Clinical Teaching of Prosthodontics in Undergraduate Courses in a German Dental School: Patients, Visits, Efforts, and Incentives

Fabian Huetting, Dr med dent; Florian Behrend

Abstract: It is unknown what disadvantages are faced by patients deciding for a prosthodontic treatment by inexperienced students. Commonly, the related extra effort and time are compensated by cost reduction of treatment fees. Thereby, the dental schools subsidize treatments to teach clinical prosthodontics. The aim of this study was to clarify the benefits to patients as well as the efforts of the dental school. Data collected from three courses in a dental school in Germany were patient gender, age, occupation, zip code, number of visits, scope of treatment including costs, financial discount, and remaining copayment. Travel costs were calculated based on zip code. Balance of travel costs and treatment discount was defined as financial benefit. The results showed that 185 patients (95 male) aged 32 to 82 years (median=58) were treated with fixed restorations (FR, n=110), telescopic dentures (TD, n=87), complete dentures (CD, n=17), or other (RD, n=3). The mean number of visits was 11 for FR, 12 for TD, and 9 for CD. Single distance to the clinic ranged from 0.6 to 65 miles (median=12). Total costs of prosthodontics were reduced by 19% on average. The mean financial benefit was 429 USD (median=298, min=-482, max=4025). The financial benefits were found to differ widely, including additional expenditures of patients. Participation, travel burden, and copayment did not depend on age, gender, or occupation. The financial benefit was relativized because students needed at least twice the sessions of a dentist. As a result, the financial efforts of dental schools are significant and compromise a cost-covering education.

Dr. Huetting is Assistant Medical Director, Department of Prosthodontics, Center of Dentistry, Oral Medicine, and Maxillofacial Surgery, Tübingen, Germany; Mr. Behrend is a doctoral candidate, Department of Prosthodontics, Center of Dentistry, Oral Medicine, and Maxillofacial Surgery, Tübingen, Germany. Direct correspondence to Dr. Fabian Huetting, Department of Prosthodontics, Center of Dentistry, Oral Medicine, and Maxillofacial Surgery, Osianderstrasse 2-8, D-72076 Tübingen, Germany; +49 7071 2986183; fabian.huettig@med.uni-tuebingen.de.

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Dental schools have to recruit patients for student treatment from all patients referred, recommended, or simply showing up at the outpatient department. Teaching prosthodontics requires frequent visits and compliance of the patient to finish the treatment. These treatments encompass uncomfortable procedures such as tooth preparation and impression taking. Additionally, prosthetic treatment is quite expensive for the patient, even if subsidized by statutory health insurance in Germany. These circumstances worsen when the patient is treated by clinically inexperienced (undergraduate) students. A substantial consequence will be more appointments, resulting in a greater time commitment for treatment. Ultimately, this situation may cause fear of treatment failures or more severe pain in patients. According to patients’ attitudes, dental schools try to compensate the efforts by providing high standard therapy, constant care, and observation of the treatment as well as financial incentives in kinds of cost reductions. But little is known about patients who declare themselves willing to comply with a prosthodontic treatment in undergraduate student courses.

In a study published in 1973 coping with profiles of patients under student treatment, the reported cohort encompassed a large proportion of children. Nevertheless, these data illustrate the discrepancy of pros and cons, which were also mentioned for prosthetic treatment. On the one hand, the patients confide in the quality of a treatment and attitude of personnel as well as the profit from reduced fees. On the other hand, the patients dislike the length of the treatment and number of appointments as well as the distance and parking situation. Knowing this, there is a lack in the extent of the trade-off between potential benefits and inconveniences. Moreover, no data are available about the realized time performance of students providing patients with prosthodontics. These data are crucial for both patients and dental schools. The patients should be informed about how many visits of which length they have to expect for their treatment, so that they can calculate their remaining
benefit due to significantly longer or more frequently visits adding expenses for traveling and parking. Therefore, cutoff values would be desirable to inform and educate the patient. Dental schools can calculate their educational capacities and budgets based on the number and length of treatments needed and a discount, which could be worthwhile for the patient as a stimulus. This calculation depends on how many students have to be trained clinically because the more patients who have to be treated, the more capacity has to be provided and a higher volume of financial reduction has to be taken into account by the dental school. Thus, the aim of this retrospective study was to evaluate patients' efforts and benefits for prosthodontic treatments as well as the connected efforts of a dental school in an undergraduate clinical course in prosthodontics.

