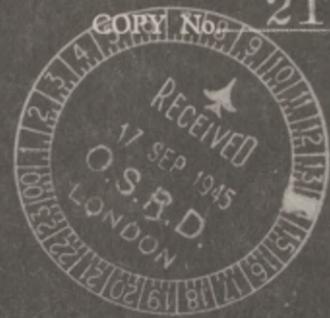


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# DENTAL EDUCATION, PRACTICE AND EQUIPMENT IN GERMANY

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COMBINED INTELLIGENCE OBJECTIVES  
SUB-COMMITTEE

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DENTAL EDUCATION, PRACTICE AND EQUIPMENT

IN GERMANY

Reported by

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CIOS Item 24  
Medical

COMBINED INTELLIGENCE OBJECTIVES SUB-COMMITTEE  
G-2 Division, SHAEF (Rear) APO 413

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## INTRODUCTION

The writer of the present report has visited a very large number of dental targets in Germany, including dental schools, clinics, hospitals and commercial plants. A preliminary report of his findings, appears in CIOS Technical Report "Medical, Dental, and Veterinary Education and Practice in Germany as Reflected by the Universities of Leipzig, Jena, Halle and Erlangen". Sections I-VI of the present report are essentially summaries based on the investigation of numerous targets. Section VII consists of a portion of the interviews on the basis of which the summaries were prepared. These interviews are published because they supply some details not contained in the summaries, and also because they present a sample of the spread in German dental thought.

### I. DENTAL EDUCATION

There are in Germany two distinct educational systems for dentists; one for "Zahnärzte", or degree dentists, and the other for "Dentisten" or mechanical dentists. It should be noted, however, that the distinction between these groups as far as legalized practice is concerned is very slight. The "Dentist" does all types of work authorized for the "Zahnarzt" except the giving of intra-venous injections, the administration of general anesthetics, and major oral surgery. The distinction is largely one of background rather than of the types of work done. The training of the "Zahnarzt" is carried on in a university along the lines followed in the United States. The "Dentist" receives all but one year of his training in dental laboratories or in the offices of other dentisten. No one in Germany defends this system whereby men destined for the same work received received such widely different training. It grew out of the successful attempt of laboratory technicians to have legalized for them certain operations within the mouth, especially the making of oral prostheses. As the field of their activities widened the difference between Zahnarzt and Dentist largely disappeared, and in 1933-34 an attempt was made to standardize training and do away with the double classification. This trend was discouraged by the Nazi party, probably in line with their policy of encouraging various doubtful schools of medical thought to offset the conservative influence of the established medical profession. At present, dentists and Zahnärzte in Frankfurt are drawing up a plan for a merger of the two groups, and this trend may be expected to spread to other cities.

The Zahnarzt, who corresponds most closely to the

American dentist, began his dental training with the maturum certificate, equivalent to our high school course. In a few cases men who were considered especially well qualified on the basis of intelligence and aptitude tests were admitted with less than the established requirements in preliminary education after extensive interviews with faculty members. In a very few cases the state paid expenses of especially promising students, but most dental education was at the expense of the student.

The seven semester dental course was divided into a three semester "preclinical" course and a four semester "clinical" course. This course qualified the graduate to practice, but if he desired the degree of "doctor", as more than half did, he was required to put in an additional semester, write a thesis, and pass a special examination. During the war, three semesters were given each year so that the course could be completed in a little over two years.

The preclinical course included instruction in prosthetic laboratory procedures, dental materials and metallurgy, orthodontia, filling operations on mannequins, anatomy (with dissection of head and neck), physiology, histology, chemistry and physics. For details as to hours of study see preliminary report on dental education.

After a rigid "physicum" examination at the end of the preclinical course the student entered the clinic where he received instruction in operative dentistry, prosthetics, crown and bridge construction, ceramics, instrumentation, dental public health, treatment of fractures, mouth and jaw diseases, dental hygiene, pharmacology, pathology, internal medicine, skin and venereal diseases, surgery (general and dental), ear, nose and throat diseases, and laryngology. This schedule appears comprehensive, but lack of time required that many subjects be covered superficially. Prosthetic clinical experience was particularly limited. Requirements differed but a student often made no more than eighteen prosthetic pieces, including full and partial dentures and bridges. About fifty amalgam fillings were usually required, with twenty inlays and no gold foils. Root canal fillings were well up on the list with an average requirement of about twenty five. Extractions usually varied with the amount of clinical material available, but on the whole surgical preparation seems to have been better than operative. Detailed courses of study have been reported previously.

Much of the last semester was spent in preparing for

the final examinations, which were given by the school under the very general supervision of the state. Questions were formulated by the school. Successful completion of this exam entitled the graduate to practice in any part of the Reich. In order to take part in the state insurance system, however, the graduate had to have a certificate from the local authorities of the town in which he intended to practice to the effect that his services were needed in that town.

Completion of an additional semester did not affect the graduate's legal status, but did give him the degree of "doctor" (doctor of dental medicine). More than half the students took the degree.

No dental internships were required, nor were they routine for men going into general practice. Men specializing in oral surgery or orthodontia were required to spend three additional years in the clinic of a large school or hospital handling patients in the desired specialty. During the war a shortage of specialists caused the government to sponsor courses designed to attract men who were already in general practice. These courses were given for two weeks out of every six months over a period of three years. Thus a man who completed the course received 12 weeks of training. He was also expected to treat cases in his specialty in his own practice and was encouraged to bring his problems to the training center for help. Circumstances of war compelled the abandonment of these courses in 1944, before any of them had gone on to completion. Graduates of these courses were not to have been limited thereafter to the practice of the chosen specialty, as had previously been the case with all specialists registered as such.

The specialty of prostheses construction does not exist in Germany outside of the university clinics.

The candidate for certification as a "Dentist" began his training at an earlier age than did the Zahnarzt, with the equivalent of a grammar school education. For three years the student worked as an apprentice in a dental laboratory, going to a special apprentice school one day out of each week. This school was operated by the community, and they were found only in the larger cities. The student next spent two years in the office of a practicing Dentist (not Zahnarzt) doing laboratory work and observing. During this period he received a small salary. He then spent one year, nine hours daily, in an

institute for Dentisten, where he took intensive and curtailed work in most of the subjects taught in dental schools, including some work in the basic sciences and anatomy. During this year the student had to pay his own expenses, for the first and last time during the course. He then put in another year with a practicing dentist doing dental work, receiving a small salary. He was required to pass a state-controlled examination at the end of each of the phases described above, and successful completion of the last examination entitled him to practice anywhere in the Reich. He was eligible to work in the state insurance system and an attempt was made to make the relative numbers of Dentisten and Zahnärzte practicing in any single city roughly approximate their proportion in the whole population. They were not eligible for commissioning in the army.

Statistics on the relative number of Dentisten and Zahnärzte graduated each year are unavailable, though they may be found in Berlin when Americans enter that city. Rough estimates place the number of each at about 500 yearly, with probably a few more Zahnärzte than Dentisten being graduated. Dental schools outnumbered schools for Dentisten by at least four to one (there were only seven of the latter) but the whole enrollment of the schools for dentists graduated each year, so that total output was not as disproportionate as would appear at first glance.

Dental education received severe setbacks during the war. With mobilization all schools for Dentisten were closed and remained closed for the duration. All physically qualified males were taken from the schools for Zahnärzte and did not begin to trickle back until 1941 when it became apparent that Germany's hope of a short war would not materialize and that she must give consideration to the long-term health program of the nation. Even then, when the army returned selected former students, paying their salary as non-commissioned officers but paying no school expenses, the total enrollment remained about half its peacetime figure. Between two thirds and three quarters of the wartime students were women. Faculty members, especially oral surgeons, were taken into the armed services and scattered all over Europe and Africa. Bomb damage varied, but was extensive over the whole of Germany. Of twelve schools visited, eight were almost completely destroyed, one was three-quarters destroyed, and three had escaped serious damage. It is believed that this proportion will hold true over all of Germany. Even the above figures do not tell the whole story as the smaller universities were the ones which escaped damage. The

big schools at München, Freiburg, Düsseldorf, Köln, and Leipzig suffered severe damage, and probably the schools at Berlin and Wien will be found to have been destroyed. The three schools which escaped damage were the small schools at Erlangen, Heidelberg, and Marburg, towns so small that they did not justify heavy attacks.

Students also lost much time in shelters during air raid alerts which occurred almost every day in some areas.

In almost every school, however, a nucleus of teachers is on hand, usually working in an improvised clinic, and plans are being made to reopen the schools as soon as authority is given and the necessary equipment and supplies can be obtained. At München blue prints for a new building were already drawn up and it was the opinion of the director that the construction could be financed if materials could be obtained. How soon this can be accomplished depends upon factors which can only be guessed at, at present. Officials of the University of Frankfurt expect to open the school there in October 1945.

