percentage of those who receive treatment do so because they have severe dental problems. This peak disappeared by 2007 after the recommendation for early dental visits for well infants was made by the American Academy of Pediatric Dentistry.[11] Taking 1- and 2-year-olds to the dentist became more common after the recommendation was made, which resulted in the denominator being larger and, thus, the per capita number of extractions appeared to fall.

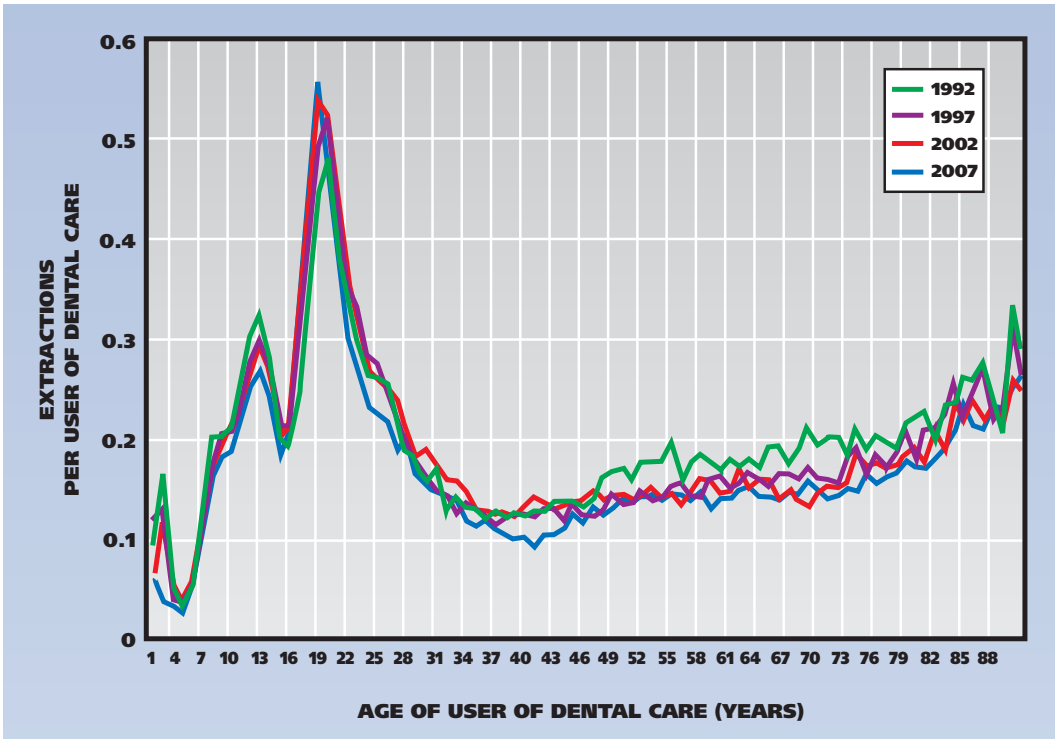

Figure 5. Changes in the number of extractions per user of dental care, from 1992 to 2007. The number of procedures shown is the average number of procedures per user per year.

Extraction patterns in adults show a much more regular pattern (a general absence of large changes through the years) compared with those shown in Figures 1 through 4, with a gradual increase associated with increasing age. The pattern for adults suggested a slight decrease in extractions in more recent years at any age, indicating a trend of increased tooth retention in adults at any age between 1992 and 2007.

Figure 6 shows the pattern for the number of endodontic procedures in primary and permanent teeth. I present the data on the same vertical scale as I did the extraction data in Figure 5 to make it clear that the relative number of endodontic procedures was well below the number of extractions, even in the insured groups. Although the absolute numbers were small, there was a pattern of decreases in the per capita number of endodontic procedures between 1992 and 2007 across all adult ages.