Educational Environment

Recruitment of Patients

The Center for Dentistry at the University Hospital of Eberhard-Karls-University, Tübingen, Germany, is open to all patients without referral. Reasons are widespread why patients show up for consultation about prosthetic treatment. Dentists at the prosthodontic walk-in clinic sum up the following reasons: second opinion on complex situations, opportunity of treatment at a university hospital, recommendation by acquaintances or family, referral of a dental office or another department of the Center for Dentistry, and ultimately also because of a potential cheaper treatment in clinical student courses.

To be considered for treatment in an undergraduate prosthodontic student course, patients had to fulfill the following criteria: need of at least three crowns, one fixed partial denture, one removable partial denture (preferably supported with telescopes), or a complete denture in both jaws. Exclusion criteria were as follows: severe systemic diseases (depression, anticoagulation with an INR>1.9, dementia), multiple allergies, pregnancy, need of a complete periodontal or several endodontic treatments, or need for extended oral surgery and extractions prior to prosthetic treatment. If the latter treatments are necessary prior to prosthodontics, the patient is placed on hold for the next term and referred to the appropriate department meanwhile.

Patients are informed according to a standard protocol about at least three prosthodontic options and their associated risks, costs, and aftercare. If the patient fits the selection criteria, the option of treatment in an undergraduate student course is offered. Hence, patients are informed about the treatment setting, a higher number of visits (by guess about twice as much compared to an examined dentist), and the potential discount of patient's copayment (half of the dentist's fee). The remaining copayment is calculated as shown in Table 1.

Treatment Settings in Clinical Courses

The treatment repertoire in the undergraduate courses does not differ from regular treatments at the dental clinic or in a regular private practice. Except for dental implants, all types of prostheses are inserted. Nevertheless, the department has a focus on telescopic dentures made from non-precious alloys as well as on fixed all-ceramic restorations (full crowns and partial crowns made from monolithic lithium disilicate as well as crowns and FDPs with porcelain veneered Zirconia frameworks). These types of restorations are favored over blocked crowns with precision attachments for removable dentures or metal-based fixed restorations including porcelain fused to metal.

Six fourth-year students share one dental chair unit including the cupboards and inventory (so called “box”) for the whole term. There are ten boxes observed by two examined dentists, who are always present during treatment time at their desks. Three of the six students constitute a learning group. One group has the possibility to share the forenoon treatment time (8 am to 12 noon); the other group shares the afternoon (1 to 5 pm) for treatments. The course runs from Monday to Friday, except Thursday forenoon and Friday afternoon.

Thus, 60 students are able to treat for the same amount of time during the 13.5-week term. They assist each other to treat their patients. Normally, one student treats one patient in the box during a half-day (forenoon or afternoon). The reported treatment time of each visit is 3.5 hours on average (range two to five hours for each session) independently from the treatment performed. Thus, normally only one patients is treated on such a half day.

Treatment Planning and Treatment

Every student is issued at least one patient during the first week of the semester. During the first visit, the student performs an anamnesis and extroral examination, as well as functional, mucosal, hygiene,
Table 1. Example of calculation of patient's copayment for prosthodontic treatment (3-unit FDP to replace 35) and financial benefit due to travel costs (all in U.S. dollars)