The relative part to be played by schools for Dentisten and schools for Zahnärzte in Germany during reconstruction is a decision for the occupying authorities and may play an important part in determining the future trend of dental practice in Germany.

Nazi policies did not make for an improvement of the status of dentistry in Germany. With a few notable exceptions the heads of dental schools have been removed by the occupying authorities for political activities, and in most cases these men were better politicians than scientists. They do not appear to have taken too vigorous a part in the operation of the schools in which they were located, however. In most cases the constituted faculty were allowed to continue their teaching activities without interference as long as they were not outspoken anti-Nazis. The time in which the Nazi party was in control before the war was not sufficient to allow its policy of preferment for party members to be seriously felt in the quality of teaching in the schools.

There is a general feeling among dental educators, however, that dental education in Germany leaves much to be desired. The three and a half year course of study does not give sufficient time for a comprehensive coverage of the field, and students have had sadly inadequate clinical experience when they graduate. Suggestions for

improvement are varied, ranging from short increases in the length of the course, through plans for dental internships or provision for a year's practice with another dentist after graduation, to suggestions for requiring a medical degree as a preliminary to the study of dentistry. The solution will probably be found between these extremes. Financial returns from the state insurance system do not justify a long and expensive course of study, and there is a feeling that the economic condition of the population will not support the high standard of dentistry found in the U. S. The establishment of a system for dental internships whereby the young graduate could work a year under supervision of skilled men in accredited clinics, receiving a small salary, would probably raise the standard of dental preparation and not prove an economic burden on either student or public. Certainly every student should take the full four years' course for a degree, and the last semester should have more time devoted to practical work and less to cramming for a final examination and writing a thesis on a specialty before the student has an adequate groundwork in the essentials of his profession.

## II. SOCIALIZED DENTISTRY

The social insurance system of Germany was incredibly complex and its operation was entrusted to many official and semi-official agencies. The following is a discussion of the system in its simplest aspects, without spending too much time in differentiating between various groups doing approximately the same work in different cities or within different groups of insured persons.

Socialized dentistry in Germany was only a part of the comprehensive social insurance scheme, which included medical care, dental care, unemployment benefits, disability benefits, accident insurance and old age benefits. A levy of about seven percent was made on the salary of every employee in the insured class, and the employer paid in an amount equal to half that paid by the employee. Insurance for every employee making less than three hundred marks a month was mandatory. Persons making more than this amount could not enroll in the public insurance system unless they had previously been members while making less than this amount, in which case they could retain membership. Other persons making more than three hundred marks monthly could enroll in one of the many private insurance systems or could pay medical bills on a fee basis.

Funds for the various benefits named above were kept

in a common account and paid out by the same agencies. The laborer paid only on the basis of his salary. Before 1933 the beneficiary paid according to the size of his family as well as according to income, but with the advent of the Nazi party, this extra charge was abolished. Present state insurance plans provide for full care for workers families.

The central insurance fund allotted eight marks and forty pfennigs quarterly for each insured employee to cover all medical expenses. As nearly as can be determined this was about two dollars, though in the absence of a free market for the mark it is difficult to relate the mark to the dollar in buying power. This meant that eight dollars per insured family per year had to cover all medical costs. (This sum did not include disability payments for loss of time.)

As originally set up, the insurance system functioned on a purely local basis, with only moderate supervision from the central government. With the advent of the Nazis, however, the system was centralized in Berlin, so that all funds collected were sent to Berlin first, and were subsequently disbursed from there. There was a Reichs office for insurance, and under this a series of "Observers-icherungsamt" having regional control and a more numerous series of "Landversicherungsamt" having authority within provinces.

Within cities and counties the insurance system became more complex. Within each of these units were found two distinct types of insurance corporation, the "Reichs Versicherungs Ordnung" (Par. 123) type and the "Versicherung für Kaufmännischeangestellte und Beamte". These corporations are usually referred to by their initials as "RVO" and "VKB". These were semi-official organizations, with control from higher offices but with a measure of local authority. The director was usually nominated locally, for instance, though he had to be approved from the central office.

"RVO" consisted of three separate groups, as follows:

1. The municipal, or Ortskrankenkasse, group.

This was the common insurance group which any laborer within the prescribed salary range could join. It was operated by local directors determined by the community. It functioned independently of the local government however, except that the municipality guaranteed the the adequacy of funds and exercised general control through

the director. It was, of course, a non-profit organization, and excess funds were used to operate hospitals and convalescent homes. As in all the public insurance systems, the employees contribution was collected by the employer and turned in to the fund. This money was forwarded to the central office in Berlin, which in turn paid out fees to medical personnel once quarterly, on the basis of vouchers submitted for work done. Every employee had to be insured and it was the responsibility of the employer that the proper collections were made. Domestic help were not exempt.

2. Betriebskrankenkasse groups.

Many larger commercial organizations (I. G. Farbenindustrie, for example) preferred to control their own insurance plans. In such cases benefits for their employees could be integrated into the public insurance system. In these cases, the company collected the same fees as were collected from employees under the Ortskrankenkasse system described above. The company did not send these funds to Berlin, however, but accounted for them themselves, paying to the Berlin fund enough money to cover vouchers turned in for treatment for their employees. Their employees went to the same dentists and doctors as did other employees, and had freedom of choice within the panel, which included most of the medical personnel in the vicinity. As surplus funds did not go into the municipal account, however, these companies had to furnish hospitalization for their employees at their own expense. This was, in fact, one of the benefits of the Betriebskrankenkasse groups, which were more popular with employees, in that it was felt that hospitalization furnished by the companies, who were more interested in their employees, was on a better scale than in the public hospitals. As a matter of fact, however, it had become increasingly common for these company insurance systems to arrange to hospitalize their employees in the municipal hospitals, paying a fee therefor. This trend was partly to avoid the overhead of operating a hospital and partly because it has been found that the municipal hospitals get their patients out in less time and thus avoid absenteeism and excessive payments for disability. Many companies paid more liberal benefits than did the public system. Payment for disability in the public system was limited to six months, for instance, while companies often paid up to a year. It should be emphasized, however, that the company insurance systems were part of the public system, and that no private contracts were made with dentists or doctors, and that patients under this plan were treated by the same doctors as were the municipal patients.

### 3. Innungskrankenkasse groups.

These were organizations on a craft basis (i.e. bakers, tailors) who preferred to operate their own system. Their groups were operated substantially as were the Betriebs groups operated by large commercial firms.

The "VKB" group was established for employees of a slightly different classification than those included in the "RVO" groups. These were the more highly skilled workers, the foremen, engineers, and salaried office employees. These people paid the same percentage fees, but as their incomes were generally higher, the fees collected averaged more than for ordinary employees. This group therefore paid out somewhat higher fees for work done, though usually limited to fees for prosthetic work. Thus the fees paid for fillings were the same as for other groups, but "VKB" paid double the common fee for dentures. This group also benefited somewhat from the fact that they were better medical risks. As medical and dental funds were handled together, this meant that the saving on medical care could be applied to dental treatment. Employees eligible for this group could belong to the group for ordinary laborers if they chose, but as there was no difference in the fee collected they seldom did so. An ordinary laborer, on the other hand, could not belong to the "VKB" group. The VKB group paid the full cost of dentures, while the "RVO" group paid only three quarters of the cost.

The patient from any of the above groups who needed treatment went to the local public health office and got a certificate that he was entitled to treatment. This he took to the dentist of his choice, provided only that the dentist was enrolled in the KZVD. The dentist took the certificate and submitted it at the end of the quarter with vouchers itemizing the work done and the amount due.

Dental matters in regard to the insurance system were handled by a special organization to which every dentist doing this work had to belong. This was the "Kassenzahnärztliche Vereinigung Deutschlands" (KZVD). Its head man was Dr. Ernst Stuck, a prominent Nazi, and officers of the organization were appointive from the next higher headquarters, on the "Führer" principle. This society published weekly paper devoted largely to administrative matters (Zahnärztliche Mitteilung) handled disputes and coordinated matters affecting both dentists and insurance groups. It was not a scientific body. There was a corresponding society for non-degree dentists, the KDVD.

Contracts between individual dentists and the insurance groups were negotiated by KZVD. Peculiarly, these contracts may vary slightly from area to area. Thus the fee for laboratory work on a vulcanite denture was less in the Rhineland than elsewhere in Germany. The reason for this variation is not clear. It seems to be based on areas rather than on location in urban or rural districts. It has been said that people in the Rhineland have worse teeth than others and that it was therefore necessary, to make insurance income balance outlay, that fees paid for work there be lower. This is not considered a very probable reason, however. Contracts were renegotiated from time to time and minor adjustments made in fees to bring expenses in line with actuarial experience.

