# A Report on Materials Used by Dental Students for Core Restorations in Single and Multiunit Crowns

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***Purpose:*** This study evaluated the materials used for tooth core restorations by dental students. ***Materials and Methods:*** The study included all patients treated with a single crown or fixed partial denture by undergraduate dental students during the years 1984 to 1986, 1994 to 1996, and 2004 to 2006. ***Results:*** More direct (62%) than indirect (38%) cores were prepared during the total time period evaluated. ***Conclusion:*** The complication rate of indirect cores compared with direct ones appeared to be higher in single crowns, but not in fixed partial dentures. *Int J Prosthodont 2014;27:73–75. doi: 10.11607/ijp.3609*

Tooth core reconstructions are frequently required for restoring teeth under single or multiple crowns used in fixed partial prostheses. Traditional direct core materials such as amalgam alloys, composite resins, and glass-ionomer cements are used in vital teeth, while cast gold and other metal alloys are employed as indirect core materials in endodontically treated teeth.[1–3] It was presumed that the introduction of newer materials might have changed the distribution of core materials used in the past 20 years; therefore, the distribution of core materials used by undergraduate dental students was evaluated.

## Materials and Methods

The study included all abutment teeth restored with cores to support a single crown or fixed partial denture (FPD) by undergraduate dental students during the years 1984 to 1986, 1994 to 1996, and 2004 to 2006. The data were gathered from patient files (1984 to 1986 and 1994 to 1996) and from an electronic database (2004 to 2006, Effica, Tieto).

A total of 1,516 cores (983 cores in maxillary and 533 cores in mandibular teeth) were fabricated and recorded (321 cores from 1984 to 1986, 651 cores from 1994 to 1996, and 544 cores from 2004 to 2006). The materials were divided into direct core materials (dentin with a small restoration, composite resin with a metal screw, composite resin with parapulpal pins, composite resin with a glass fiber post and amalgam restoration) and indirect core materials (cast post and core or one-piece dowel crown). The core materials were also divided according to tooth location (incisors, canines, premolars, or molars in the maxilla and mandible). Bar charts were used to display differences between the time periods and core materials for each tooth group.

The outcome of direct and indirect cores was analyzed based on a long-term (18 to 20 years) clinical follow-up study of metal-ceramic crowns and FPDs made by dental students at the Institute of Dentistry, University of Oulu, Finland, from 1984 to 1987.[4,5] The technical complications were fracture of porcelain, recementation, loss of the restoration (root fractures, esthetic problems, or periodontal problems), extraction of an abutment tooth, and fracture in the metal framework.

This study was approved by the Ethical Committee of the Northern Ostrobothnia Hospital District, Finland.

## Results

More direct (62%) than indirect (38%) cores were prepared from 1984 to 2006 (Table 1). The proportion of direct cores increased in maxillary and mandibular incisors from 2004 to 2006 compared with earlier time periods (Fig 1). Direct cores were prepared in nearly 80% of maxillary canines in all time periods, while in mandibular canines, the proportion of indirect cores increased from 1984 to 1986 and from 2004 to 2006.

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**Table 1** Direct and Indirect Cores Fabricated by Undergraduate Dental Students from 1984 to 2006

| | 1984 to 1986 | | 1994 to 1996 | | 2004 to 2006 | | Total | |
|---|---|---|---|---|---|---|---|---|
| Material | n | % | n | % | n | % | n | % |
| Direct | 189 | 59 | 347 | 53 | 403 | 74 | 939 | 62 |
| Indirect | 132 | 41 | 304 | 47 | 141 | 36 | 577 | 38 |
| Total | 321 | 21 | 651 | 43 | 544 | 36 | 1516 | 100 |