<table>
<thead>
<tr>
<th>Calculation (total cost: 1680.19)</th>
<th>Treatment by Dentist</th>
<th>Treatment at Student Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Dentist's fee</td>
<td>758.40</td>
<td>0.5 * 758.40 = 379.20</td>
</tr>
<tr>
<td>(2) Invoice of the dental lab</td>
<td>816.93</td>
<td>816.93</td>
</tr>
<tr>
<td>(3) Cost for dental materials (impression material, adhesives)</td>
<td>104.86</td>
<td>104.86</td>
</tr>
<tr>
<td>(4) Indication-based subsidy of statutory health insurance</td>
<td>-463.10 (no bonus)</td>
<td>-463.10 (no bonus)</td>
</tr>
<tr>
<td>(5) Remaining copayment of patient</td>
<td>1217.09</td>
<td>837.89</td>
</tr>
<tr>
<td>(6) Treatment discount</td>
<td></td>
<td>379.21</td>
</tr>
<tr>
<td>(7) Travel costs for 8 visits (examination, pre-treatment, preparation, impression, framework try-in, final try-in &amp; color adaption, luting, final check-up) driving 15 miles single distance</td>
<td>8 visits * 0.42 (mileage allowance) * 15 miles * 2 (roundtrip) + 8 * 4 parking</td>
<td>100.80 + 32.00</td>
</tr>
<tr>
<td>Treatment discount (6) minus travel cost (7) = (8) financial benefit</td>
<td></td>
<td>246.41</td>
</tr>
</tbody>
</table>

Note: Example is case of a missing tooth 35 in a dentition, where all 27 other teeth are present or at least replaced. The statutory health insurance will subsidize a fixed budget due to this gap topography (4). This subsidy may rise to 100% bonus (=subsidy x 2), which depends on prophylaxis and dental check-ups by the patient in the recent years. This budget (4) minus the legally capped dentist's fee (1) and lab invoice as well as dental medical materials (2, 3) sums up the remaining copayment of the patient (5). The total cost of the FDP is the sum of the invoice line items 1 to 3. For student courses, the dentist's fee is normally halved and is the equivalent of the treatment discount (6). Travel costs (7) due to visits and parking have to be subtracted from this discount to calculate the financial benefit (8) of the treatment.

and dental status including tests for sensitivity and percussion pain. Due to the preceding screening at the outpatient clinic, radiographs (orthopantomogram) are already present. If indicated, further radiographs are taken in the radiology department. All findings are noted in the patient chart as well as a student treatment protocol. Furthermore, alginate impressions are taken for diagnostic casts, which are mounted in a semi-adjustable arcon-articulator via facebow transfer. Finally, the supervisor of the student course visits each box. The students present their patients, and the supervisor evaluates the clinical situations to give input as well as decision or answers to open questions. The students are not allowed to treat in this session, because they have to pass the subsequent pre-treatment conference (assessing their competence).

Therefore, all findings, documents, and casts are used for a critical clinical planning of the complete prosthodontic treatment in the learning group. The results are reviewed and thoroughly discussed with the assigned dentist in a pre-treatment conference. During this meeting, the complete treatment is fixed, and students have to show that they are familiar with the steps and procedures as well as with the medical devices used. All information is fixed in the treatment protocol. After students pass this kind of exam, they are allowed to make appointments with their patients on their own to get the treatment started.

During the treatment, one dentist supervises five chairs. Students have to present at least the following steps for the dentist’s chairside control: application of local anesthesia, removal of caries, finished core built up, finished tooth preparation before gingival displacement, need of gingival HF-surgery, final tooth preparation prior to impression, border molding, final impression, temporary restorations prior to luting, interocclusal records/jaw relationship, try-in of frameworks or copings, coping impression, trial placement and wax try-in, fit and occlusal adjustments of the final restoration, arrangement for definitive luting/insertion, and final check-up one week after luting/insertion. Whenever unconfident with a procedure, the students are encouraged to ask the observing dentist for supervision, support, or demonstration. A contracted external dental lab is in charge to manufacture the commissioned prosthodontic works because the lab of the dental school is not capable to cover this workload.

The planned treatment has to be finished, and the prosthesis must be inserted (after final check by the assistant medical director) by the student to pass the clinical course. One week after insertion,
the patient is seen again for a final check-up by the student. In this session, the patient is assigned to a dentist for aftercare.