To assess how the changes in endodontic and extraction procedures interact so I could evaluate the use of these treatments for more severe conditions, I combined the per capita counts for the two procedures to produce Figure 7. This figure makes more evident several notable trends, which were difficult to see clearly in Figures 5 and 6. From about 35 years and older, there was a general pattern of a reduction in the number of extractions and endodontic procedures, which was consistent

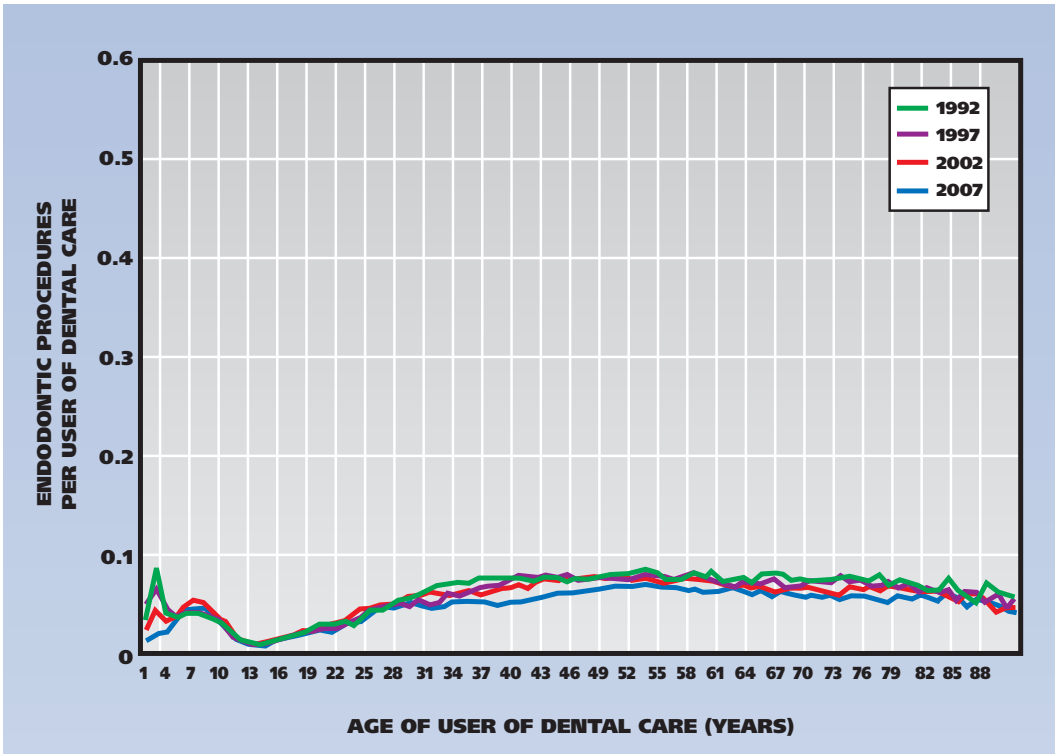

Figure 6. Changes in the number of endodontic procedures per user of dental care, from 1992 to 2007. The number of procedures shown is the average number of procedures per user per year.

