

Scientific article

**Prevalence and type of
removable prostheses manufac-
tured in dental laboratories in
Switzerland over the last 10
years.**

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Johan Haerri¹, Frauke Müller^{1,2}, Philippe Mojon^{1*}

¹ Division of Gerodontology and Removable Prosthodontics, University Clinics of Dental Medicine, University of Geneva, Geneva, Switzerland

² Division of Geriatrics, Department of Rehabilitation and Geriatrics, University Hospitals of Geneva, Thônex, Switzerland

* Correspondence: Dr Philippe Mojon, Division of Gerodontology and Removable Prosthodontics, University Clinics of Dental Medicine (CUMD), 1, Rue Michel-Servet, 1211 Geneva 4, SWITZERLAND, Tél: +41 22 379 40 60, Email: philippe.mojon@unige.ch

Keywords

Removable dental prostheses, manufacturing methods, dental laboratories, e-survey, evolution

Abstract

Due to effective preventive measures and advanced techniques in operative dentistry, tooth loss occurs later in life and implant restorations have become a common solution for replacement of missing teeth. Therefore, the use of removable dental prostheses (RDPs) is expected to decline over time. This study aims to evaluate the expected decrease in the production of RDPs in Swiss dental laboratories over the past decade. From 2012 to 2022, two indicators of prostheses production were examined: the number of dental laboratories (DL) and dental technicians in Switzerland, and the import and sale rates of denture teeth. 85 DL participated in a survey and indicated their perception regarding market trends. Finally, in-depth data collection was conducted in 16 DL in French-speaking Switzerland to gather the production of various types of RDPs over the last ten years. Over the observation period, the number of DL significantly decreased ($p < 0.05$), while the decrease in dental technicians was less pronounced. The overall quantity of prosthetic teeth imported into Switzerland or sold by Curaden AG witnessed a significant decline ($p < 0.05$). Survey findings revealed inconsistent perspectives from the respondents on the profession's development, despite a tendency suggesting a decline in complete prostheses and an increase in partial or hybrid removable prostheses ($p < 0.01$). Except for a decline in the number of chrome-cast partial prosthesis manufactured ($p = 0.04$), no clear trend was observed in the 16 DL. Despite lower import rates of denture teeth and a perceived shift in denture type, the overall production of RDPs seems to remain substantial.

Introduction

Removable dental prostheses (RDPs) are among the most common treatment modalities to restore the dentition in patients with partial or total tooth loss (1). RDPs help restore aesthetics, ensure occlusal stability, and improve masticatory function. In Switzerland, RDPs are widely used in dental treatment, but their design and manufacturing techniques have evolved over the years.

According to the Federal Statistical Office (FSO), Switzerland's older population has been growing, with an annual 1.9% increase in people aged 65 years and older (2). In 2021, persons over 65 accounted for 19.5% of the population. With the sequelae of dental disease accumulating over a lifetime, the prevalence of edentulism increases with age (3-6). Consequently, RDPs are more likely to be manufactured for older patients.

The number of completely edentulous individuals appears to be decreasing in developed countries but remains high due to the increasing life expectancy. Mojon and collaborators examined in 2004 the impact of demographic changes and a declining edentulism rate on the dental prosthetics prevalence in Great Britain, Finland, and Sweden (7). They concluded that population aging would not result in a growth of the dental prosthetics market in Europe, even when considering the most pessimistic projections for edentulism rates. Reduced edentulism rates appear to be substantial enough to counterbalance the influence of a growing aging population, influencing future models for dental treatment and education.

Three Swiss National Health Surveys (5, 8, 9) examined the progression of oral health in Switzerland from 1992 to 2012. These studies confirmed a decline in tooth loss over the two-decade span, with the overall prevalence of edentulism decreasing from 5.8% to 2.2%.

The same Swiss National Health Surveys revealed a change in prosthetic restoration prevalence according to various age strata (9) with reduced numbers of missing teeth and fully edentulous persons being reported (4, 5). Accordingly, these surveys indicated a decrease in the prevalence of complete removable dental prostheses (CRDP) in favor of removable partial dentures or fixed dental prostheses (FDP), including implant-supported restorations. These changes were more noticeable in older age cohorts where tooth loss is most prevalent. For individuals aged 75-84 years, the prevalence of RDP declined from 72% to 43% between 2002 and 2012, while for those over 85 years, it decreased from 85% to 60%. Overall, the percentage of participants under 74 years old wearing RDP decreased from 18.7% in 1992 to 7.7% in 2012. At the same time, the proportion of surveyed participants with dental implants tripled from 2002 (3.2%) to 2012 (9.8%). In 2012, 5% of participants had fixed implant restorations, compared to 1.5% in 2002. Another 1.5% had implant-retained removable restorations in 2012, compared to 0.8% in 2002 (9). Conversely, the use of FDP increased, peaking in 1992 with 55% in the 45-54-year age group, whereas the same peak occurred ten years later in the 45-64-year-old and in 2012 in the 55-74-year-old age strata.

Hence in Switzerland, a decrease in removable dentures prevalence among older groups can be noticed. Natural teeth are retained longer, and once lost, they tend to be replaced more often by fixed restorations. In 2012 the age of the insertion of the first RDP was observed to be around 10 years later compared to 2002 (9). In other European countries, similar trends can be observed (10).

According to Swiss National Health surveys, the type of prosthetic restoration seems influenced not only by age but also by education and income levels. People with higher education or income levels were more likely to have implants and fixed restorations than those with lower income or education. Furthermore, the proportion of participants with RDPs was higher in rural than in urban areas (1, 5, 9). However, these surveys have some limitations, such as self-reported tooth loss and wearing of prostheses. Only participants reachable by phone and speaking one of the three national languages were included, which presents a selection bias, given the high percentage of foreigners living in Switzerland (2). Furthermore, healthier participants may have been more likely to participate in surveys than their frailer and dependent peers.