# Materials and Methods

The study protocol of the retrospective acquisition was counseled and approved by the Independent Ethics Committee of Eberhard-Karls-University’s Medical Faculty & Hospital (471/2013R). A list of patients enrolled and treated in the clinical courses of the Department of Prosthodontics (Center for Dentistry, Oral Medicine, and Maxillofacial Surgery at the University Hospital of Eberhard-Karls-University, Tübingen, Germany) was derived from educational supervision software (self-build database program, MS Access 2003, Microsoft Corp.). Patient charts and students’ treatment protocols were reviewed, and the following data were extracted to enable anonymity: year of birth, gender, zip code of home address, occupational status, number of sessions (starting from first examination in the student course till check-up visit after insertion of the denture), extent of prosthetic treatment (number of preparations, treated jaws upper and/or lower), kind of restoration inserted as these were crowns, partial crowns, inlays, fixed dental prostheses, overdentures with telescopic crowns, complete dentures, or clasp retained removable partial dentures. Invoice data (treatment discount, remaining copayment of the patient, overall treatment costs including lab share, and fixed subsidy) were extracted from the accounting system of the clinic. Every patient was given a random four-place code to trace patients (if showing up in more than one course).

The variables were handled as follows. The age of the patient was the calculated difference between treatment year and year of birth. Age groups are constituted by following rationales: ≥65 years (age of retirement in Germany and decreasing utilization of prosthodontics), 50-65 years (age of high prosthodontic need), <50 years (rising need of prosthodontics). Occupational status was grouped into “occupied” for employed or self-employed and “unoccupied” for unemployed, retired, in training, and unknown status. Prosthodontics was grouped into fixed restorations (FR) (crown, partial crowns, FDPs); telescopic dentures (TD) (because of the department’s treatment focus they form an own group), complete dentures (CD), and other removable partial dentures (RD) (clasp prostheses). Regarding traveled distances, the single route was determined via Google Maps (maps.google.com) as the mean of the shortest and the alternative distance by car between the address of the dental school and the zip code of the patient. Travel costs were calculated based on the number of visits in the student course multiplied by twice the single route (round trip) and the official mileage allowance of 0.30 EUR per kilometer, which is about 0.65 USD per mile. Financial benefit was calculated as balance of travel costs and treatment discount. Exchange rates of 1 EUR to USD were averaged for every accounting period: summer 2011=1.401, spring 2012=1.322, and summer 2012=1.262. To ensure comparability, patients with complete treatment compensation by the statutory health insurance or in a special arrangement due to study procedures were excluded from the calculation of financial benefit because these patients were not given a treatment discount or even full deduction of their copayment.

All data were analyzed as distributions and densities. Differences were statistically tested by the Student t-test (α=5%); relevant differences had to be at least 20%. Correlation analysis was performed to estimate coherence functions of fit or to substantiate stochastic dependence.

# Results

## Patients and Prosthodontic Treatment

The results showed that 185 patients (95 male, 90 female) were treated in three semesters (summer 2011, short S11; winter 2011, short W11; summer 2012, short S12) in the undergraduate student course of prosthodontics. Distribution of gender was similar for all semesters: S11=29m+32f; W11=34m+27f; S12=32m+31f. The patients were a median age of 58 years (mean=58, min=32, max=82, SD=11.2) (Figure 1). There was no statistically significant difference in age distributions of male and female patients (p>0.05). The occupational status showed a uniform distribution of occupied and unoccupied patients: 40% retired, 39.5% employed, 7.5% self-employed, 6.5% unemployed, 1% in training, and 5% unknown. Out of 185 patients, 17 (nine male, eight female) showed up for another treatment in a subsequent semester. These recurrent patients were aged similar to the whole cohort (mean=57, median=58, min=35, max=77, SD=11.2), and likewise the age distribution of the genders was not significantly different.
showed high variety (Figure 3). Occupational status had no influence on the median travel distance (occupied=12.4 miles, unoccupied=11.7 miles) or visits (11 vs. 11.5). The mean driving distance of the 17 recurrent patients did not differ significantly from the whole cohort with 19.82 miles (median=12.1, min=8, max=44, SD=11.9).

