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The DENTAL DIGEST

May
1933

France

Germany

ITALY



This map of Switzerland represents pictorially the typical sources of nutrition in some of the districts studied by Doctor Price: (1) Loetschental; (2) Grächen; (3) Visperterminen; (4) Ayer; (5) St. Moritz; (6) Herisau

WHY DENTAL CARIES WITH MODERN CIVILIZATIONS?

III. FIELD STUDIES IN MODERNIZED ST. MORITZ AND HERISAU, SWITZERLAND

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LIFE, as viewed in the light of modern social trends, is a paradox if we do not find that with the accumulation of the conveniences, comforts and luxuries for which mankind in general strives, there is an increasing degree of perfection in bodily development, both in man's efficiency and in his continued functioning. If, we reasoned, we could find communities with all the physical advantages of altitude, climate, and locally produced natural foods similar to those of Loetschental, Grachen, Visperterminen, and Ayer, which were reported in the last two installments of this article,¹ and if, in addition to these advantages, the people of these communities were able to avail themselves of the helpfulness of modern medical and dental science (hospitalization, prenatal care, child welfare clinics, and public health instructions including oral hygiene)—then, we should find a high state of dental efficiency and freedom from caries approximating physical perfection and superb physical efficiency. To find such a place one would naturally think of places that are world-famed as health resorts providing all of the best of modern conveniences that science and industry can assemble. Surely such a place should be St. Moritz which is situated in the southeastern part of the Republic of Switzerland near the headwaters of the Danube in the upper Engadin. This world-famous watering place attracts people of all continents for both summer and winter health building and for the enjoyment of the mountain lakes, snow-capped peaks, forested mountain sides, and crystal clear atmosphere with abundance of sunshine.

The journey from the Canton of Wallis (Valais) to the upper Engadin takes one up the Rhone valley continually climbing to get above cascades and beautiful waterfalls until

¹Price, W. A.: Why Dental Caries with Modern Civilizations? I. Studies in Primitive Loetschental Valley, Switzerland. II. Field Studies in Primitive Valais Districts, Switzerland, THE DENTAL DIGEST 39:94 and 39:147 (March and April) 1933.

one comes to the great Rhone glacier which blocks the end of the valley. The water gushes from beneath the mountain of ice to become the parent stream of the Rhone river which passes westward through the Rhone valley receiving tributaries from snow-fed streams from both north and south watersheds as it rolls westward to the beautiful Lake Geneva and then onward west and south to the Mediterranean.

It is of interest and significance that a study of the child life in this valley as made by Swiss officials and reported by Doctor Adolf Roos and his associate showed that practically every child had tooth decay and the majority of the children had decay in an aggravated form. People of this valley are provided with adequate railroad transportation for bringing them the luxuries of the world.

If one proceeds from the end of the Rhone valley he might go north by the Grimsel pass over a high range or southeast over the Furka pass through snow banks (even in summer) and on eastward toward the Engadin country. As we travel westward through the Rhone valley we are paralleling to the north the Loetschental valley which we have previously studied. I have referred to the great glacier system extending westward from the snow fields of the Jungfrau to Loetschental, the approach to which by way of the Loetschental is so difficult that few ever undertake the journey. There is, however, an easy approach to this mountain system from Interlaken which is reached by going northward from the Rhone valley over the Grimsel pass. The portal of this monarch is through the Lauterbrunnen valley which is one of the grandest gems of mountain scenery in all Switzerland. I have shown this scene in Fig. 2 of this issue in which will be seen the varied splendor of one of the glimpses from our train as it passes before an ever-changing panorama of waterfalls, glaciers, multi-hued granite peaks and a vast expanse of carpet-laid valley. The train plays

hide and seek with the eagles, even diving beneath glaciers and coming to the surface on occasion to permit of superb vistas and finally, through one of the master feats of engineering, reaching the continental divide at Jungfraujoch, 11,340 feet above sea level. One reason for tracing the course to this view is to give a conception of the enormous expanse of the snow and ice fields that slope away in various directions. One gets the notion that he would like to take his food and clothing in a toboggan and go coasting on and on westward to the end of the snow field as it makes the eastern retaining wall for the Loetschental valley. It would be a perilous journey except in most favorable weather and with skillful guides since this is the home of the summer blizzards. These are the snows that nourish the streams for watering the many plains where man has built his industries for supplying the markets of the world. The snow fields are the store houses of the energy which man will harvest. Will it always be used for his physical betterment?

Presently the people in the lower plains will be considered, but first a group that has been reared in the companionship of the higher valleys should be studied. We go on eastward to the headwaters of the Danube for which these eternal snows furnish the sinews of a mighty river. As we pass eastward through Andermatt we are reminded that the trains of the St. Gotthard tunnel go thundering through the mountain a mile below our feet en route to Italy.