The aim of this study was to assess changes in the prevalence of removable dentures and production in Switzerland over the past 10 years, from 2012 to 2022, along with the number of dental laboratories and dental technicians in Switzerland. Both, dentists, and dental technicians may be interested in potential changes in treatment need of the population in order to plan for manpower and resources. These findings may also impact the need for basic and higher education in prosthodontics.

Materials and methods

This study does not fall within the scope of Swiss legislation on human research, and approval from a cantonal ethics committee was not required (Req-2023-00303).

The number of licensed dental technicians and DL was obtained from the Federal Statistical Office (www.bfs.admin.ch) and via Association of Swiss Dental Laboratories (SDL). Swiss dental technicians were recruited via the SDL for this online survey on the production of the different types of fixed and removable dental prostheses. SDL was equally contacted concerning the number of imported denture teeth. Swiss resellers for dental products were asked to share their sales numbers of denture teeth. A convenience sample of regional DL known to manufacture RDPs were recruited for an on-site survey of the type RDPs annually produced over the abovementioned 10-year period.

Evolution in the number of dental laboratories and dental technicians

The evolution in the number of DL and the number of full-time equivalent dental technicians that are members of the SDL Association from 2012 to 2022, as well as the changes in the number of DL and active dental technicians in Switzerland from 2011 to 2020 (SFO, STATENT: Structural Business Statistics) were analyzed.

Imports and Sales of Prosthetic Teeth

The SDL provided data on the import of prosthetic teeth used for removable denture detailing the quantity (in kilograms) and cost (in Swiss Francs). Imports from over 90 countries were considered between 2012 and 2021. These data came from the Federal Office for Customs and Border. In addition, three main companies that sell prosthetic teeth were approached but only one (Curaden AG) provided the sales numbers of prosthetic teeth in Switzerland for the period from 2011 to 2022.

Online Questionnaire for Dental Technicians

An online questionnaire was developed, tested and retested for comprehensibility with a focus group of Dental technicians. It was divided into three sections: The first set of questions, 'Socio-demographic,' aimed to identify the location, type, and size of the DL. The second set of questions pertained to the manufacturing of RDPs and their different versions. It sought to evaluate the evolution of the time spent, the number of RDPs manufactured, and the use of various novel digital technologies. A third set of questions concerned the manufacturing of fixed prostheses, detailing the types of materials used for different types of restorations. The results of this last part will be published separately later.

The questionnaire was initially developed in French, then translated into German and Italian by native-speaking colleagues, and subsequently back-translated into French for accuracy. A focus group of dental colleagues reviewed and tested the questionnaire, with modifications made where necessary. A survey software (LimeSurvey; Produced by LimeSurvey.org, Version 5.6.45) was used to create an online version of the questionnaire in each language.

In collaboration with the General Manager of the SDL, the survey was emailed to the 481 laboratories that were members of this association. After one month, 118 dental technicians had clicked on the survey link. A reminder was sent resulting in 57 new further responses.

Qualitative analysis of Prostheses Manufactured by Dental Technicians

The aim of this arm of the study was to have an in-depth evaluation of the production of RDPs by 16 DL in the French-speaking Switzerland. To obtain a sample size of 16, a convenient sample of 18 DL (eleven in the canton of Geneva, four in the canton of Vaud, and three in the canton of Neuchâtel) were selected based on their location and on their likeliness to participate since the data to be collected were sensitive and time consuming for the head of the laboratory. Out of the 18, one owner declined to participate, and one produced only resin removable partial dentures (resin-RPDs) and was therefore discarded. An on-site visit was paid to the 16 selected DL with the aim to access to their accounting software and employees' number over the last 10 years. The numbers to be collected pertained to the various types of RDP per calendar year from 2012 to 2022:

1. Complete Removable Dental Prosthesis (CRDP) and Immediate CRDP,
2. CRDP on attachments of all types,
3. Resin Removable Partial Denture (resin-RPD),
4. Chrome Removable Partial Denture (chrome-RPD = clasp-retained removable partial denture with a framework),
5. Chrome-RPD with attachments of all types).

The method of data extraction varied depending on the computer software used by the laboratories: for certain software, such as Easyfact (n=2), a search based on the job description (« complet » or « partiel » or « stellite ») was conducted. For Odonsoft software (n=8), an update was specifically created by the program's creator to extract an Excel file containing all work reports based on the date, which was then sorted and counted for each prosthesis type. Using Winbiz software (n=3), a file was extracted based on the tariff codes (Dental Technical Tariff 2017). For these laboratories, the different types of dental prostheses were grouped into three categories due to the absence of specific codes for complete or partial prostheses on

attachments (1. CRDPs and Immediate CRDPs, including CRDPs on attachments, 2. resin-RPDs, 3. chrome-RPD, including those with attachments). The five remaining laboratories used a customized software, and data were extracted by either counting delivery reports or conducting a search based on the prosthesis type. The other information collected during the visit related to the owner of the laboratory and the number of employees over the last 10 years.

Since the number of dental technicians employed by laboratories changed significantly over time, the reports were standardized by dividing the number of prostheses produced per year by the number of equivalent full-time position. The computation was performed for RDP (total), CRDP, resin-RPD, and chrome-RPD. The result obtained represent the different type of prostheses produced by one technician over each year.

Statistical analysis

The statistical software SPSS (SPSS Inc. V. 27) was used for analysis. For the analysis of the changes over time in production of prostheses, import of denture teeth and sell, coefficient of variation was computed to illustrate variability over the years and between laboratories. Linear regression analysis was performed on data reporting numbers per year such as the importation of denture teeth and number of prostheses produced.