On average, the patients visited the student course 11 times (median=11, min=5, max=18, SD=3). These numbers of visits include the first presentation, the treatments, and the last visit for final examination after insertion of the prostheses. There was a slight but not statistically significant difference of one visit between male and female patients: median and mean of female vs. male=12 vs. 11 visits. Depending on the group of prostheses and the number of treated jaws, different numbers of visits could be identified (Table 2). The sessions needed by students differed not significantly from the planned visits by factor 1.3, but with an average factor of 1.9 significantly from the visits that would be usually needed by a dentist.

Financial Benefit of Patients

Travel costs, based on the official fixed rate for kilometers driven by car in Germany, were esti-
In return, the financial benefit was even so slightly higher in unoccupied patients: median=314 vs. 252 USD. The 18 patients returning for another treatment in a subsequent course (recurrent patients) had a similar mean financial benefit of 434 USD (median=317, min=-482, max=1286, SD=399).

The results showed that 23 patients (13%; 12 male, 11 female) had a negative financial benefit (mean=-117 USD, SD=120) in kinds of collateral expenditures. These patients were averagely aged 59 (median=60, min=41, max=75), and there was also no difference between the female and male age distribution. Their treatment encompassed CD (n=3), CD+RD (n=2), TD (n=8), and FR (n=14). Their single route to the clinic was 26.5 miles on average (median=27, min=7, max=49, SD=11.5). This distribution of distance to dental school differed statistically significantly from the patients who had a positive financial benefit (mean=15 miles, median=12, SD=10.6). A distance cut-off was estimated at 18 miles single distance, having 11 visits for the complete treatment (Figure 4). In addition to this, the financial benefit depended on the extension of the prosthodontic treatment. Extensive treatments are more expensive, and thereby the percentage of

Figure 2. Proportion of inserted prostheses (FR=fixed restorations, TD=telescopic dentures, CD=complete dentures, RD=other removable partial dentures) to grouped age

Note: Female patients are shaded.
discount results in higher amounts (Table 2). These sums compensate both a higher number of visits as well as a greater distance to the clinic. Furthermore, two of these 23 patients were compensated with financial benefit due to treatment in a subsequent course (sum: -184 instead of -482 USD and 860 instead of -125 USD).

Discussion

Patients’ Efforts and Benefits

The evaluated data about patients treated by undergraduate students with prosthodontics were limited in comparability due to a lack of similar reports. McCracken et al. reported that low-cost implant-supported dentures from dental students were utilized by patients with a mean age of 60 years who travel a mean single distance of 70.7 road miles (=114 kilometers). Other data from the United States reported a mean value of 17.5 miles (28.2 kilometers) of travel for medical care, which is comparable to our data and patients from rural areas. However, patients in Germany travel only 4.2 miles on average to visit their dentists. Patients who received prosthodontics in a German student course were also reported to be aged 58 ±12 years with a 1:1 ratio of genders.

Our data showed no dependence of gender, age, or occupational status towards both participation in student treatment and acceptance of distance traveled to visit the clinic. Due to a prevalence of multimorbidity in older age, it was unexpected that no stronger age dependence was shown in the distance traveled between home address and dental clinic. Regarding the calculation of travel costs, it can be criticized that the mileage allowance was applied to all patients, assuming that they come to the clinic by car. However, public transport (in the present amount traveled) is comparably priced to these estimated expenditures. Furthermore, the current mileage allowance of 0.65 USD does not cover the real expenditures for a road mile driven by car. These are estimated about 1.08 USD per road mile (0.5 EUR per km) unofficially. Compared to a regular dental practice, the travel costs are significantly higher for a treatment in the dental school due to more frequent visits and a higher mean travel distance (16 instead of four miles). Additionally, dental practices provide by law an adequate number of parking lots free of charge to