In addition to the state operated insurance systems, there were in Germany many private systems. These were operated for groups able to pay higher fees than were the employee groups, and fees charged and paid might therefore vary from very low to very high. These groups made their own contracts with selected dentists and work performed was supposed to be of higher quality. Dentists authorized to do state insurance work could combine that practice with private insurance work, or private practice.

There is very little simon-pure private practice in Germany. From 50 to 60% of all dentists belong to the state insurance system, and the most treatment not given under this plan is handled under private insurance plans.

The KZVD could not make a dentist move to a town where it felt he was needed, but they could refuse a contract if they felt that no additional dentists were needed in an overcrowded city, and could thus indirectly direct the flow of dentists to areas where they were most needed. It was not considered practical for a young dentist to try to make a living in dentistry without a KZVD contract.

Fees paid by the insurance system were so low that only hurried treatment for a large number of persons daily would bring in a reasonable income. In estimating the following fees in terms of U. S. currency the mark should probably be considered as worth about twenty-five cents. Its current exchange rate of ten cents is much below the actual buying power of the mark. Even at twenty-five cents, however, it will be noted that these fees would hardly be considered satisfactory in the U. S. even if the dentist were guaranteed all the work he could handle.

Local anesthesia	1.2	marks
Extraction	1.0	"
Silver filling	1.0	"
Root resection	7.0	"
Post operative care	1.0	" each sitting
Night calls	Add 3 marks to above fees.	
General anesthesia	5.0	"

In general the German population favors the insurance system, feeling that without it dentistry for many of them would be out of reach. Enthusiasm of the dentists is less marked, due to the low scale of fees. It is true that dentists in Germany have a generally lower standard of living than in the U. S., but this low standard is shared with the rest of the population and is probably inevitable until the entire German economy is directed to producing for the needs of the people rather than toward preparing for war. It is doubtful if as large a proportion of the national income would go to providing dental care under a system of private practice as is now devoted to that end under the state insurance system. Thus under the state insurance system a large amount of mediocre dentistry is done for many people, while under private practice a much smaller amount of better dentistry would be done for a much smaller number of people. The Germans, people and dentists alike, recognize the fact and prefer their present plan.

Even under the rigid regimentation existing in Germany for the past twelve years there have been abuses of the insurance system. Dentists (and doctors) have collaborated with patients in submitting bills for work not done and in unnecessarily prolonging hospitalization or treatment. Such abuses have not been common, however, and are not considered sufficiently important to warrant discarding the whole plan. It is believed that future practice in Germany will continue to be carried on under this plan or under minor modifications of it.

It should be noted here that the non-degree dentists shared equally in the insurance system with the "Zahnärzte" or degree dentists. It seems probable that a merger of these two groups will occur as soon as permanent plans for the future can be made.

### III. CARIES CONTROL

Caries research in Germany has been sporadic and on an individual basis, the nearest approach to coordinated study being occasional symposiums at society meetings. Such men

as Euler, Wannemacher, Proll, Korkhaus, Harndt, Kientopf, Mathis, Tholuck and Schmitz carried on independent research along lines well known in the U. S. and failed to bring out, as far as can be determined in a hurried survey of the field, any facts or methods of control not already known there. Information regarding the use of fluorides in caries control in the U.S. was published in Germany at least as early as 1943 but seems to have attracted no attention. No educator or dentist interviewed had ever heard of research on fluorine therapy. Similarly, the use of bacillus acidophilus counts, or the possible role of this organism in caries formation, were either unknown or considered unimportant.

Most research has been directed at nutritional studies and the effect of vitamin administration, leading to the conclusion that coarse, unrefined, fresh foods tend to protect against caries. The coarse black bread of the German peasant is thought to be particularly effective in this respect. Proll analysed the literature of 70 authors and found the following factors mentioned:

<u>Factor</u>	<u>Times Mentioned</u>
Composition of diet	32
Action of bacteria	22
Vitamin intake	18
Mineral intake	17
Environment	16
Mastication habits	16
Composition of saliva	15
Structure of teeth	15
Sugar consumption	14
"Constitution" of patient	14
Effects of civilization	14
Local formation of acids	10
Climate and sunlight	8
Mouth hygiene	8
Effect of hormones	7
Metabolism	6
Use of white flour	6
13 other causes (including calcium and phosphorus metabolism)	35

The low importance attributed to oral hygiene is particularly noteworthy. Oral hygiene is nevertheless taught routinely in the schools. Most reliance seems to be placed on administration of Vitamins C and D, but the average dentist or dental educator seems to feel that no really effective answer to the caries problem has yet been found.

Dentists in Germany almost unanimously feel that the diet of German children during the war years was inadequate and that mouth health suffered as a result. There is no statistical data available to confirm or disprove this opinion, however. Such statistical data may be available in Berlin when that city is opened to American investigators. Except for a shortage of vitamin products there is no concrete evidence even that the diet was inadequate. Certainly German children do not show the obvious results of malnutrition seen in other parts of Europe.

A bacteriologist of Köln, Dr. Ginz, is reported to have regarded caries as a specific bacterial infection, but his work was not widely accepted and no published reference to it has been found. Personal investigation cannot be made as this is outside the American zone of occupation.

IV. DENTAL PLASTICS

The development of dental plastics in Germany has followed lines well known in the U.S. The phenol-formaldehyde compounds, the celluloids, resovins, vinyl chlorides and vinyl acetates have been tried and discarded until the acrylic resins have been left in practically sole possession of the field.

The principal manufacturer of dental plastics in Germany is Kulzer & Co. This company is a subsidiary of Degussa (Deutsche Gold und Silber Scheide Anstalt) which in turn has connections with I. G. Farbenindustrie. This firm had a large factory with research department and dental clinic, in Frankfurt until 1943, when it was completely destroyed by bombing. It was said that this plant used four tons of raw acrylic resin a month, and supplied a large part of Europe. After the main plant was destroyed, the company moved to the village of Friedrichsdorf north of Frankfurt and established a small factory, without research or clinical facilities, capable of supplying the needs of Germany. The firm did not make the raw materials used, but purchased the unprocessed acrylic resin from Rohm and Haas of Darmstadt.

I. G. Farbenindustrie produced an acrylic resin called "Perpax" (pink) or "Gingivist" (clear) but it failed to become popular due to poor color. Vague reports have been heard that I.G.F. was working on a new denture base material but questioning of all persons who might have any information in the matter has brought denials that such a product was under consideration. A request for

information from the American authorities operating the Höchst plant has brought an unqualified denial that any such work was in progress. A request has been made through channels for information from the Leverkusen plant which is in British territory but it is considered doubtful if any important developments will be brought to light by this inquiry.

Heko-Werke of Berlin also produced resin products, including a denture base (Neohokolith), a tooth-colored resin (Hekodent), a transparent base plate, plastic temporary filling material (Hekopercha) and plastic root canal points. As this firm was located in Berlin it has not been possible to get information regarding their products, other than to obtain samples of baseplates, root canal points, and temporary filling material.

Among the denture bases, "Paladon", made by Kulzer, was by far the most popular. In powder and liquid form (no ready-mixed acrylics are marketed in Germany) it has a good shelf life and seems to be quite satisfactory. The color is not as good as similar products sold in the U. S., but was stable and was superior to the I.G.F. product, which was too opaque. It was used by the army and replaced rubber during the war when rubber became scarce. It will probably remain the most used base after rubber becomes available because of superior esthetic qualities. It was stated to absorb less water than vulcanite, but this claim is considered doubtful in view of experiments carried out by the Bureau of Standards on American products.

Among the acrylics for crown and inlay work "Palapont" by the same company also was almost undisputed in its field. It came in six shades and a translucent shade, from which sixteen color combinations were derived.

Plastic base plates, which handle very well and make a transparent tray with obvious advantages for immediate denture work, were produced by Heko-Werke and the I.G.F. Composition is not known but an attempt is being made to get the formula through the I.G.F. Plant personnel at Frankfurt.

Plastic temporary filling material was produced by Heko-Werke. This material was apparently not well known in Germany and no reports as to its usefulness are available. It was tested clinically by one American dentist who gave only qualified approval. It softens quickly and seems to adhere well to a dry cavity. It sets

very rapidly, however, and seems more difficult to trim in the cavity. It is very hard when set and should be more durable than gutta-percha.

Plastic root canal points were produced by I. G. F. at Leverkusen, but do not seem to have been widely used. They are claimed to be well tolerated by the tissues and their flexibility and stiffness make it possible to force them to place more easily than points made of gutta percha. Apparently they were not available for a sufficient time for clinical reports to be made on them. Samples were obtained and are being forwarded.

Experimentation was being carried on in Germany on the use of acrylic resins for direct filling of teeth, with polymerization within the cavity. This work was being done by Kulzer and further progress was halted in 1943 with the destruction of their Frankfurt plant. The material was not named, though it was referred to as "Palapont", S.H. (Self-hardening). It was never marketed, but had been given to universities and individual dentists for testing. It was also tested on employees and officials of the firm and this reporter has seen the material as used in practical cases.