Concerning the analysis of the survey, data were recoded for frequency table calculations and the analysis of subsets of specific participant groups. Descriptive data analysis was performed using frequency tables to present the results in the form of tables or frequency charts. The differences in distribution of laboratories based on city size, canton, age groups, and employee count, was evaluated using Pearson Chi-Square Test or Mann-Whitney U Test.

Results

1. Evolution in the number of dental laboratories and dental technicians

According to data from the FSO, the number of DL in Switzerland has been steadily decreasing. Between 2011 and 2020, the number of DL dropped by 17% from 1'193 to 988. The regression line was highly significant ($p < 0.01$) with a slope of -21 laboratories per year. These figures were consistent with data from the SDL Association regarding the number of member laboratories, which also showed a linear decline.

According to data from the FSO, the number of full-time equivalent jobs experienced a slight decrease between 2011 and 2013, followed by an increase between 2013 and 2019, and then a new decline after the COVID-19 pandemic. The total decrease between 2011 and 2020 was less than 4%.

2. Imports and Sales of Prosthetic Teeth

The import of prosthetic teeth in Switzerland has shown a remarkable decline. In 2012, a total of 142'000 kg of prefabricated teeth were imported from over 90 countries. This quantity gradually decreased over the years, reaching a level three times lower in 2021, with an import of 52'000 kg (Fig. 1). The regression line was highly significant with a slope of -7545 Kg per year ($p = 0.01$).

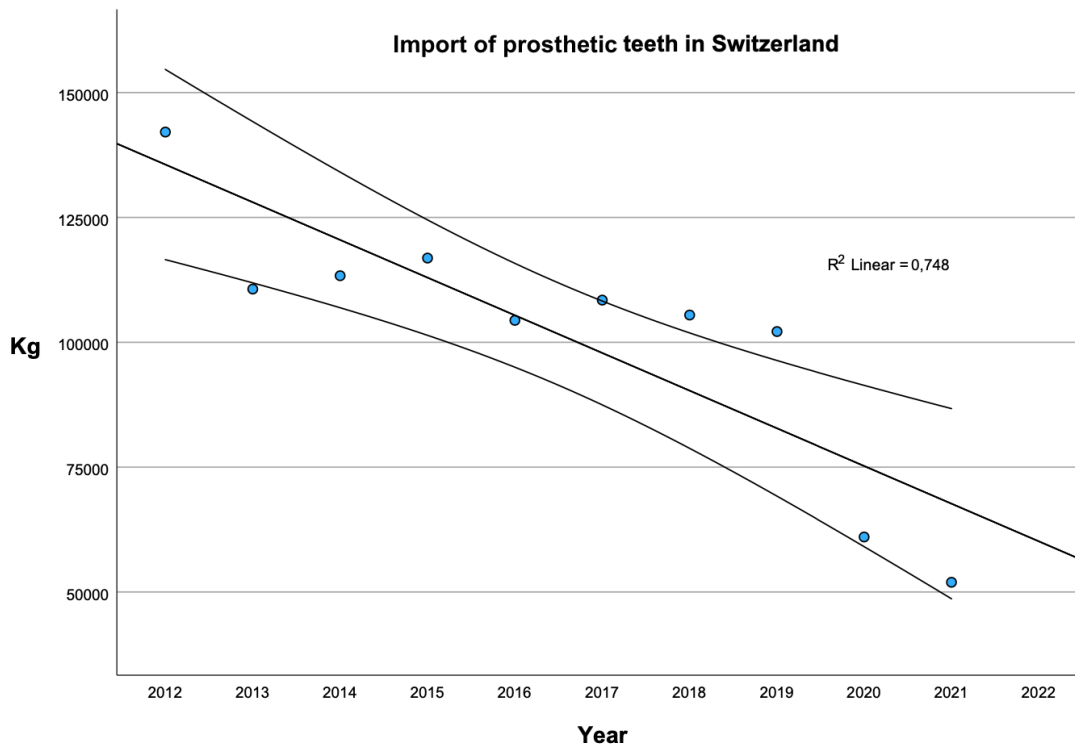


Figure 1. Mass (kg) of prosthetic teeth imported to Switzerland via the Swiss Dental Laboratories Association (SDL). Dots indicate the mass for each year, line for best fit according to linear regression and curves for 95% interval around the line.

The reported quantity of prosthetic teeth sets sold in Switzerland by the company Curaden SA between 2011 and 2022 followed a similar pattern. Their quantity decreased gradually between 2011 and 2020, from 128'075 to 83'520, with a slight increase to 92'418 in 2022 (Fig. 2). The regression line was also highly significant with a slope of -3798 prosthetic teeth per year ($p < 0.01$).