Figure 3. Correlation analysis of patients’ single route (distance between home address and dental school at y-axis in road miles) and age during treatment (x-axis in years)

Note: Grey line shows quadratic fit line. Dark line illustrates fit of each value as mean distance for each age.
Table 2. Overview of inserted prostheses regarding number of visits, cost reduction, and financial benefit of patient (all in U.S. dollars)

<table>
<thead>
<tr>
<th>Group of Prostheses/ Treated Jaws (Number of Patients)</th>
<th>Regular Number of Visits for Dentist's Treatment</th>
<th>Mean Value of Planned Visits in Conference (median, min-max, SD)</th>
<th>Mean Value of Visits Needed for conference (median, min-max, SD)</th>
<th>Mean Total Cost of Treatment (median share of lab costs)</th>
<th>Mean Realized Treatment Discount (median, min-max) and Median % of Total Costs</th>
<th>Mean Remaining Copayment (median realized deduction of copayment via treatment discount)</th>
<th>Mean Financial Benefit (median, min-max)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete dentures; one and both jaws (n=8)</td>
<td>5</td>
<td>6.1 (6, 3.8-1.6)</td>
<td>9.1 (9, 6-13, 2)</td>
<td>1108 (54%)</td>
<td>209 (251, 111-260)</td>
<td>207 (46%)</td>
<td>77 (88, -70 to 208)</td>
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<td></td>
<td>19.4%</td>
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<tr>
<td>Complete dentures and other RPD; both jaws (n=3)</td>
<td>6</td>
<td>8.7 (8, 7-11, 2)</td>
<td>11 (10, 8-15, 3.6)</td>
<td>1744 (67%)</td>
<td>143 (156, 80-193)</td>
<td>324 (27%)</td>
<td>31(-39, -107 to 53)</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td>8.5%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Telescopic denture and complete denture; both jaws (n=6)</td>
<td>7</td>
<td>9.1 (9, 9-10, 0.7)</td>
<td>12.3 (13, 7-18, 4)</td>
<td>4376 (64%)</td>
<td>763 (677, 244-1925)</td>
<td>2416 (24%)</td>
<td>451 (465, -482 to 1060)</td>
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<td></td>
<td>14.5%</td>
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<tr>
<td>Telescopic denture; one jaw (n=51)</td>
<td>6</td>
<td>9.2 (9, 6-12, 1.2)</td>
<td>11.8 (12, 8-17, 2.2)</td>
<td>4723 (65%)</td>
<td>771 (685, 244-1925)</td>
<td>2451 (24%)</td>
<td>554 (519, -229 to 1366)</td>
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<td></td>
<td></td>
<td></td>
<td>14.9%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Telescopic denture; both jaws (n=12)</td>
<td>7</td>
<td>10 (9, 9-15, 2.1)</td>
<td>12.8 (12.5, 9-18, 2.5)</td>
<td>6450 (68%)</td>
<td>899 (810, 517-2187)</td>
<td>2877 (26%)</td>
<td>507 (443, -17 to 1726)</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td>13.2%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Telescopic denture and fixed restorations; one and both jaws (n=6)</td>
<td>7</td>
<td>11.1 (11, 9-14, 1.7)</td>
<td>13 (13, 11-17, 2.3)</td>
<td>4796 (60%)</td>
<td>843 (769, 509-1177)</td>
<td>1978 (31%)</td>
<td>325 (248, 84 to 892)</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td>18.2%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed restorations; one jaw (n=78)</td>
<td>5</td>
<td>7.6 (7, 4-13, 2)</td>
<td>10.6 (10, 5-18, 3.3)</td>
<td>3273 (55%)</td>
<td>732 (481, 102-4376)</td>
<td>1515 (31%)</td>
<td>466 (245, -218 to 4025)</td>
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<td></td>
<td></td>
<td></td>
<td>19.4%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed restorations; both jaws (n=21)</td>
<td>6</td>
<td>8.7 (8, 6-13, 2)</td>
<td>12.2 (12, 8-18, 2.7)</td>
<td>3557 (52%)</td>
<td>728 (565, 249-1812)</td>
<td>1840 (29%)</td>
<td>417 (359, -186 to 1320)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>19.8%</td>
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</tbody>
</table>