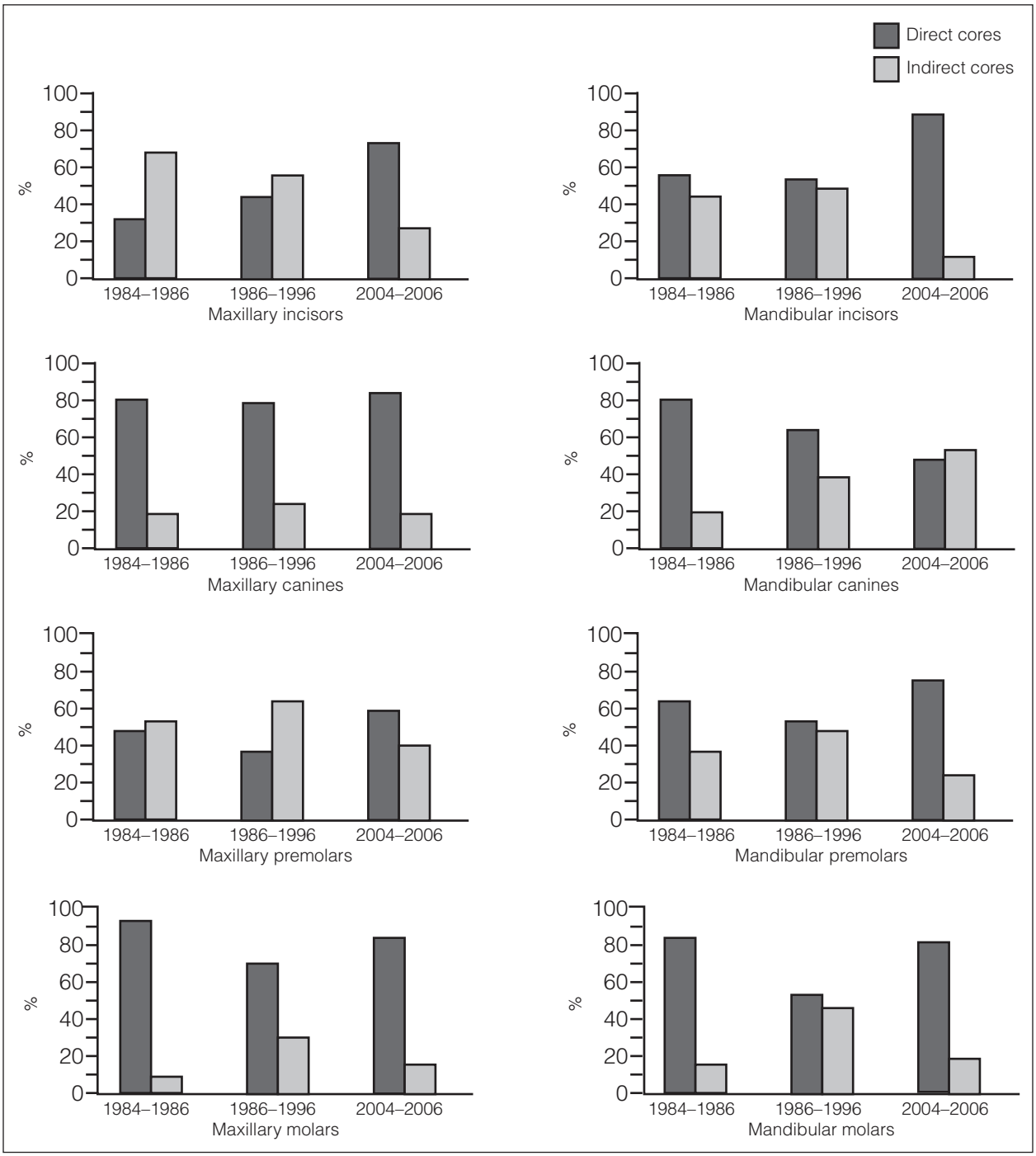


**Fig 1** Number of direct and indirect cores of maxillary and mandibular incisors, canines, premolars, and molars in fixed prostheses made by dental students from 1984 to 2006.

In premolars, more indirect cores were prepared in the maxilla than in the mandible, while in molars, the direct cores accounted for nearly 80% of all cores placed in both arches.

The complication rate for single crowns was 16% (5 of 32) for direct cores and 29% (20 of 68) for indirect cores. The complication rate for FPDs with direct cores was 14% (22 of 160); for indirect cores, the complication rate was 11% (4 of 37).

## Discussion

More direct than indirect cores were used in fixed prostheses made by undergraduate dental students in the years 1984 to 2006. The increased use of direct posts was also seen in studies carried out in the United Kingdom (Table 2).[2,3] Preparation of direct cores as a chairside procedure saves time and is less expensive than indirect cores, and the technique is easily taught in undergraduate education. In addition, the complication rate of indirect cores compared with direct cores appeared to be higher in single crowns but not in FPDs. The published reports on long-term results also support the use of direct cores.[6]

The proportion of direct cores mainly increased in maxillary and mandibular incisors. These teeth—lateral incisors, as well as maxillary first premolars—are anatomically weak, and it is important to preserve their dentin as much as possible. In endodontically treated teeth, the amount of coronal tooth material (ie, the ferrule) has been shown to be the most important factor in preventing complications.[7] In molars, enough dentin can usually be retained for bonding the direct core following endodontic treatment.

Metal posts have been largely replaced by glass fiber posts and fiber-reinforced composite resin posts[8,9] for the fabrication of direct cores. Fiber posts are also reported to have fewer complex failures than metal posts.[6] Furthermore, tooth-colored fiber posts provide a more natural appearance than metal posts, with a better overall esthetic result.

Patient records of the Institute of Dentistry, University of Oulu, provide homogenous material for evaluation, since all treatment phases are strictly registered and controlled by clinical instructors using the same criteria. Teaching is based on evidence-based knowledge and generally accepted protocols, with new treatment methods adopted more slowly than in private practice.

**Table 2** Post Systems Used by Practitioners in the United Kingdom*

| System | Practitioners in 2004 (%) | Practitioners in 2008 (%) |
|---|---|---|
| Indirect posts (precious) | 67 | 55 |
| Direct posts | | |
| Fiber | – | 34 |
| Stainless steel | 14 | 11 |

*The data were collected by a postal questionnaire and results are presented as number of respondents.[2,3]

## Conclusion

More direct than indirect cores were used in fixed prostheses made by undergraduate dental students in the years 1984 to 2006. The complication rate of indirect cores compared with direct ones appeared to be higher in single crowns but not in FPDs. More long-term outcome studies are still needed to evaluate the survival and success of direct and indirect core protocols used in fixed prosthodontics.

## Acknowledgment

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