The professionals complementary to dentistry: systematic review and synthesis

Authors' objectives
To compare the effectiveness of professionals complementary to dentistry (PCDs) with dentists in clinical and educational roles, and in terms of acceptability and productivity.

Searching
MEDLINE, EMBASE, CINAHL, the Science Citation Index and Social Sciences Citation Index (via BIDS), the Cochrane Controlled Trials Register, SIGLE and HMIC databases(DH-Data, King's Fund and HELMIS) were searched. The database searches were conducted in 1999 and the Cochrane Oral Health Group's Trials Register was searched in 2000; the searches were updated in 2002. The reference lists of identified items were checked and two journals (Community Dental Health and Community Dentistry and Oral Epidemiology) were hand searched. Experts were contacted for unpublished and in-press reports. Studies in any language were eligible, although English language publications were given priority.

Study selection
Study designs of evaluations included in the review
The study designs eligible for inclusion were not explicit beyond that they directly compared PCDs with dentists. The various study designs included were described as meta-analysis, randomised controlled trial (RCT), controlled trial, before-and-after, observational, cohort, interrupted time series, simple transversal comparison, incremental design, questionnaire and epidemiological. These included prospective and retrospective studies, and some of the controlled studies involved a crossover.

Specific interventions included in the review
Studies that compared dental care provided by PCDs with that provided by qualified dentists or dental students were eligible for inclusion. Studies in which PCDs either complemented or substituted for dentists, or that compared the work of PCDs against an external benchmark, were also eligible. The tasks performed included diagnosis or screening for various conditions, technical procedures (such as fillings) and oral health promotion. Tasks that did not have a direct measurable effect on oral health status or the quality of the functioning dentition were excluded.

Participants included in the review
PCDs were defined as dental nurses, hygienists, therapists, technicians, assistants and any variations on these nomenclatures. A dentist was defined as someone who had completed formal dental training. The patients were assessed for acceptability of the services they received. The patient populations varied between the studies.

Outcomes assessed in the review
The review focused on outcomes relating to disease recognition, the quality of work carried out, technical competence, oral health, oral health education, acceptability and productivity. The outcome measures in diagnostic studies included measures of agreement, sensitivity and specificity; measures of technical competence included quality of dental restoration and other dental treatments; oral health promotion outcomes included attitudes of patients; acceptability outcomes included patient and professional attitudes and satisfaction; and productivity outcomes included output and cost. To be included in the review, the studies had to provide data on the outcomes of the work of both PCDs and dentists.

How were decisions on the relevance of primary studies made?
One reviewer selected studies that were relevant, while another reviewer checked a sample. Any disagreements were resolved by discussion. One reviewer applied the inclusion criteria to the relevant studies and five other reviewers checked a sample. Consensus was reached or a final arbiter resolved any disagreements.
Assessment of study quality
The authors did not state that they assessed validity, although they mentioned relevant aspects of study quality in the narrative synthesis and the tables suggested that they might have.

Data extraction
One reviewer extracted the data using a standard form, while five other reviewers data-extracted a sample of studies. A glossary was developed to standardised the nomenclature of professionals. Summary results from each included study were extracted as reported.

The data for the meta-analysis were extracted at the level of practitioner (dentist or PCD). The preferred measures of output extracted were relative value units (RVUs) or patient visits, which for the analysis were converted to a percentage increase over the baseline output by dentists before the addition of a PCD. Data for the standard deviation of the output between dentists within each study were not available in all studies, so variation within the studies was assumed to be equal.

Methods of synthesis
How were the studies combined?
A narrative synthesis was undertaken, with the studies grouped according to the five main themes: diagnosis, technical competence, oral health promotion, acceptability and productivity. Some studies provided information on more than one theme.

A meta-analysis was used to calculate the pooled weighted mean difference (WMD) in marginal output, with 95% confidence intervals (CIs), when a single-handed dental practice took on one expanded duty dental nurse, one regular dental nurse, or one dental hygienist. The estimates were calculated using a random-effects model, together with unweighted estimates, estimates weighted by the number of dentists, and estimates weighted by the square root of the number of dentists. Funnel plots were used to evaluate consistency and publication bias.

How were differences between studies investigated?
In the narrative synthesis, the studies were subgrouped within each theme as follows: diagnosis by the condition or test; technical competence by procedure; oral health promotion as oral health education or smoking cessation advice; acceptability of expanded-duty dental nurses or expanded-duty dental hygienists; and productivity in primary studies, computer simulations or economic models. The characteristics of the included studies were described individually in the text and tabulated, thus allowing differences to be compared.