Note: Table summarizes the patient treatment in “groups of prostheses” and necessary visits in student treatment course for completion as well as related costs and benefits. Mean of total costs is shown with lab share. The 50% reduction of dentist’s fee results in a treatment discount (USD and as percentage of total costs). The remaining copayment is shown (including percentage of realized deduction of copayment due to treatment discount). Far right column shows mean financial benefit for patients depending on their distance traveled for appointments needed.
their patients. Dental practices offer also much more convenient opening hours to their patients, including early (around 6:30 am) and late hours (up to 9 pm), Friday afternoons or even Saturdays, which is not possible for dental schools in public service.

The provided treatments were comparable to supply and demand of prosthodontics in Germany and also comparable to the report from a German prosthodontic student course.\textsuperscript{10} This might be due to the fact that prosthodontics are an inherent part of the German statutory health insurance.\textsuperscript{2} Even if the subsidy is capped, this quite complex payment system allows a wide comparison towards treatment in a dental practice.\textsuperscript{3} This enforces the reasoning that treatment discounts are the major stimulus. Interestingly, the occupational status seems to have no influence on the participation. However, the study lacks information about concrete socioeconomic variables such as civil status, assets, profession, hours of labor, and income of the patients. This should be explored in further research. But in contrast, taking the mean values of financial benefit and number of visits into account, the benefit is questionable at all because travel and treatment result in a quotient of $\sim$7.70 USD (about 6 EUR) per hour as realized incentive (calculated from 429 USD mean financial benefit divided by 11 visits multiplied with 4 hours in clinic plus two ways of 32 minutes travel time). This amount is only 70\% of the current minimum wage (8.50 EUR per hour $\sim$11 USD) in Germany and thereby unattractive compared to the time spent working (in a part-time job besides retirement). The travel times of about one minute for each half mile by car is negligible compared to the visit time of about 3.5 hours of treatment plus 0.5 hours of registration and waiting. This mean length of any visits in students’ treatment is discussed below. However, this low financial benefit per hour in treatment implies that for both groups of patients (unoccupied/occupied) other traits and conveniences may contribute to the perception, decision, and later satisfaction as discussed in the 1970s.\textsuperscript{11}

As communication is a key for patient satisfaction, the time spent in the dental chair on continuing interaction with two students may contribute to lower anxiety and higher appreciation in the patient.\textsuperscript{12,13} This might be enforced by the continuing supervision by a third party, which also cares about explanation, progress, and quality of treatment.\textsuperscript{4} Furthermore, a
patient’s sense of self-esteem is risen by a student’s higher awareness of discomfort and concern for patients as people.\textsuperscript{14} Last mentioned might result from the double relatedness between student and patient. The students and patients are aware that the treatment is performed by less marked skills and simultaneously applied to a person who is the only guarantee for the students to pass the course. Finally, it can be considered that the altruistic trait “to help students training their skills” may contribute to patient’s self-esteem.\textsuperscript{7} It remains to be evaluated which of these or other motives may outweigh the relatively low economic benefits of participation in a prosthodontic student course. Even so, it remains unclear how satisfied the patients were with their treatment and if the burdens were comparable to a dentist’s prosthodontic treatment.\textsuperscript{1}

However, patients interested in student’s treatment can be informed now that they have to show up twice as much as treated by a dentist, independently from the prosthetic construction they are going to receive. Furthermore, they can be sensitized for travel costs and the statistical cut-off for the travel distance. Such a cut-off can be estimated by a dental school with the presented variables based on their specific circumstances, conditions, and assumptions.