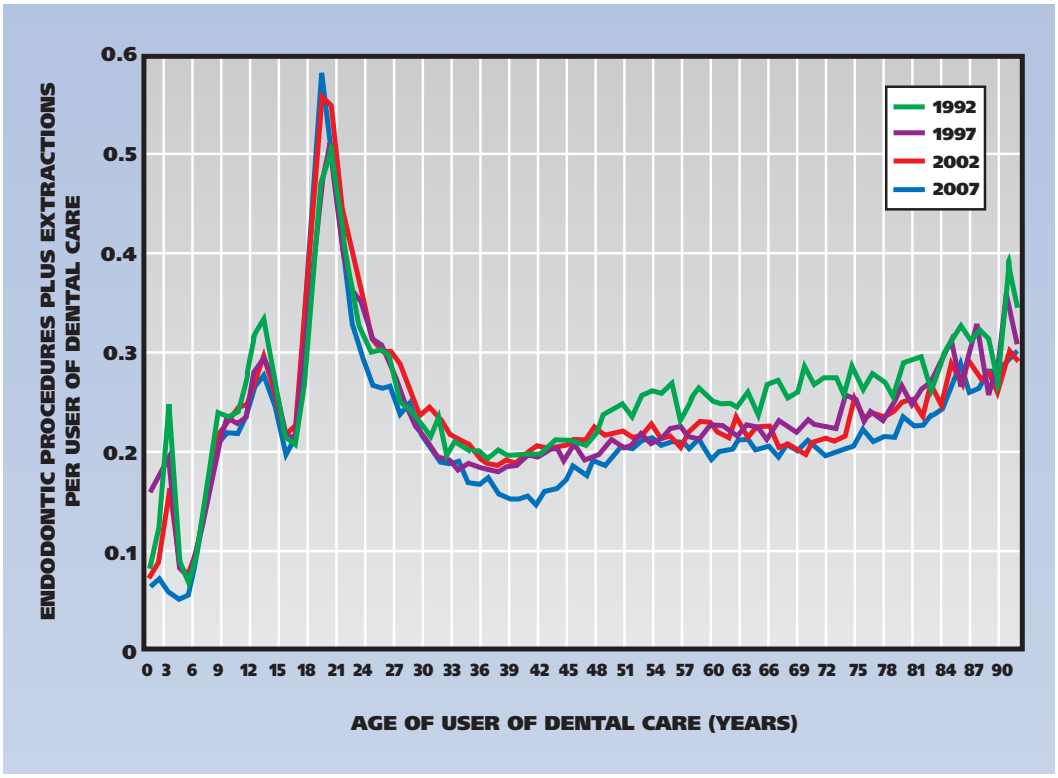

Figure 7. Changes in the number of extractions and endodontic procedures per user of dental care, from 1992 to 2007. The number of procedures shown is the average number of procedures per user per year.

with a likely underlying pattern of healthier and less heavily damaged teeth in the more recent birth cohorts than in the earlier birth cohorts. At around age 12 years, there was a noticeable slight reduction in extractions and, on the contrary, a trend toward more extractions at around age 18 years.

Prosthodontic procedures. With an apparent trend toward less tooth loss, prosthodontic procedure patterns also should have shown a downward trend. Figures 8 and 9 show some of those patterns. Figure 8 shows the pattern during the study period for the number of pontics. I used the number of pontics to determine the number of teeth replaced by pontics. Figure 8 shows a decline in the number of pontics per person of the same age receiving any type of dental care in a year between 1992 and 2007. Furthermore, the peak in the rate per user also might have shifted to a slightly older age during the study period.

Figure 9 shows that the number of removable partial

dentures did not increase, as would be the case if they were used instead of pontics. In fact, the number of removable partial dentures sharply declined during the study period to levels even lower than those for pontics, except in people older than about 70 years.

The only prosthodontic procedure that increased was the use of implants. Although for many insured groups implants are not covered, the crowns that are placed on implants almost always are. The 2000 advent of separate Current Dental Terminology procedure codes for crowns associated with implants has made it possible to see that, even with this increase, the use of implants does not begin to explain the magnitude of the declines seen in Figures 8 and 9. Even at the peak ages for the placement of implants (between ages of 60 and 75 years [data not shown]), implant-associated crowns account for less than 0.01 procedure per person per year, which is less than the decreases seen for