Separate meta-analyses were conducted according to the type of PCD and a statistical test for homogeneity was applied.

Results of the review
A total of 125 studies were included, of which 6 were RCTs.

Diagnosis and screening.
The included studies looked at diagnosis or screening for dental caries (15 studies), periodontal conditions (3 studies), soft tissue diagnosis (4 studies), slide tests for salivary bacteria (1 study), temporo-mandibular disorders (2 studies) and orthodontics (1 study). Most of the studies were from the 1990s but did not meet basic quality criteria for diagnostic studies. Overall, the studies suggested that PCDs with appropriate training can diagnose as well as dentists. Seven of the 26 included studies were conducted in the UK.

Technical competence.
The included studies looked at complete restorations (4 studies), periodontics (4 studies), clinical aspects of denture provision (1 study), orthodontics (2 studies), and preventive therapies, fissure sealants and a traumatic restorative treatment (9 studies, plus 24 studies in an existing meta-analysis). Most of the studies were from the 1970s and were of a poor quality. Almost all of the studies suggested that PCDs with appropriate training can perform a wide variety of
dental procedures as well as dentists. Only one of the 41 included studies was conducted in the UK.

Oral health promotion.

The quality of the included studies was poor. Overall, they suggested that PCDs can deliver oral health promotion as well as dentists, based on 4 studies of oral health education and 6 studies of giving advice on smoking cessation. Only one of the 10 included studies was conducted in the UK.

Acceptability.

The included studies looked at acceptability among patients treated by expanded-duty dental hygienists, expanded-duty dental nurses (9 studies) or clinical dental technicians (4 studies). Most of the included studies were questionnaire surveys and the response rates fell as low as 5%. Overall, the results suggested that having procedures carried out by PCDs was acceptable to patients. Most of these studies were conducted in the 1970s and none were conducted in the UK.

Productivity.

Twelve of the 53 studies provided data that could be used for a meta-analysis. A random-effects meta-analysis of 8 studies showed an increase in output from a marginal extended-duty dental nurse (WMD 46%, 95% CI: 35, 56). Two studies showed an increase in output from a marginal dental hygienist (WMD 36%, 95% CI: 14, 59), while 5 studies showed an increase in output from a marginal regular dental nurse (WMD 18%, 95% CI: 15, 20). The studies pooled in these analyses were not statistically homogeneous.

Cost information

Based on evidence from 17 non-UK studies, the authors estimated that if a typical UK single-handed dental practice earns £100,000 a year, the addition of one expanded-duty dental nurse would increase this to £146,000 (95% CI: 135,000, 156,000) while the marginal cost of employing the PCD is probably less than £35,000. However, data on the financing of dental health care in the UK are needed to confirm this.

Authors’ conclusions

PCDs are able to diagnose a range of conditions and, with appropriate training, complete a wide-range of dental procedures as well as dentists. The evidence supported the delivery of oral health promotion by PCDs, but the evidence that PCDs are acceptable to patients was weak and the evidence about orthodontic PCDs and clinical dental technicians was insufficient. The authors stressed that the results should be treated with caution because most of the included studies were of a poor quality and old.

CRD commentary

This appears to be a thorough review with an extensive search (although it was unclear what the authors meant by giving English language publications priority), and pragmatic steps were taken to limit bias and errors in the study selection and data extraction processes. However, the scope of the review was very wide and the review questions about effectiveness were not well defined. The narrative synthesis was appropriate given the wide variety of studies included, and was ostensibly thorough. The meta-analysis graphs, however, suggested the quantitative pooling of data from studies with clearly dissimilar results is questionable. Without more exploration of the possible reasons for the dissimilarity, the average effects obtained are probably not very meaningful. The funnel plots were not sufficiently convincing of consistency and had too few studies to adequately assess bias. The information about study quality that could be gleaned from the report supported the authors’ warning to treat the results of the review with caution. The results from the meta-analyses require particular caution.

Implications of the review for practice and research

Practice: The authors stated that in the UK, unless new research contradicts the conclusions of this review, increasing the ratio of PCDs (not basic dental nurses) to dentists closer to 1:1 needs serious consideration.
Research: The authors stated that the NHS needs more and better research on the effectiveness of PCDs and the optimal type and length of PCD training.

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