**Dental Schools’ Efforts and Role of Discounts**

In a wider perspective, the results illustrate also the efforts made by dental schools to cover education in clinical prosthodontics. The educational and institutional setting is not suitable to work financially successful when compared to dental practice. According to Nash and Benting, the mean number of patients treated in a week by a specialized prosthodontist is 35, and only 18% of the treatment session are over 100 minutes.\textsuperscript{15} Our students underperform timely because their treatment time needed in any session is at least 120 minutes. This is mainly due to the process environment of the dental school. Besides a slow treatment in principle, students report that time is consumed by walks and wait for the radiology department during pre-prosthetic treatments (endodontics, root posts, caries diagnostic, and removal), paperwork, discussions with the patient, which is normally delegated to nurses, and latency for the supervising dentists to check a finished procedure. Furthermore, they report that patients claim recovery phases during the prolonged sessions. The supervisors report that mostly the fabrication of temporary restoration is very time-consuming. In complete dentures, the functional impression (including border molding) as well as wax try-in is experienced as demanding to meet supervisors and patient’s expectations. Beside the covered sessions in this evaluation, the recruitment, necessary retreats, and the later aftercare of patients (when students have passed their course/exams and left the school) have to be provided by the staff of the department. These are crucial points in overall calculations, which have to be addressed in further studies.

In this perspective, the reduction of a dentist’s fee is only one share of a dental school’s expenditures, which culminates with the number of students along with consumption and replacement of materials, instruments, and medical devices. This cohort of patients received a treatment volume of 700,000 USD in three clinical courses, including the external costs of the dental lab invoiced by the clinic. The dental school and medical faculty subsidized about 130,000 USD in treatment discounts (as it is half of dentist’s fee) from its clinical share of 275,000 USD. Thus, the department had to get by with 145,000 USD running the three clinical courses. The two dentists supervising during the opening times while the 13.5 weeks course draw a salary of about 35,300 USD, which is 106,000 USD for all three courses. The remaining 13,000 USD for each course do not cover the expenditures for clinic hygiene (gloves, single use instruments, disinfection and sterilization, water purification), amortization of medical devices (dental instruments, dental chairs), or the nurses supporting the organization. Even so, a student’s consumption of materials (impression materials, retraction cords, adhesives, filling materials) is expected to be higher than a dentist’s treatment.

In addition to this, the German statutory health insurance system and treatment contracts include allocated budgets for a dental school. Strictly speaking, an overdraft by realized clinical income is capped and has to be refunded. As education economics was not the objective of this study, the presented data raise the question if the patient-centered approach in undergraduate clinical courses can turn into an efficient and financially sustainable delivery system of prosthodontic treatment.\textsuperscript{16} Our data indicate shortcomings in institutional and insurance financing. As the share of the dental lab is a significant item on the invoice, implementation of new and cost-beneficial dental lab technologies such as CAD/CAM systems may contribute to a beneficial ratio.\textsuperscript{17,18} Furthermore, clinical treatment performance of students could
be improved if preclinical training focuses on later clinical aspects and handling. This could make dental students less dependent from faculty during early stages of clinical teaching. Due to the complexity and complicity of this issue, further investigation and evaluation are needed to clarify today’s financing of clinical education in prosthodontics in Germany. Due to the specific situation in prosthetic dentistry, especially the amount of sessions for treatment, the findings and data might not be applicable to other disciplines of clinical dental education.

Conclusion

In this study, age, gender, nor occupational status predicted participation in student treatment with prosthodontics. For such care, the patients were willing to travel disproportionately far to a dental school. Patients benefitted financially from the treatment discount, but it was nominal in relation to the time spent for treatment and travel compared to treatment in a dental practice. Thus, cost reduction can be regarded as a stimulus, but other impetuses may also contribute to the decision for treatment by undergraduate students. It remains to be explored whether special reasons of patient satisfaction such as friendliness of the dental school staff or expected and experienced quality of treatment and equipment are still valid and compensating the burdens taken. As a result of these facts, the financial efforts of dental schools are significant and compromise a cost-covering treatment in education. Even these aspects should be addressed in further research of today’s clinical education.

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REFERENCES