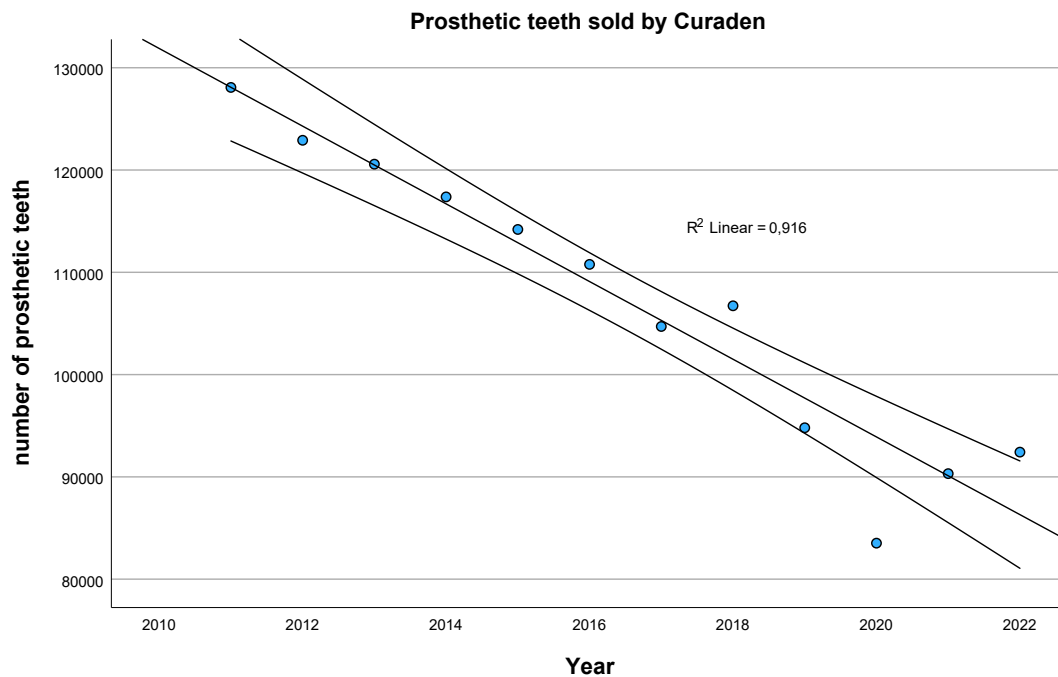


Figure 2. Sales number of prosthetic teeth sets from the distributor Curaden. Dots indicate the number for each year, line for best fit according to linear regression and curves f 95% interval around the line.

3. Online Questionnaire for Dental Technicians

The online survey was distributed to the 481 DL that were members of the SDL in 2023. The response rate was 17.7% for a fully completed questionnaire. An additional 36% responded but did not complete the questionnaire. The group of dental technicians who completed the questionnaire were similar to those who completed it partially in terms of city size, canton, age groups, and employee count ($p=0.125$; $p=0.223$; $p=0.435$; $p=0.072$ respectively).

Demographics:

The results of the demographic part are represented below (Table 1).

Table 1. Demographic results of the online survey

Number of participants (laboratories): 85	
Region [language]	German-speaking part: 63.5% French-speaking part: 29.4% Italian-speaking part: 7.1%
City size	>50'000 inhabitants: 36.5% 10'000-50'000 inhabitants: 38.8% <10'000 inhabitants: 24.7%
Cantons	All cantons, except for five small ones, were represented
Number a full-time technicians per laboratories	1-2 technicians: 50.6% 3-4 technicians: 24.7% 5-10 technicians: 15% >11 technicians: 9.4% Two larger laboratories employ 22 and 25 dental technicians, respectively.
Age of the responding technicians [years]	>50 (65%) 40-50 (23%) <40 (12%)

Removable dental prosthesis:

Among the 85 respondents to the part of the survey on RDPs, only 4 laboratories reported a very low removable prosthetic activity (<10%), while 8.4% were considered specialized, with 90-100% of their time dedicated to removable prosthodontics.

Regarding the manufacturing of removable dentures over the last 10 years, 34% of respondents reported a decrease in time spent on manufacturing CRDPs, while 28% reported an increase, and 39% observed no change. Concerning removable partial dentures (resin-RPD+chrome-RPD), 23% reported a decrease, 31% an increase, and 46% no change. In contrast, for removable implant-supported prostheses, 55% of respondents reported an increase in working time, 13% a decrease, and 31% noticed no change. More than 2/3rd (70%) of the

respondents did not see any difference in evolution between CRDP and RPD, but 15% evaluated that CRDP decreased over the 10 years while resin-RPD+chrome-RPD did not change or increased. Only 3 respondents (4%) answered that resin-RPD+chrome-RPD decreased over the 10 years while CRDP remained unchanged or increased. The difference was significant with 60.6 ($p < 0.01$).

Regarding CAD-CAM techniques, half of the laboratories (50.6%) offer milled prosthesis bases from a resin block, whereas one quarter (26%) provide milled frameworks for chrome-RPDs; 47% supply milled bars. As for 3D printing techniques, 42% of laboratories can manufacture resin-printed prosthesis bases, 16.5% offer microfusion-printed metal frameworks, but only 9.5% provide PEEK-printed frameworks.

Concerning their equipment, 55% of the laboratories have a CAD-CAM milling unit, 67% have a 3D-printer at their disposal, yet the latter may not necessarily be used for prosthetics. Only 3.5% of laboratories have a spark erosion machine.

Questions on the future of the dental laboratory:

With regards to recent developments observed, 63% of dental technicians expect a trend towards larger DL. In contrast, 26% expect that DL will decrease in size, while 11% think that there will be no major change. Concerning the type of DL, 62% envision a shift towards more specialized laboratories, focusing on a specific expertise; 22% anticipate a relocation of the laboratory work to lower-cost countries, while 5% expect that DL will evolve by specializing and relocating.

Demographic influencing factors:

The size of the town where the DL is located influenced neither their work profile, nor their response to the questionnaire. However, Swiss-German dental technicians manufacture more digital removable prostheses than their French-speaking counterparts ($p < 0.05$). No significant differences were noted based on the age of dental technicians ($p = 0.881$).

Dental laboratories who have implemented digital technologies had more employees (median = 4, IQR = 5.6) than those without (median = 1, IQR = 1; $p < 0.001$). These laboratories dedicated less time to removable prostheses ($p = 0.02$). DL equipped for digital partial dentures did not see a significant change in their working hours dedicated to removable prostheses ($p = 0.222$). Thirty-two out of 85 laboratories still manufactured their prostheses using conventional techniques only.