This material was the same base as was used for "Palapont", corresponding to American products for inlays and jacket crowns. There was no change in granule size and the same organic colors were used. It was modified only by the addition of an accelerator to the powder which reduced the setting time to from ten to fifteen minutes. This accelerator was said to be a tertiary amine. Use of an infra-red lamp to hasten setting was recommended but was not considered absolutely essential.

The material was given the widest application in clinical testing. It was used for all types of fillings, including occlusals, compound occlusal-approximals, incisal-approximals, and gingivals. Most of these fillings were placed in 1943 and margins were still good. The single occlusal-approximal filling seen, on the m-o of the lower first molar, showed no signs of wear and margins were good. It was very poorly trimmed, however, and seemed to fill the approximal space, with considerable overhang. It did not appear to have been placed with a matrix band in place though it was claimed that a matrix could be used. The material was kept dry for ten minutes after being placed in the cavity but was protected by no varnish after initial setting had taken place. The filling was trimmed after fifteen minutes. A novel application of the material was as a cement for the placing of bridges and

crowns. Used as the cementing medium for an acrylic jacket crown, for instance, it was said to adhere so tightly to the tooth that it could scarcely be removed even after the jacket crown had been cut away, and it sealed the margins of the jacket crown so that they could scarcely be detected. In cases where gold shell crowns had worn through, they were simply removed and replaced using acrylic self-hardening resin as cement, sealing the holes and giving very tenacious adhesion. The material was also used to build up acrylic pontics in the mouth where porcelain pontics had fractured away. Cavity preparation was not changed for this material. It was not thought to require any more bulk than silicate cement. This reporter saw one distal-incisal filling on a left central incisor which had been in place over two years.

In spite of successes in clinical use of the material it was not yet considered ready for market, nor is it planned to put it out for sale until the research laboratory of this firm can be reestablished and further experimentation carried out. Two principal problems remain to be solved:

a. Shades are not permanent. The same organic colors are used as are used in Palapont, whose colors are stable, so it is believed that the accelerator is the cause of the trouble. Colors tend to darken with ageing.

b. There is some reason to think that pulp damage may result in deep cavities. This factor is uncertain, but is thought to require further study to decide whether the material actually is irritating to the dental pulp. It is believed that, if pulp devitalization actually results in some cases, the accelerator is again at fault. There is no proof for this belief, however. Pending further study of this matter, it is recommended that a cavity liner be used in all deep cavities.

A director of Degussa, Herr Hirtes, denied reports that similar products were being developed in France and Switzerland, and stated that the Swiss were working with samples of the Kulzer product which had been submitted to them for testing.

Complete samples of this product have been obtained with considerable difficulty and are being forwarded.

The processing of acrylics in Germany varies in some points from general practice in the U. S. At first casts were tin-foiled, but as vulcanization techniques were replaced by boiling techniques, the use of any separating

medium was gradually abandoned. Present practice is to paint the cast and secondary investment, after boiling out, with about three coats of 30% calcium chloride, allowing each coat to sink into the plaster before adding the next coat. As explained in a previous report, the calcium chloride is said to raise the boiling point of moisture within the flask to a point where no vapor is formed. Another material used is sodium silicate (water glass) which also has been used, with indifferent results, in the U.S. For use with a vulcanizing technique, the firm of Heimerle und Meule of Pforzheim marketed a material called "Viton" which was a solution of a plastic produced by I.G.F. having the trade name of "Celit". As with other I.G.F. products, the exact nature of this material is unknown. (The director of Heimerle U. Meule did not himself know the formula.) Request for information regarding this material was included in the list submitted to the present control of I.G.F. Samples have been obtained and are being forwarded.

Plastic teeth are in common use and were, in fact, almost the only type available at the end of the war due to the shortage of precious metals for pins. They are of good shades, and were well liked. They were made by a large number of small firms all over Germany and molds were even sold for use by individual dentists who wanted to make their own teeth. DeTrey in Berlin and Wienand in Sprendlingen were the two largest producers. Plastic teeth produced in Germany were similar in every respect to those produced in the U.S.

#### SUMMARY

No new basic plastics for dental use have been discovered in Germany.

New applications of plastics which are probably known in the U. S. are being made in their use for transparent base plates, temporary filling material, and for root canal points.

Results of experimentation with acrylic resin as a material for direct filling of teeth justify the belief that this material may ultimately supplant the admittedly unsatisfactory synthetic porcelain cements.

#### V. FINAL REPORT ON SUBSTITUTES FOR GOLD IN GERMANY

Before the war such firms as Degussa (Deutsche Gold und Silber Scheideanstalt), Heimerle u. Meule, Dr. Wienand, Heraeus, and C. Hafner produced high-carat dental golds similar to those used in the U. S. For some years before the war, however, the low-carat alloys with palladium

became popular for general use because of their economy, always a big factor in German dentistry. A general formula for this type of alloy would be:

Gold	10%
Palladium	20%
Silver	70%

This formula was varied by the addition of copper, zinc, platinum, or nickel for special purposes. It was used for inlay, crown and bridge work in the cast form, for dentures in sheet form, and for clasps in wire form. It was seldom used for cast clasps, and this form of construction is, in fact, almost never used in Germany. Some typical alloys of this type were:

<u>Name</u>	<u>Formula</u>	<u>Manufacturer</u>
Phoebus (Crowns)	Gold	10%
	Palladium	20%
	Silver	61%
	Copper	7%
	Zinc	2%
	-----	
Phoebus (Inlay)	Gold	10%
	Palladium	20%
	Silver	57%
	Copper	11%
	Zinc	2%
	-----	
Econor (Crowns)	Gold	10%
	Palladium	20%
	Silver	70%
	(This alloy was sometimes hardened by adding 2% copper)	
	-----	
Econor (Clasp wire)	Gold	10%
	Palladium	18%
	Silver	70%
	Platinum	2%
	-----	

With the coming of war, gold became increasingly scarce and these palladium alloys became the only ones available. They were considered reasonably satisfactory. They did not discolor badly and soldered well. They were not strong enough nor stiff enough for cast clasps or 3/4 crowns though they were used for these purposes where sufficient bulk could be attained. Lack of gold and palladium forced even these low carat alloys from the market in 1940.

No platinum was available after 1939 and was early replaced by nickel in high-carat clasp alloys. A clasp

metal by C. Hafner of Pforzheim was:

Gold	75%
Nickel	5%
Silver	10%
Copper	10%

This was modified to:

Gold	75%
Nickel	3%
Silver	12%
Copper	10%

The shortage of gold forced these products off the market in 1940.

After 1940 gold or palladium alloys were produced only in small quantities on special order when the dentist himself furnished equivalent gold scrap. Early in 1940 the type of silver alloy known in the U. S. as "Acolyte" was resurrected under old or new names and of necessity held the non-ferrous field during the remainder of the war. They lacked strength, discolored (even after gold plating), soldered poorly and were generally disliked. They could not be used for clasps. Samples of these alloys were:

Silca	Silver	82%	Degussa
	Tin	15%	
	Copper	3%	
Dentosil	Silver	83%	Th. Wienand
	Tin	6%	
	Copper	7%	
	Cadmium	4%	
	Zinc	traces	
Un-named	Silver	80% to 90%	Heimerle u. Meule
	Cadmium	2% to 5%	
	Tin	) Small -variable amounts	
	Zinc		
	Copper		
Un-named	Silver	50%	C. Hafner
	Tin	40%	
	Zinc	5%	
	Copper	5%	

Even the manufacturers did not consider these alloys as anything but makeshift substitutes.

Vitallium has been used in Germany almost as long as in the U. S. It has not proved widely popular however, for reasons which are not clear. The difficulties

attending its fabrication are not a factor as they are not greater than those connected with steel processing. Another reason may be that full cast appliances, for which Vitallium is widely used in the U. S. are seldom used in Germany. The general feeling seems to be that Vitallium is more complex and more expensive than steel, without having any great advantage for the types of appliances most popular here.

The stainless steels have, of course, been known and used in Germany since the first world war. The lack of precious-metal alloys after 1940 meant that steel became the universal dental metal in both military and civilian practice during most of the war. For the army, this meant that the four laboratory chests for field laboratories had to be augmented by two additional chests containing the heavy equipment needed for steel fabrication.