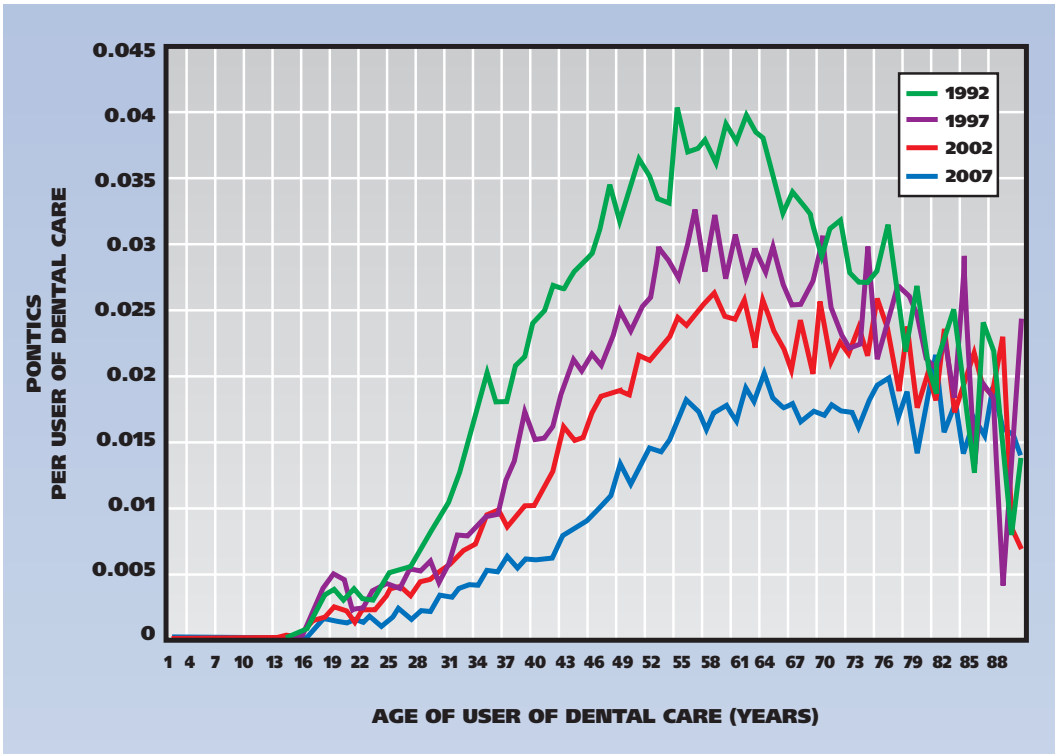

Figure 8. Changes in the number of pontics per user of dental care, from 1992 to 2007. The number of procedures shown is the average number of procedures per user per year.