4. Number of Prostheses Manufactured by Dental Technicians

The 16 visited DL in French-speaking Switzerland showed different patterns of evolutions in the production of RDPs. The owners of the DL were on average 54.5 years (SD 9.1) at the time of the visit and they had employed on average 1.8 (SD 0.9) dental technicians, including the owner, over the last 10 years. Not all the DL could provide the 10 years of follow-up, but a minimum of 7 consecutive years was documented, with an average follow-up period of 9.5

years. Overall, the total number of RDPs, of all types, per full-time dental technician, showed variations of up to 28% over time. There was a decline from 2012 to 2014 then a slight rebound up to 2017. From 2020 to 2022 the number of prostheses increased again. Overall, the changes were not significant (linear regression analysis $R^2 = 0.03$, $P=0.593$). A dental technician producing RDPs manufactured an average of 85 to 60 prostheses per year (mean 78.3, SD 43.5). Variability over the years in the number of prostheses produced by a dental technician increased over time for RDP (SD 30.8 in 2012 / SD 55.8 in 2022) and for CRDP (SD 13.2 in 2012 / SD 20 in 2022), demonstrating that differences between laboratories increased over time. For other prostheses, the variation remained stable. The greatest disparity between DL was observed for chrome-RPDs.

Resin-RPDs were found to be the most often produced type. The number of resin-RPD slightly increased by 13% between 2021 and 2022, rising from 46.2 to 48.7 prostheses produced per technician per year. The increase was, however, not significant ($R^2 = 0.315$, $p=0.345$; Fig. 3).

CRDPs, whether with or without root or implant support, ranked second in terms of production by dental technicians, and their quantity did not decrease between 2012 and 2022. The results showed a slight decrease from 31.1 to 19.6 CRDPs per year between 2012 and 2020 (37%), followed by an increase from 19.6 to 30.1 CRDPs between 2020 and 2022 (34%). The changes were not significant over the 10 years ($R^2 = 0.13$, $p=0.274$; Fig. 3).

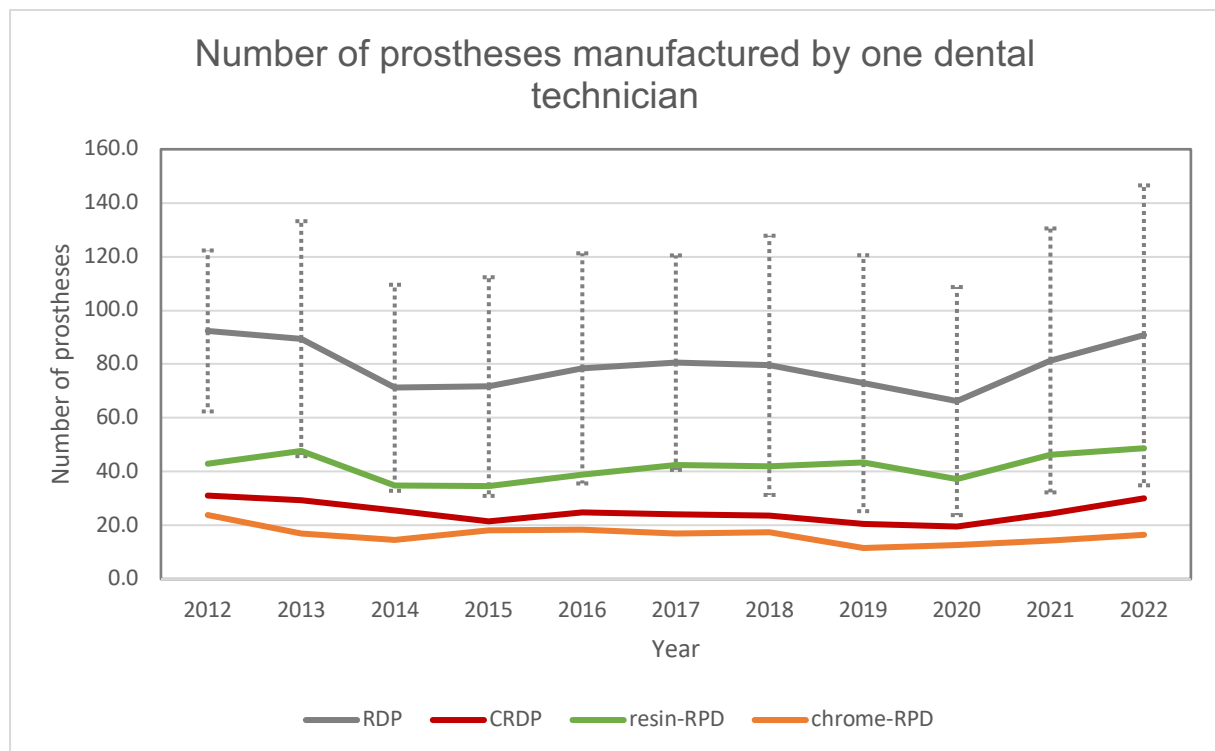


Figure 3. Evolution of prevalence of dentures manufactured in the 16 visited laboratories (RDP = Removable Dental Prosthesis; CRDP = Complete Removable Dental Prosthesis; resin-RPD = Resin Removable Partial Denture; chrome-RPD = Chrome cast Removable Partial Denture). Vertical lines indicate standard deviation.

Regarding the numbers of chrome-RPD, with or without attachments, they decreased significantly from 23.8 to 16.4 between 2012 and 2022, representing a 31% decrease ($R^2 = 0.383$, $p=0.042$). The decrease was estimated at 0.62 prosthesis per year and per dental technician (Fig. 4).