The principal stainless steels, which were already well-known before the war, were:

Wipla V2A	Iron 74% Chromium 18% Nickel 8%	Krupp (Essen)
-----		
BH3 (used by army)	Iron 72% Chromium 20% Nickel 8%	Steinlechner (Vienna)
-----		
Imuzit	Made in British-occupied territory. Formula not known but said to be similar to above.	Pontica-Labor (Mülheim)
-----		
Remanit G	Made in British-occupied area. Formula not known but said to be similar to above. Samples forwarded.	Deutsche Edelstahl Werke (Krefeld)

These steels were used in plate form for dentures; as wire for clasps; cast for clasps, inlays, pontics, bases for post crowns, and occlusals of crowns; in band or prefabricated form for full crowns. They were completely unsatisfactory for inlays or cast crowns as they did not cast with sharp margins and were too hard to allow minor adaptation in the mouth. They required special investments of aluminum oxide and phosphoric acid. They required hydrogen or acetylene and oxygen for casting, or the electric arc. Electric arc

melting and welding was preferred to flame melting or soldering as it was considered that prolonged heating in a gas flame causes separation of carbon crystals and weakness at the point heated. The German army included a heavy-Italian-designed (Vulcanus), centrifugal, electric-arc casting machines in their laboratory chests for stainless steel.

Special solders and fluxes were used routinely, though gold solder and borax could be used. Bridge design usually called for prefabricated steel crowns on both ends as abutments, with cast steel pontics soldered or welded in. Inlays and three-quarter crowns were practically unknown, or rather, unused, due to lack of suitable alloys. Where a dentist had gold scrap available he sometimes used gold full crowns as abutments with stainless steel pontics, soldered with gold solder.

#### SUMMARY

German prosthodontists prefer the high-carat gold alloys used in the U. S. They do not expect these alloys to be available in Germany for more than a small percent of the population for economic reasons. They consider alloys containing 10% gold and 20% palladium as acceptable and expect this type of metal to be the most widely used for cast restorations after the war. Alloys of silver and tin, zinc, copper and cadmium are not considered useful for any but temporary fillings, of great bulk. Stainless steel is well liked as wire for clasps, and in the pressed form for denture bases. Its use for other purposes is based only on economy and availability. Its use for military personnel requires additional complicated and very heavy equipment. The types of fixed replacements which can be made from steel would be esthetically unacceptable in the U. S.

The principal manufacturers of dental alloys are:

<u>Name</u>	<u>Location</u>	<u>Products</u>	<u>Estimated per- cent damageto plant</u>
<u>(Gold, palladium and silver alloys)</u>			
Deutsche Gold und Silber Schneid- anstalt	Frankfurt & Pforzheim	Palliag Silca	80%
Heimerle u. Meule	Pforzheim	Econor Argodent	90%
Heraeus	Hanau	Alba	Not known
Th. Wienand	Pforzheim	Phoebus Dentosil	99%
C. Hafner	Pforzheim	Pangold	99%

<u>Name</u>	<u>Location</u>	<u>Products</u>	<u>Estimated per- cent damage to plant</u>
( <u>Stainless Steels</u> )			
Krupp	Essen	V8A	Not visited British area.
Deutsche Edelstahl	Krefeld	Remanit	British area.
Steinlechner	Vienna	BH3	Russian area.
Pontica-Labor	Mülheim	Imuzit	British area.

VI - GERMAN MILITARY DENTAL EQUIPMENT.

No attempt has been made to evaluate German field dental equipment for several reasons. No valuable estimate could be arrived at without actually using the equipment for a reasonable length of time under field conditions. This time was not available. Also, any written report on such equipment would be of less value to the medical equipment board than samples of the sets themselves. Several complete sets of German dental equipment were forwarded for study, first to Paris where they were uncrated and set up for preliminary examination at the Equipment Laboratory, and then to Carlisle Barracks for examination at leisure by experts.

German field dental equipment was much more elaborate than that furnished American dental officers, with less emphasis on the saving of weight. The 12 chests making up the set were arranged so that they complemented each other and so that progressively more complete units could be built up by the addition of the desired chests to the simpler units. Thus the simplest unit available consisted only of chests 1 and 2, with a set of drawers for instruments, an operating lamp, a combination foot- and motor dental engine, alcohol sterilizer, and head rest and cuspidor to be fitted onto an ordinary chair. This unit weighed, with the chests, about 230 pounds. According to American standards it contained many items of doubtful value, especially root canal instruments and proprietary drugs of uncertain composition. On the other hand the use of an ordinary chair for dental work was not satisfactory. The selection of instruments was complete, including those needed for minor oral surgery, and the operating light provided an item badly needed in American sets.

The two chests of the lighter set could be augmented by the addition of chests 3 and 4 to form the medium unit. These chests weighed about 310 pounds and included a chair (140 pounds), additional surgical and additional operating instruments. Thus the medium set, which was most widely used, weighed almost 540 pounds and required four boxes. It provided a very complete and workable unit, but examination at Carlisle will show that many items could be omitted without curtailing its efficiency. One obvious advantage is the provision of chest or drawers for all regularly used instruments. This was possible by agreement among the instrument manufacturers of the Ruhr and Tuttlingen areas on uniform models for war time production. Thus all instruments, no matter where made, could be fitted into their intended location in the chests. The "handform"

type hand instruments included have been favorably reported by American dentists.

The heavy set was formed by adding four laboratory chests to the four operating chests of the medium set. These four chests weighed a total of almost 600 lbs. and provided a very complete laboratory set-up with tables, electric lathe, foot lathe, vulcanizing and casting and soldering apparatus. It did not provide equipment for fabricating stainless steel. The total weight of the heavy set was almost 1140 pounds. To make possible the fabrication of the widely used stainless steel appliances another 2 chests were added, weighing about 375 pounds, for a total of 1515 pounds for the heavy set of ten chests.

Chest No. 11, containing a dental x-ray machine and a light proof box for developing films, weighed only 242 pounds. The machine is very simple, without controls for adjusting for line voltage or for changing milliamperage, but took satisfactory pictures and could be set up or dismantled in five minutes.

Chest No. 12, weighing 176 pounds, contained only those surgical instruments needed in major oral and plastic surgery. Only 200 of these chests were made. All 12 chests weighed, therefore, about 1933 pounds, or roughly one ton.

The cost of the four chests making up the medium set was about 3,000 marks, or 500 dollars at present exchange rates. At a valuation of 25 cents on the mark, which is closer than the present rate to an estimate of the actual buying power of the mark, the cost would be about 750 dollars. 1500 of these medium sets were assembled (according to Emil Huber, the agent who assembled them.) The four laboratory chests cost about 1500 marks, or 375 dollars at a 25 cent mark. 400 of these laboratory sets were assembled. 400 stainless steel tecnic sets, 500 x-ray sets, and 200 heavy surgical sets were assembled according to Herr Huber, but the cost of these chests could not be stated with any accuracy. (All Herr Huber's records were completely destroyed when his plant in Karlsruhe was bombed out. Even the location of the plant could not be definitely determined.)

The best comment on the American dental officer's estimate of the German equipment was that he almost always used the captured German equipment when available, and managed somehow to keep it with him, in spite of the greater weight, even under combat conditions. Certainly the German sets seem unnecessarily heavy and complicated, even for a mechanized army. On the other hand their better selection of instruments, the greater convenience of having sets of drawers for



VII INTERVIEWS WITH OFFICIALS OF GERMAN DENTAL SCHOOLS.

Prof. Dr. Elizabeth von Schnitzer, Professor of  
Orthodontia, Heidelberg University.

Dr. von Schnitzer has under treatment about three hundred orthodontia cases in her private practice and in the University clinic. She is using a method introduced about two years before the war by Dr. Andreson of Denmark and developed by Dr. Leopold Petrik of Vienna.

Briefly the Andreson technique consists of two phases. The first phase comprises the widening of the arches if necessary, and the gross movement of individual or groups of teeth by an expansion splint placed on the lingual and worn only at night. After this first phase is completed, in a year or less, the second phase of treatment begins. This phase is the slow development of harmony in occlusion and jaw relations by means of a loosely fitting-splint fitting both uppers and lowers and worn only at night. This phase may last two years and requires few adjustments. This splint is ground so that it acts only as a large guide plane for all teeth, channeling them to the final correct position. It does not exert positive pressure at any time, and the teeth grow to their new relations rather than moving under compulsion. The splint is so loose that at first it tends to fall out at night, which is the only time it is worn. It results also in considerable bite-opening if desired. This reporter is not an orthodontist, but results shown on casts appeared good and the occlusion between individual teeth seemed better than normally expected. While requiring a somewhat longer period of treatment, the total cost was reduced by the infrequency and simplicity of adjustment. Some patients not seen for four months due to the confusion of war progressed normally during that time. The fact that only removable appliances, worn at night were used, appealed to the patients. Cost per case varied from 500 marks to 1500 marks. It is difficult to translate this sum in terms of American exchange as the mark has not had a free market for some years. At present rates, this fee would be from \$50 to \$150. At the old rate of about 4 marks to the dollar the sum would be from \$125 to \$375. This is probably a fairly accurate translation in terms of buying power.