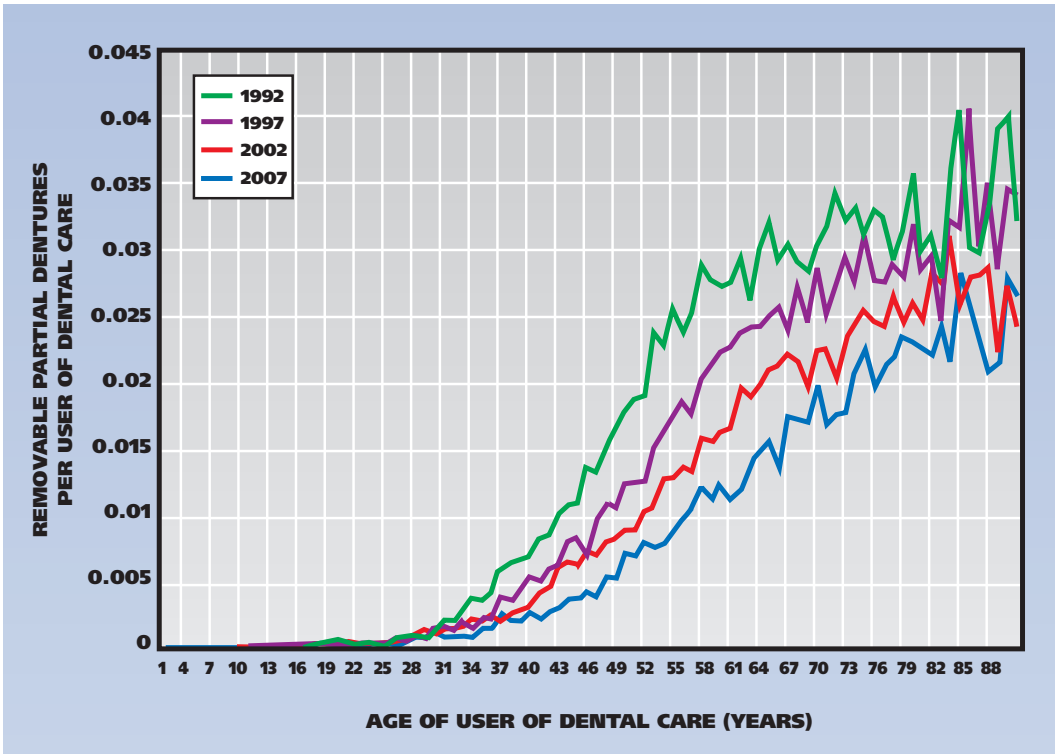

Figure 9. Changes in the number of removable partial dentures per user of dental care, from 1992 to 2007. The number of procedures shown is the average number of procedures per user per year.

pontics and removable dentures.

The number of complete dentures also decreased and shifted to ever-older age groups (data not shown). This is owing to the fact that even if it is increasingly rare for people in the United States to be rendered edentulous (especially if they have dental insurance), many people who were born in the 1910s, 1920s and 1930s were rendered edentulous when they were younger and will need periodic replacement of complete dentures for the remainder of their lives.

DISCUSSION

The patterns in the number of restorative and prosthodontic procedures by age of patient during the study period were consistent with the patterns reported previously.[6] The patterns I saw also are consistent with the effects of the decline in caries that was first reported in the 1980s and initially appeared to affect people who were born in the 1960s and later.[1-5] The result of the decline in caries in people born since the 1960s is that, on average, these people had fewer and smaller restorations as children than did people born in earlier decades. The effect of these changes is appearing as these people move well into adulthood. People born in the mid-1960s were about 40 years old in 2007. Because they received fewer large restorations as children compared with people who were born 15 years earlier, they required fewer crowns and large restorations in 2007 compared with the similarly aged people in 1992 who were born in the early 1950s.

As with patterns in the number of restorative procedures, the patterns of tooth loss and prosthodontics showed that at any given age fewer of these services were being used per capita over time. This might be because these services were not needed and because the teeth were less damaged by extensive earlier disease.

Finally, because of the large number of periodontal procedures that exist, as well as analytic difficulties that result from changing procedure coding and definitions that have occurred between 1992 and 2007, I will report on trends in the use of periodontal services in a future article.

Economic circumstances change from time to time, which can change the way people use dental care. Michigan and other states have experienced economic turmoil in recent years; however, it is unlikely that this economic unrest can explain the patterns I found in my analysis. First, all of the people included in this analysis were employed or were dependents of employed people, they all had dental insurance coverage, and they all were receiving dental care. This is true throughout all years of the analysis. Also, if the tightening economic circumstances were causing concerns about future employment, it is more likely that people with insurance would make sure to complete any outstanding oral health treatment, rather than reduce the use of these dental procedures, as has occurred generally. Finally, although Delta Dental of Michigan, Ohio, and Indiana does not have data going back as many years for other states as it has for Michigan, the more recent data that are available from other states show patterns that are similar to those I observed when using data from Michigan. Based on the concordance of all of these results with data from the CDC[7] and the American Dental Association,[8-10] it seems likely that similar patterns are occurring across most if not all of the United States.

CONCLUSIONS

On average, the per capita need for restorative and prosthodontic procedures in the United States appears to be declining, and it seems likely that this trend will continue as the people born since the 1960s continue to age. As a consequence of there being less need for restorative procedures and less loss of tooth structure, the need for more involved restorative procedures through adulthood also is likely to continue to decline. Tooth loss and the need for prosthodontics as a consequence of this condition also will continue to be increasingly less common. For the average dentist to keep busy providing the traditional restorative services, more patients likely will be needed. Of course, the effects of the changes reported in this article on any dental practice or insured group will be affected profoundly by the age and socioeconomic mix of the patients in that practice or group. ■

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