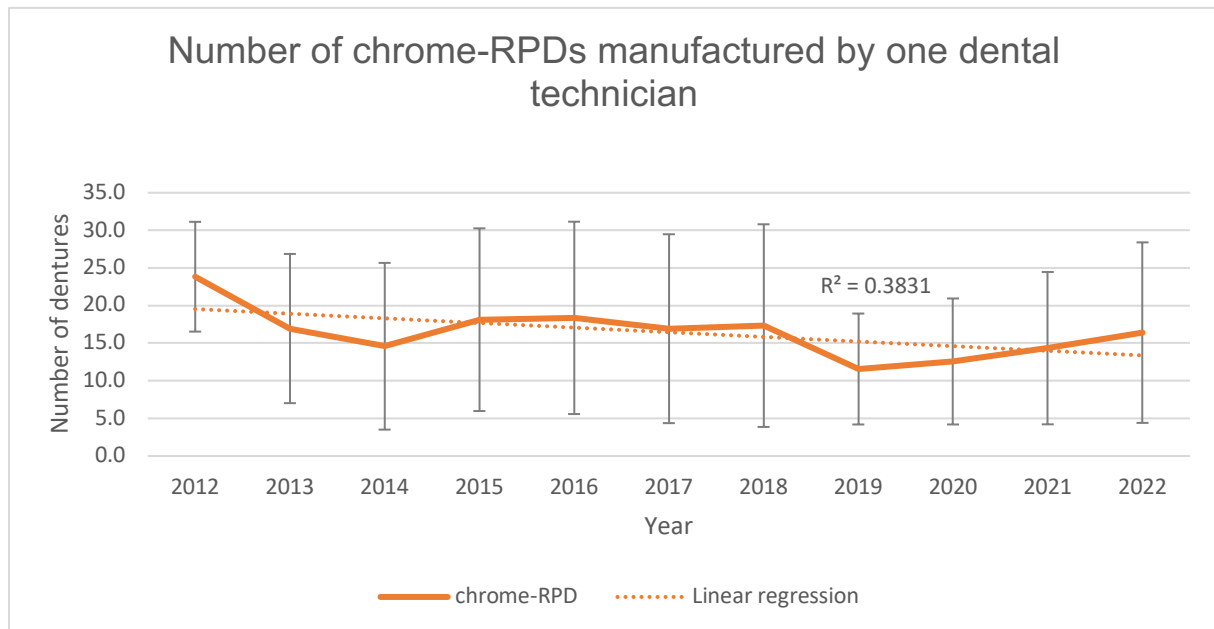


Figure 4. Evolution of prevalence of chrome cast removable partial dentures (chrome-RPD) manufactured in the 16 visited laboratories. Vertical lines indicate standard deviation, dotted line for linear regression (slope = -0.62)

In more detail, hybrid prostheses (chrome-RPD + attachment) or overdenture prosthesis (CRDP + attachment) were produced in small quantities. There were no significant variations in the production of these types of prostheses between 2012 and 2022.

Discussion

This study investigated manufacturing of removable prostheses over the last 10 years in Switzerland and documented a mixed picture, with some information indicating a decrease in the production of certain types of removable dentures, while survey results and qualitative evaluations from 16 laboratories largely suggest stable production levels.

In the current study, both the total number of DL (FSO) and the number of SDL member laboratories have shown a substantial decrease of 17% over the past ten years. However, the number of full-time equivalents decreased by only 4% over the same period. It seems therefore that laboratories were fewer but becoming larger during this period. One reason could be that CAD/CAM technologies request larger sales to accommodate the substantial investments required by these technologies.

The data on the reduction in the import and sales of prosthetic teeth have limitations that preclude definitive conclusions. First, the method of data collection by the Federal Office for Customs and Border could not be found and, second, only one company out of 3 accepted to

reveal their sales numbers. In addition, the newer CAD-CAM manufacturing methods allow milling denture teeth from resin blanks or printing denture teeth but no question investigated this recent development. Nevertheless, the declines are so obvious that it is likely that the demand for denture teeth has decreased over the last ten years. It seems highly unlikely that the lower import numbers are compensated by local production or milling and printing denture teeth within the CAD-CAM workflow.

The results from the online survey provided valuable insights into Swiss dental technicians' perceptions and opinions regarding the evolution of removable prosthetics. However, it is important to acknowledge that the survey represents individual opinions which are subject to potential biases. It is likely that specialized technicians in orthodontics may not have responded, feeling the survey was irrelevant to their field. Despite being designed to be completed in 10 to 15 minutes, many participants did not finish it, likely due to time constraints within their busy daily schedules. The response rate was low at 17.7% and we cannot exclude that they are not representative of all the Swiss DL. At least, there was no difference between those who completed the survey and those who partially completed it in terms of sociodemographic characteristics.

As expected, more laboratories (34%) reported a decrease in time allocated to fabricate CRDPs than those reporting an increase (28%). Conversely, time devoted to resin-RPDs is increasing, and even more for implant-supported removable prostheses (55%). These findings align with improved prevention, conservative dental care and the declining prevalence of edentulism. Along with the increasing life expectancy, tooth loss today occurs later in life, thus rendering partially and completely edentulous populations older. High purchasing power among some Swiss residents also allowed more people to consider dental implant after tooth loss (9), favoring fixed restorations. New technologies and materials have also made the fixed restoration more affordable. It's also worth noting that new technologies, like 3D printing and milling of denture teeth decrease costs, but their use may be still limited due to potential shortcomings.

The uptick in resin-RPDs production is unsurprising given their lower cost and versatility, as well as their use as interim solutions during implant osseointegration and as definitive option for restoring oral function in the steadily growing frail and geriatric population (11-13).

Contrary to expectations, age did not influence the adoption of digital technology. Most dental technicians using digital tools (65%) were over 50, while only 12% were under 40. This suggests that factors other than age, such as perceived benefits, cost-effectiveness and ability to invest, play a crucial role in adopting digital technologies in DL.