There is a shortage of trained orthodontists in Germany. Dr. von Schnitzer was the only one in Heidelberg, Mannheim and Ludwigshafen, and her patients from Strasbourg and Saarbrücken. In an effort to increase the number of practicing orthodontists, the German government sponsored in 1940 a plan whereby Heidelberg and seven other schools gave courses to practicing

dentists. These courses were planned for two weeks every six months for three years, for a total of twelve weeks. The dentist was expected to treat orthodontia case in his own practice, during this three year period and could bring casts of his practical cases for guidance and advice. Due to the war these courses were discontinued before they could be completed. Completion of the course was to qualify the dentist for registration as a Fachzahnarzt für Kieferorthopädie, or specialist in orthodontia. It was not, however, planned to limit these men to the practice of orthodontia as had previously been the case with specialists of all classes. Previous requirement had been three years as assistant in a clinic treating orthodontia cases.

Three books have been published on the Andreson technique. These are:

"Funktionskieferorthopaedie", III Auflage, by Andreson and Haupl, published by Johann A. Barth in Leipzig, 1942.

"Gebissregelung mit Platten" by A. Martin Schwarz, published by Urban u. Schwarzenburg, Berlin/Vienna, 1944.

"Lehrgang der Gebissregelung V Teil, Die entwicklungsbezügliche Bestimmung der entwicklungsbezügliche Befund" by A. Martin Schwarz. Urban u. Schwarzenburg, 1944.

The method has also been applied to bite opening for prosthetic cases as reported by Richard Grohs and Leopold Petrik in Zeitschrift für Stomatologie, April 1944.

Dr. Bernhard Kramer, Head of the Dental Society (KZVD) of Heidelberg.

Dr. Kramer is head of the local dental society at Heidelberg in an informal capacity as the society is actually a part of the Mannheim group and its headquarters is in that city. Dr. Kramer is in general practice and is not connected with the University. He may be regarded as an average German dentist, maintaining a good practice consisting partly of insurance practice and partly of private patients. His opinions are not necessarily representative of the most advanced German dental science, but represent German dentistry as actually practiced.

In Heidelberg the "Zahnärzte" (degree dentists) outnumber the "Dentisten" (non-degree dentists) by two to one, and Dr. Kramer believed the two groups will eventually merge into one class, with common educational requirements. Such a move was under way in 1933 but was not encouraged by the Nazi party.

Caries is believed to be the result of poor diet and poor oral hygiene. Thinks these two factors are of about equal importance. Does not have much confidence in the ability to control caries by diet and hygiene, however, indicating some other unknown factor.

Focal infection from teeth is believed to cause "heart disease, kidney disease, rheumatism and nerve diseases." Practices a simple root canal technique without rubber dam or bacteriological check, sealing in antiseptic (chlorphenol) for two treatments and filling the canals with gutta percha. Not sure of result from health standpoint.

Sulfa drugs are used internally in cases of developed infection but are not used prophylactically nor locally.

Periodontoclasia is believed due to "inner constitution" of patients, old age, or lack of adequate diet, especially Vitamin C. Treatment of moderate cases is by prophylaxis and relief of traumatic occlusion. Late cases are treated by gingivectomy. Patients are given a paste called "Cebion" which contains vitamin C and is massaged into the Gums twice daily.

Dr. Kramer thinks the acrylic resins are good for denture bases but are not sufficiently tested for crown and inlay work. He has not heard of the use of acrylic resin and liquid for direct insertion in cavities followed by polymerization by the use of the infra-red lamp.

He routinely used steel for crowns and prosthetic work. He uses palladium alloys, when available, for inlays. Would prefer gold.

Preventive dentistry has been carried on by bi-annual examinations of school children followed by treatment by the school dentist, and by instruction in home care. Before the war, poorer children in Heidelberg were given an accessory "ration" by an American Quaker organization. This ration also contained vitamins C and D and was believed to help dental health.

Dr. Kramer thinks the state insurance system is good for the patient but does not give the dentist much incentive to improve his technique by post-graduate study as fees remain the same for good or poor work and most dentists are busy throughout the working day. The more effective incentive is to get out more work by seeing as many patients as possible in a given time. The system does provide for every citizen at least minimal dentistry. Through its

control of licenses it also insures that smaller towns will have adequate dental care.

The state dental system provides replacements only if less than five teeth remained above and below, in occlusion. (Total of at least ten occluding teeth.)

Mr. Neumann, Karlsruhe.

Mr. Neumann is currently directing the school for "Dentisten" (non-degree dentists) in Karlsruhe, in the absence of Mr. Emil Kimmich who has moved to Baden Baden, pending opening of the school.

There are seven schools for dentisten in Germany at Berlin, Dresden, Düsseldorf, Frankfurt, Karlsruhe, Munich and Vienna. They graduated about 550 students yearly before the war. During the war they were closed except for their operating clinics. Their graduates were not commissioned in the army. There are said to be about 20,000 dentisten in Germany but this figure is believed to be too high by the undersigned. Exact figures are unavailable outside of Berlin, if there.

The School at Karlsruhe was said to be the largest in Germany with about 130 students. Only 5% were women, as women did not like the required preliminary qualification as a laboratory technician.

Only one year was put in in the Institute for Dentisten, but seven years were required for qualification after completion of grade school, as follows:

3 years as apprentice in a commercial laboratory, with one day weekly spent in a special apprentice school.

2 years in the office of a practicing "Dentist" (non-degree)

1 year in institute for Dentisten. In this year 4 hours were put in class work daily and 5 hours were put in in the clinic. Studies included physics, chemistry, anatomy (general and special) surgery, X-ray, operative procedures, and prosthetic technique.

1 year in the office of a practicing dentist.

During his apprenticeship in the lab the student received no pay. During his first two years in a dental office, he got a small salary. While in the institute he paid the school a small fee. After graduation he again received a small

salary while working with a licensed dentist. Each stage of his study was followed by a state-controlled examination.

The school itself is privately owned. Only the examinations are state-controlled.

Mr. Neumann estimates that the ratio of "Dentisten" to "Zahnärzte" in Germany is 2 to 5. This ratio agrees roughly with those suggested from other sources.

The licensed graduate could legally perform all dental operations except (a) intra-venous therapy (b) general anesthesia (c) major oral surgery.

Prof. Dr. Peter P. Krantz, München.

Dr. Krantz, who has a medical and dental degree, is director of the dental school of the University of Munich, a position he has occupied since 1929. He is also professor of oral surgery. Other full professors are Dr. Carl Falck (prosthetics), Frau Dr. Kostas (ceramics), and Dr. Carl Piepe (operative and periodontoclasia). Dr. Piepe is in custody as a nazi. Other members of the staff are available.

The medical school of the university is 50% destroyed. The dental school is 100% destroyed and at present is operating only a small clinic in temporary quarters. Before the war this school was second in size only to the one in Berlin.

The dental school had a maximum enrollment of 1923 of 780 students. This number dropped gradually to about 250 at the beginning of the war. The cause of this drop has been discussed in other reports. The positions open for dentists has decreased considerably by 1938. Of 250 students in 1938, 40% were women and 20% were foreign students, chiefly from the Balkans. It was not known how many dentists graduated yearly during the war.

In 1940, Dr. Krantz was taken into the military service and served until April, 1944, most of the time as chief of the maxillo-facial service of a Luftwaffe hospital in Paris. Enrollment in the school dropped immediately after the start of hostilities to a total of about 60 students, of whom 60% were women, 20% foreign students, 10% disqualified males, and 10% military in student companies.

Dr. Krantz believes the trend toward more women in dentistry will continue. He does not believe that the fee scale in socialized dentistry had much effect on enrollment, but that difficulty in getting a place to practice after

graduation was a limiting factor. A dentist could participate in insurance practice only if an opening was certified by local authorities.

Dr. Krantz was pessimistic about dental education in Germany, past and future. He says students came from the Gymnasiums (high school) poorly prepared, due in part to time lost to parades and political activity. He believes that a four year course is sufficient for general practice if the time is well used. He believes an internship is essential for specialists. In this school oral surgeons took one year of additional schooling and then put in two years as assistant in the clinic. This was the system followed at Wien also. Dr. Krantz says that general practice in Germany is to require 3 years in a hospital or clinic treating jaw cases, after which a certificate from the clinic will authorize registration as a specialist without special examination. This statement is not in accord with that of the director of the dental school of Jena, but was emphatically stated to be correct. This question will be investigated further.

Operative requirements in the clinic years of the dental school in Munich, which were set by the professor in charge, were as follows: First year:

- 4 bridges
- 12 full or partial dentures
- 13 amalgam fillings
- 9 amalgam fillings rebuilding crown of tooth
- 9 silicate fillings
- 9 cement fillings
- 28 root canal fillings
- 11 inlays
- 5 gold foil fillings (if patients could be obtained)
- 13 prophylaxis

During the second clinic year the student worked on cases as they were assigned or as he individually preferred, except that no prosthetics work was done after the first year unless by the students special preference.

The Nazi regime did not interfere with operation of the school. Only once did a party representative interview members of the staff. Dr. Piepe was said to be a strong party man and not a good scientist.

The school was most noted for its oral surgical department, which attracted many students from the Balkans.

Caries prevention was based on improved diet and hygiene.

Dr. Krantz believes diet of the mother is most important if first molar is forming then. He believes hygiene is more important than diet, and that there is also a hereditary factor of unassessed importance. He believes the diet of the past 12 years has not been wholly adequate.

Dr. Krantz states that there existed in Germany a dental research council which acted as a clearing house for information but which did not itself finance or direct investigations. Yearly meetings were held but only to discuss in a general way one specific problem each year. The last meeting was held in 1939. There were no standing committees. Chief researchers in caries were Dr. Euler of Breslaw, Dr. Schroeder in Berlin (deceased), Dr. Graz of Vienna, and Dr. Mathis (last location unknown.) The investigation of these men apparently followed the lines of investigation most common in the U.S. regarding effect of diet. Their work has been reported in the literature, files of which are being forwarded to the Army Medical Library.

There was in Germany no council for passing on the merits of products offered for sale to the dental profession.

At present, maxillo-facial cases in Munich are treated at the Ober-fohring Luftwaffe hospital. There are at present only 10 cases under treatment. Air raids did not result in many maxillo-facial cases, probably due to the nature of the injuring force. Persons were subject to crushing injuries over large areas of the body, but seldom to high velocity missiles.

Very new and favorable cases of facial wounds were treated with immediate closure without drainage. More often immediate closure was done with rubber dam drains. Unfavorable cases, either because of elapsed time or severe tissue destruction, were left open until danger of infection was past (ten or more days).

Bone grafts of the jaw were usually taken from the crest of the ileum. Ribs were not used. These grafts were usually taken as free grafts without previously imbedding them in the tissue of the abdomen. The bed for the graft is prepared up to 14 days before the graft is to be placed. The bed is left open with a drain in place. It is claimed that this procedure reduces bleeding at the time of operation, makes a cleaner field, and that granulation of the exposed bone ends in the bed promotes rapid union and reduces infection. Dr. Krantz claims that Dr. Ertl of Budapest is the proponent of this method. He claims good results in his own experience.

Simple jaw fractures are usually treated with splints of acrylic resin. Simple fractures in the mid line are usually immobilized only with bandages. Inter-maxillary wiring is used infrequently. When used it is applied with rigid immobilization for two weeks, after which only "semi-immobilization" is kept up, for another two weeks. Direct fixation with plates or pins is not practiced. Circumferential wiring of edentulous cases is occasionally, but rarely, used.

Sulfa drugs are used prophylactically in severe cases, especially where bone is exposed.

Novocain is used routinely for local anesthesia. Pantocain has been used but no advantage is seen for it.

Periodontoclasia is treated by early gingivectomy. Advanced cases are not believed curable. Gingivectomy is considered as the conservative treatment, not a last resort for severe cases.

Dr. Krantz mentioned an operation for correction of labially prominent anteriors in adults. He stated that this operation was common and had been practiced in Germany for many years. If all six anteriors are to be moved back, vertical cuts are made in the mucous membrane vertically between the cuspids and first bicuspids on the labial surface. The labial gingivae are reflected to a level above the apices of the upper anteriors, and the segment of bone holding the teeth is loosened by cutting with a chisel or bur between the cuspids and horizontally over the apices of the teeth. This block of bone is then pushed back to the desired position and immobilized with a labial arch wire. The lowers are prevented from striking the uppers by insertion of a splint over the lower posteriors, which is left in until reattachment takes place, about a month. It is claimed that devitalization of the teeth does not occur and that results are good. Individual teeth, or two or three teeth are moved if required. When moving individual teeth vertical cuts are made on the labial surface between the tooth to be moved and the adjoining teeth. In addition the lingualgingival tissue, lingual to the tooth, is reflected upward from the bone and sufficient bone removed with a bur to make it possible to push the tooth back the required amount. This method is only practiced for adults where orthodontia is not considered feasible. It is to be understood that the undersigned is merely reporting this method and does not indorse or condemn it. Sectioning of the neck of the condyle of the ramus of the mandible are also practiced for cases where repositioning of the mandible is required, following procedures known in the U.S.

Osteomyelitis is treated with x-ray dosages of 150 to 200 R given eight or ten times at intervals of 48 hours. Said to give rapid relief of pain, with decreased healing time. Data on KVP and filtering not known to Dr. Krantz.

Dr. Krantz believes there is increasing awareness of the dangers of focal infection among German dentists. He says he is also becoming convinced of the impossibility of sterilizing and keeping sterile the root canals of multi-rooted teeth. He believes extraction of dead teeth is safest. He thinks it will be some time, however, before German dentists will adopt a more careful attitude in selecting teeth for treatment, partly because of past training and partly because of pressure from patients. At present, treatment is attempted for almost any type of case, frequently by pulp amputation without further treatment of the canals, beyond sealing in a mummifying agent.

The provocation method of diagnosing focal infection in a suspected tooth (discussed in previous reports) by means of diathermy or vibration is practiced and taught, but is not considered more than an indication of the condition of the tooth and is not relied upon.

Dr. Krantz thinks the public insurance program in Germany has not worked out well, though he does not seem to base his reaction on definite facts. He says vaguely that it is too big and has too much overhead. More concretely, the fees are too low to encourage good work, the dentist and patient are encouraged to conspire to defraud the system by reporting work not actually done, and the dentist tries to sell the patient work not paid for by the insurance system to get a larger margin of profit. Dr. Krantz favors a system of private practice for average patients, with university or charity clinics for those unable to pay a reasonable fee. (It seems generally accepted by most German dentists, however, that the insurance scale of fees, low as it is, represents about the maximum that average Germans can, or will, pay).

Prof. Dr. Ottomar Jonas, Freiburg.

Dr. Jonas was in Leipzig until 1936, when he came to the University of Freiburg. He does oral surgery, prosthetics and orthodontia. He was a professor at Freiburg (prosthetics) until the end of the war, when Prof. Dr. Fritz Farber was relieved for Nazi activities, and Dr. Jonas became acting director. Dr. Emig was instructor in operative dentistry.

Freiburg had one of the larger dental schools in Germany.

Its students numbered about 500 until the war, without the drop noted after 1934 in most schools. Dr. Jonas says he brought many students here from Leipzig in 1936, at the time when the decrease in most schools was most evident. This sounds improbable but there seems to be no other explanation, and is borne out by the fact that the school at Leipzig dropped more rapidly (75%) than most schools in this period.

During the war, Freiburg maintained a student body of about 150, 80% of whom were women, the remainder military and disqualified males. During the war three semesters work were given each year so that a student could graduate in a little over two years. More than half took an extra semester to get the doctor's degree.

Students at Freiburg put in two semesters only in clinical prosthetic work during which time they completed a total of 18 pieces (bridges, full or partial dentures.) Dr. Jonas did not know how much operative was required.

In Freiburg there are about 30 degree dentists and about 20 "dentisten" or mechanical dentists. During the war only ten dentists were taken from Freiburg and there was no difficulty in getting dental care until the town was badly damaged in November, 1944. Gold and acrylic resin were scarce but there was no shortage of alloy or rubber. This contradicts newspaper reports in the US that only most urgent emergency work was authorized and that alloy for amalgam was very scarce. (One small firm in Pforzheim claimed the French confiscated about a ton of silver from their factory alone).

The dental school was completely destroyed in November, 1944.

Dr. Jonas believes the state insurance system is better than private practice, at least for the patients. He believes the low fees force rapid work, however, and favors the operation of clinics on a salary basis. He cites the example of the fee for a root-canal filling, which brings twenty-five cents at present exchange, or about sixty cents at old exchange rates. A root-canal file alone costs about one third of this sum. Berlin, Breslau, Hamburg, and other larger cities, operated such insurance clinics on a salary basis, but most work was done on a fee basis.

Preventive dentistry was based on hygiene and diet. The latter emphasized principally vitamins C & D. No evidence was given that Vitamin C affected caries, but it was apparently

given with the idea that it might help anyway.

Vitamin C was also given for periodontoclasia, but chief reliance was placed on a forcible spray using oxygen as the compressed gas. The solution used was though unimportant. Said to have a silver solution but it is not clear just what form of silver was used.

Only Novocaine was used for local anesthesia. The standard acrylics were used for denture and bridge work. Acrylics were not used for polymerization within the cavity. Vitonlek, an I.G.F. product (made up into solution at Pforzheim, Heimerle u. Neule) was used instead of tin foil for vulcanization. Said to be satisfactory. A bottle was obtained and will be forwarded with a separate write-up.

Dr. Karl Falck, University of Munich.