Laboratories with larger workforces enjoy greater access to digital technologies. This can be explained by the significant financial investment for acquiring the equipment for digital prosthesis manufacturing. It may also be that smaller laboratories have merged or collaborate with larger DL to afford the machine park required for digital technologies. It is important to highlight that digital technologies are widely used for both resin and cast dentures, at the time of the survey (2023).

It was initially hypothesized that the size of the cities where the laboratories are located would impact digital prosthesis fabrication, but no significant differences were observed. This might

indicate that the location of the laboratory is not related to the type of services provided as communication is highly developed in Switzerland and distances remain small.

Laboratories utilizing digital technologies allocate less time to removable prostheses. Indeed, digital technologies allow for increased productivity, as evidenced by the faster production times of digitally fabricated crowns compared to conventional methods (14, 15). Furthermore, it is likely that DL primarily focused on FDP can now incorporate digital removable prostheses into their services since they already own the necessary equipment, streamlining and facilitating the production of removable prostheses. However, the working time dedicated to removable prostheses in laboratories manufacturing digital partial prostheses has not evolved. It was assumed that the use of these technologies enabled them to work more efficiently and, consequently, more productive.

The in-depth qualitative survey conducted on-site in 16 DL in the French-speaking part of Switzerland revealed interesting trends differing from what was expected. Unlike epidemiological data related to the prevalence of edentulism in Switzerland (9), the number of CRDPs manufactured in the present sample of dental technicians remained stable instead of decreasing. Furthermore, contrary to the online survey results and the personal estimations of dental technicians, no significant increase in the production of resin partial dentures was observed, as anticipated from previous informal discussions with the owners of the DL. Several factors may have accounted for these differences. First and foremost, competition among laboratories may explain why the 16 participating laboratories were able to maintain or increase their denture production between 2012 and 2022. The current sample of DL reported an average staff increase, likely attracting new clients over the past decade. Secondly, expertise in removable prosthodontics may be becoming scarcer and these competences tend to cluster in a few specialized laboratories. This aligns well with the more pronounced decrease in the number of DL compared to the number of dental technicians decreased above.

While not representative for all Swiss laboratories, this arm of the study aimed to identify trends in the production of RDPs. In all, the trend observed was a stable production over a ten-year period, but with large variation every 2-3 years. The only exception was the continuous and significant decrease in chrome-RPDs production over ten years. This finding corroborates the consistent report of several owners of DL who observed a decline in the number of chrome-RPDs produced in their laboratories.

The persistently stable number of CRDPs manufactured in the surveyed DL can be partially explained by the fact that patients who received CRDPs 15-20 years ago are now living longer and require denture replacement.

Although some Swiss residents can afford expensive dental care like FDP or RDP with retention elements, the poverty rate in Switzerland has risen since 2014, affecting 8.7% of the population in 2021 (16). Additionally, 9.3% of the Swiss population received social benefits in 2021 (17) covering only the least expensive dental care, primarily resin-RPDs. Financial constraints faced by this expanding demographic in Switzerland may explain the slight increase in removable prosthesis, whatever the type.

While the prevalence of tooth loss and edentulism has decreased in Switzerland, it is obvious from this study that significant demand for removable prosthetics persists. It is expected that this trend will continue since the aging population, now retaining natural teeth longer or

replacing teeth by dental implants, poses challenges for dental practitioners. Transforming fixed implant-supported restorations to removable implant-supported restorations is a step facilitating cleaning, oral hygiene, and prosthesis use for these patients (18). Additionally, supporting geriatric patients in the selection and maintenance of their removable prostheses is essential to ensure their oral and general well-being

Based on the survey results, it appears that the dental technician profession is by and large self-regulated, and the number of dental technicians currently seems sufficient to meet the demand for dental prostheses. However, there is a noticeable trend toward a decrease in the number of laboratories, with an increase in the number of technicians per laboratory. This shift toward larger laboratories could potentially raise concerns for the future of the profession, as it may affect the high-quality standards traditionally associated with Swiss laboratories, as well as the close collaboration between dentists and dental technicians.

Since we have not observed a significant decline in the production of prostheses, except for chrome-RPDs, it seems premature to propose changes to the dental curriculum at this time. Nevertheless, it will remain important to continue monitoring the production of dental prostheses, as changes may arise in the future.

Conclusions

Despite the decrease in the prevalence of edentulism in Switzerland, the production of removable dental prostheses has not changed significantly over the last 10 years and remains important, except possibly for the chrome-RPDs. The contrasting results obtained reflects a complex interplay of factors that require a better understanding. To meet the current and future needs of the Swiss population, it is imperative to devote sufficient time in the dental curriculum for Removable Prosthodontics, to provide financial conditions that promote quality in dental laboratories, and to continue investing in research to ensure optimal dental care for all.

Zusammenfassung

Einleitung:

Aufgrund von Präventionsmaßnahmen und verbesserter zahnmedizinischer Techniken geht der Zahnverlust in vielen Ländern zurück und die vollständige Zahnlosigkeit tritt, wenn überhaupt, erst später im Leben auf. Auch werden fehlende Zähne immer häufiger durch Implantate ersetzt. Es ist daher zu erwarten, dass der Ersatz fehlender Zähne durch abnehmbare Prothesen seltener wird. Das Ziel dieser Studie war es, den erwarteten Rückgang der Herstellung abnehmbarer Zahnprothesen in Schweizer zahntechnischen Labors in den letzten zehn Jahren zu ermitteln.

Material und Methode:

Über den Zeitraum von 2012 bis 2022 wurden zwei Indikatoren für die Herstellung von abnehmbaren Prothesen in der Schweiz erhoben: die Anzahl der zahntechnischen Labors bzw. Zahntechniker sowie die Import- und Verkaufszahlen von Prothesenzähnen. Anschließend beantworteten 85 Schweizer zahntechnische Labor online Fragen zu diesbezüglichen Trends. Letztendlich Zudem wurde bei 16 zahntechnischen Labors in der Westschweiz eine umfangreiche vor-Ort Datenerhebung durchgeführt, um in dem genannten Zeitraum die jährliche Produktion der verschiedenen abnehmbaren Prothesen zu erfassen.