Dr. Falck is professor of prosthetics in the University of Munich. He was questioned particularly regarding the substitutes for gold used in Germany during the war.

At first the shortage of gold was met by alloying with increasing ratios of silver and palladium. These alloys were generally satisfactory but gold early became unobtainable. At this time the palladium-silver alloys came into use, a sample formula for which was:

Palladium	25%	
Silver	65%	(Information from manufacturer
Gold	2%	indicates that the percentage
Base Metals, largely copper	8%	of gold ran nearer 10%)

This material was marketed as "Pallieg", "Alba" or "Econor", made respectively in Frankfort, Hanau and Pforzheim. These alloys were widely used and were considered satisfactory. They were used for inlays or in sheet form for denture bases. They were not used for cast clasps. The metal was said not to blacken in the mouth and could be soldered.

Later palladium (obtained from Canada) became scarce and other alloys came into use. One of these (Silca) contained:

Silver	82%
Tin	15%
Copper	3%

This metal discolors badly, has sufficient edge strength, and cannot be soldered satisfactorily as the solder line breaks down in the mouth. It was used for inlays, crowns and pontics.

Other alloys of aluminum, tin or zinc and silver were used but were brittle and unstable (Deufa metal).

The most common materials in use at the end of the war were the stainless steels. These steels had adequate strength and held up well in the mouth but were difficult to fabricate and in the cast form were not accurate enough for inlays or 3/4 crowns. Among the stainless steel were:

Wipla or Krupp V<sub>2</sub>H

Fe 74%

Cr 18%

Ni 8% (for swaging or in wire form only)

BH<sub>3</sub> (Made in Vienna, name of company not known)

Fe 72%

Cr 20%

Ni 8%

Vitallium

Pontica-muzit (a complicated formula of Cr, Ni, Cu and Fe, made by Rochling in Ruhr.)

These metals required hydrogen or acetylene and oxygen, or the electric arc, for casting. The electric arc was considered best for those containing iron to prevent the separation of carbon crystals under prolonged heating; also to prevent the absorption of hydrogen. None of these metals cast accurately enough for inlay work and all required a special investment, flux and solder. The steels were usually cast in an investment of Al<sub>2</sub>O<sub>3</sub> and phosphoric acid. Krupp's was called "Pyrofen". An investment for both steel and vitallium was "Neo-kredolite", made in Breslau.

Dr. Falck states that models for acrylic work are painted with a 30% solution of calcium chloride as the only protective medium during curing. This solution is painted with a brush onto the hot, dry cast after boiling out the wax. It is applied and allowed to absorb about three times. The theory of its use is that the affinity of CaCl<sub>2</sub> for water is such that no vapor exists inside the flask. It also raised the boiling point of water to a degree that steam is not formed inside the flask. This method is reported for testing if desired. Undersigned can only state that good results were claimed for it.

Full denture techniques are sketchy. Impressions are usually taken in plaster in a stock tray, though occasionally a preliminary tray is made and the impression completed in compound so that muscle trimming can be done. The denture space is determined by closing until lips touch lightly.

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Centric is determined by having patient swallow and close or by having patient hold tongue well back when closing. The Gysi tracing is not used. Plain line articulators are almost universal. Dr. Falck states that most students learn very little about prosthetics while in school and in view of the fact that they were required to make only six full or partial dentures, this opinion seems well-founded.

Dr. Josef Kohler, Heidelberg.

Dr. Kohler is principal dentist in the dental school of the University of Heidelberg, though without official position. Former director was Prof. Dr. Karl Schmidhuber, now under arrest as a member of the SS. The present acting director is the chief of the ear, nose and throat department and is not a dentist. Others prominent in the dental faculty were:

Dr. Alexander Ritzert, assistant in oral surgery, under arrest as an SS member.

Dr. Fritz Kullman, assistant in charge of prosthetics, now a prisoner of war.

Prof. Dr. Elsbeth von Schnitzer, professor of Orthodontia.

Dr. Weissenfels, assistant in surgery till 1936, now an oral surgeon in the city giving one hour of lecture time weekly.

Enrollment figures were not available, but in the years immediately before the war, the number of students averaged about a hundred. With the outbreak of war this number of students dropped, at once, to 30 - 40, of whom twenty to twenty-five were women, five were military students, and the rest were physically disqualified males. The number of students which could be accepted annually was fixed by the government beginning with 1937. No courses were given for dental officers in the Army.

Very little damage was suffered to buildings but the staff were badly scattered during and after the war. The course of study was not much affected by the war until 1945.

As in other schools, the required course for a degree was  $3\frac{1}{2}$  years. Most students went for an additional half year to take the degree of "Doctor" in addition to the required title of "Zahnarzt". Dr. Kohler believed students should have three or four months practical experience after graduation under a practicing dentist. He believes a system of internship or a requirement that all students have a degree in medicine would be even better.

Before the war, semesters were short (3 to  $3\frac{1}{2}$  months)



was considered too toxic for injection. No other anesthetics were experimented with.

**Chemotherapy:** The common sulpha drugs were used prophylactically in severe bone injuries, both internally and by dusting in the wound. A proprietary product of Knoll AG, Ludwigshafen, called "Saltnion" was being experimented with and was thought to be very effective against the same organisms as are affected by sulfathiazol. The material is used only locally as a solution on gauze packs. No work had been done on the benzyl derivatives developed by the Kaiser Wilhelm Institute in Heidelberg.

Dr. Kullman had worked with acrylic eyes but the results were not known to the dental staff.

Fractures were treated routinely with acrylic splints. Inter-maxillary wiring, direct bone plating or external fixation with pins are not used, though the headcap is used when indicated. Bone grafts were formerly made from the crest of the ileum, the tibia (osteoperiosteal) or from a rib. Now only the ileum is used, with fixation by steel wire. Wire is removed in 8 weeks.

Mentioned that both Swiss and French have acrylic materials for direct filling of cavities, but details are not known. Has heard of hollow bur cooled by CO<sub>2</sub> but does not know by whom developed, and has never seen one.

Dr. Werner Rössle, University of Erlangen.

Dr. Rössle is an assistant in surgery in the dental school. Prof. Dr. Edwin Hauberisser was director of the dental school and has been arrested for Nazi activities. Dr. Heinz Paschke is acting director but was not available at the time of interview. Dr. Otto Winkelmeier is professor of operatives and Dr. Rössle is acting head of the surgical department.

This was one of the smaller schools in Germany. They had a maximum of about 160 students in 1932-33, dropping off gradually to about 80 students when the present war began. During this war the number of students dropped to about twenty women and disqualified males, plus a variable but small number of military. About 75% of students were women. Students from Rostock and Cologne were taken in temporarily pending repairs to schools there.

The dental school was not damaged by air raids but classes were interfered with considerably during 1944 and 1945 by air raid alerts.



open to question. (Experiments in the U.S./University of Illinois?/have shown that the cutting edge of a bur may develop temperatures up to 300 degrees, while the shank remains relatively cool.)

3. The handpiece in question is not a German invention. It was developed and patented in Switzerland. The dentist in Gifhorn had no part in the development or production of the apparatus.

4. Capt. Leblanc did not know the name of the dentist in Gifhorn, nor did he have samples or drawings of the equipment. He did not know the name of the manufacturer in Switzerland.

Subsequent questioning of dentists, supply men, and university personnel over most of the American occupied area of Germany failed to bring out any knowledge of the apparatus beyond one or two vague rumors that such equipment had been heard of in Switzerland or Sweden.

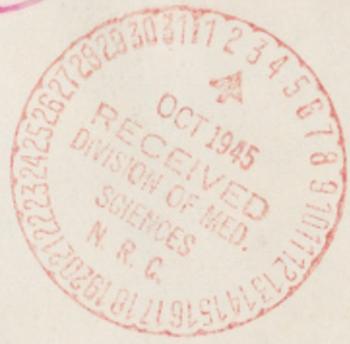
In the absence of definite clinical data, the effectiveness of this apparatus in controlling pain is open to question. It is a matter of common experience, of course, that even the touch of an explorer may cause intense pain in a sensitive cavity, and the use of even a perfectly cooled bur in such a cavity could hardly be painless. If additional information is considered of sufficient importance, it would seem that, as the item is patented in Switzerland, such information could be readily obtained through American commercial representatives there. Gifhorn itself is now, and was at the time of the publication of the article, in British occupied territory.

A report has also been received from Dr. Charles B. Jones, an American civilian expert on metallurgy and surgical instruments that he saw recently in a "metallurgical laboratory" (name unknown) in London dental burs which were hollow and designed to be filled with metallic sodium to speed conduction of heat along the shank. It is claimed that his device has been used in aircraft motors, where valve stems have been so treated. This information was given to Colonel Thomas Smith of the Office of the Chief Surgeon, Hq, USFET (Rear) who was making a trip to London, during which he intended to get additional information on this matter.

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