Ergebnisse:

Während des Beobachtungszeitraums nahm die Anzahl der zahntechnischen Labors in der Schweiz deutlich ab ($p < 0.05$), während der Rückgang der Anzahl der Zahntechniker weniger stark ausgeprägt war. Die Anzahl der in die Schweiz importierten oder von der Curaden AG verkauften Prothesenzähne ging deutlich zurück ($p < 0.05$). Die Umfrageergebnisse zeigten unterschiedliche Ansichten über die Entwicklung des Berufsstandes, obwohl ein Trend zu einem Rückgang der Vollprothesen und einem Anstieg der abnehmbaren Teil- oder Hybridprothesen angegeben wurde ($p < 0.01$). Abgesehen von einem Rückgang der Modellgussprothesen ($p = 0.04$) ergab sich in den 16 besuchten zahntechnischen Labors jedoch kein klarer Trend hinsichtlich der Anzahl der hergestellten abnehmbaren Prothesen.

Diskussion:

Diese Studie bietet einen Überblick über unterschiedliche Aspekte der Herstellung von abnehmbaren Prothesen in der Schweiz in den letzten zehn Jahren. Insgesamt ergibt sich ein gemischtes Bild: während einige Ergebnisse auf einen Rückgang der Produktion bestimmter abnehmbarer Prothesentypen hinweisen, deuten die Ergebnisse der Umfrage und der quantitativen Erhebung in den 16 Laboratorien auf eine weitgehend stabile Produktion hin. Diese inkonsistenten Ergebnisse spiegeln ein komplexes Zusammenspiel verschiedener Faktoren wider, die es besser zu verstehen gilt. Um den aktuellen und zukünftigen Bedürfnissen der Schweizer Bevölkerung gerecht zu werden, ist es unerlässlich, dass in den zahnmedizinischen Studiengängen dem Unterricht in abnehmbarer Prothetik ausreichend Zeit gewidmet wird, dass die finanziellen Rahmenbedingungen die Qualität in den zahntechnischen Labors fördern

und dass weiterhin in die Forschung investiert wird, um eine optimale zahnmedizinische Versorgung für alle zu gewährleisten.

Résumé

Introduction :

Grâce aux mesures préventives efficaces et à de meilleures techniques de dentisterie opératoire, la perte de dents diminue dans de nombreux pays et la perte totale des dents tend à survenir plus tard dans la vie. De plus, le remplacement des dents manquantes par des implants est plus courant. Nous anticipons alors que la réhabilitation des espaces édentés par des prothèses amovibles diminuera au fil du temps. L'objectif de cette étude est d'évaluer le déclin attendu de la production de prothèses dentaires amovibles (PDA) dans les laboratoires dentaires suisses au cours des dix dernières années.

Matériels et méthodes :

De 2012 à 2022, deux indicateurs de la production de prothèses amovibles ont été examinés: le nombre de laboratoires dentaires et de techniciens dentaires actif en Suisse ainsi que les taux d'importation et de vente de dents prothétiques au sein du pays. Une enquête en ligne auprès de 481 laboratoires dentaires Suisses a ensuite été menée pour évaluer la perception des techniciens dentaires sur les tendances du marché des laboratoires dentaires. Enfin, une collecte de données approfondie a été effectuée auprès de 16 laboratoires dentaires de Suisse romande afin de recueillir précisément la production des différents types de prothèses amovibles fabriquées chaque année de 2012 à 2022.

Résultats :

Au cours de la période d'observation, le nombre de laboratoires dentaires a diminué de manière significative ($p < 0.05$), tandis que la diminution du nombre de techniciens dentaires était moins prononcée. La quantité totale de dents prothétiques importées en Suisse ou vendues par Curaden AG a connu une diminution significative ($p < 0.05$). Les résultats de l'enquête ont révélé diverses visions sur le développement de la profession, malgré une tendance suggérant un déclin des prothèses complètes et une augmentation des prothèses partielles amovibles ou hybrides ($p < 0.01$). Cependant, et à l'exception d'une réduction des prothèses partielles en chrome-cobalt ($p = 0.04$), aucune tendance claire n'était observable concernant le nombre de prothèses amovibles fabriquées dans les 16 laboratoires dentaires entre 2012 et 2022.

Discussion :

Cette étude offre une vue d'ensemble sur la fabrication des PDA en Suisse au cours des 10 dernières années grâce aux différents volets de l'étude. Dans l'ensemble, nous obtenons une image contrastée : certaines données indiquent une diminution de la production de certains types de PDA, mais les résultats de l'enquête et de l'évaluation qualitative indiquent une production globalement stable. Ces résultats contrastés reflètent une interaction complexe de

divers facteurs qu'il convient de mieux comprendre. Pour répondre aux besoins actuels et futurs de la population suisse, il est impératif de consacrer suffisamment de temps à l'enseignement de la prothèse amovible dans les cursus dentaires, d'offrir des conditions financières qui favorisent la qualité dans les laboratoires dentaires et de continuer à investir dans la recherche pour garantir des soins dentaires optimaux pour tous.

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Abbreviations as they come in text

RDP : Removable dental prosthesis

DL : Dental laboratory

CRDP : Complete removable dental prosthesis

Resin-RPD : Resin removable partial denture

FDP : Fixed dental prosthesis

SDL : Swiss Dental Laboratory association

Chrome-RPD : Chrome cast removable partial denture

FSO : Federal Statistical Office