To reach our goal, the beautiful modern city and summer resort of St. Moritz, we enter the Engadin country famed for its beauty and crystal clear atmosphere. In Fig. 2 is shown a view from the car window in which is seen the lavish blending of the greens and blues, and indeed as the train climbs the winding ascent we are reminded of the vision which must have been the inspiration for Straus as he translated the picture to

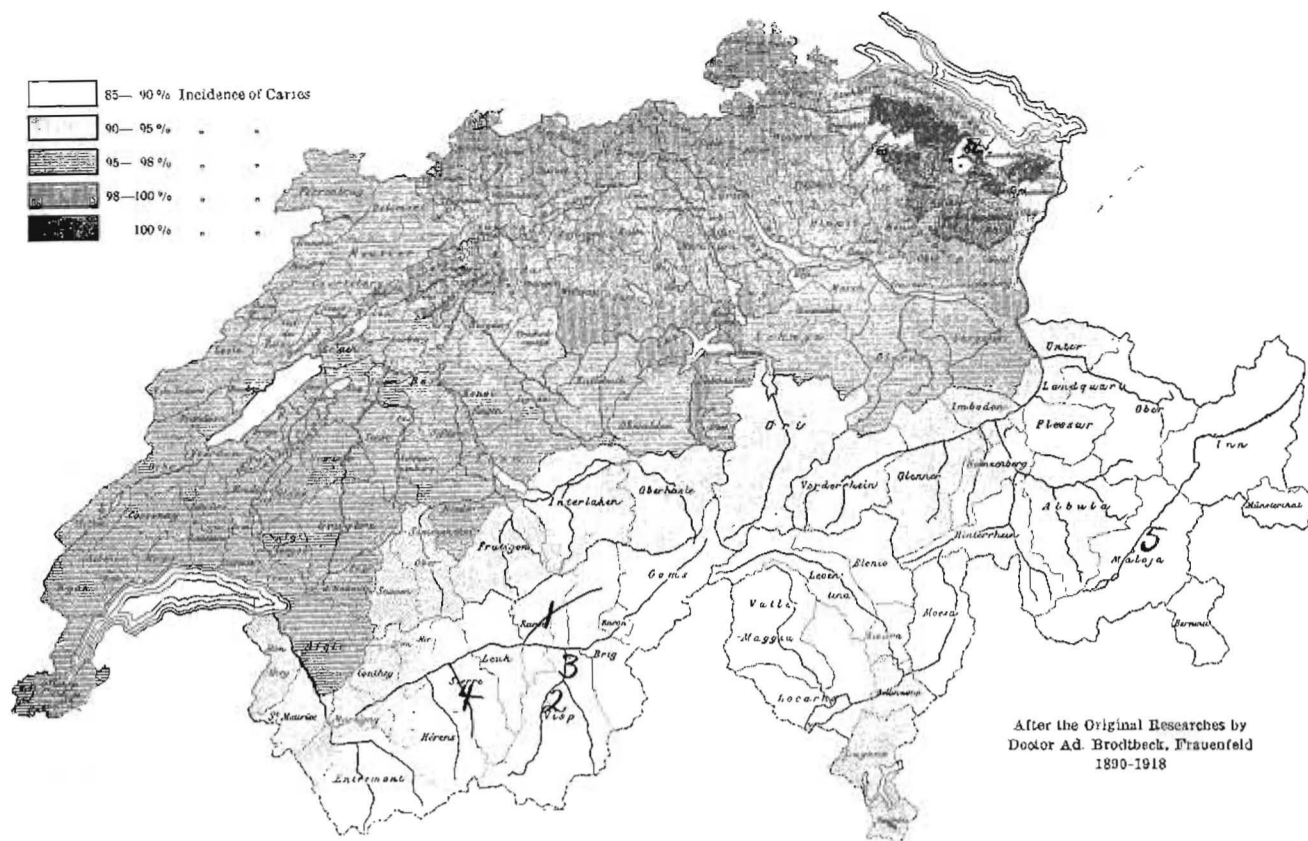


Fig. 1—The extent of tooth decay in Swiss school children. This outline map of Switzerland shows the distribution and severity of dental caries and the location of some of the districts studied by the author: (1), Loetschental; (2), Grächen; (3), Visperterminen; (4), Ayer; (5), St. Moritz, and (6), Herisau.

the music of his Blue Danube Waltz.* One is constantly impressed with the blueness of the Alpine skies, forming a background for the purple of the far-away snow-capped mountains and with the blending of the blue and the purple with the warm greens of the wooded foreground. We already know something of the beauty that awaits us which has attracted pleasure seekers and beauty lovers of the world to St. Moritz, the setting of which is shown in Fig. 3. One would scarcely expect to see so modern a city as St. Moritz at an altitude of a little over a mile, with little else to attract people than its climate in winter and summer, the magnificent scenery, and clear atmosphere. We have passed from the communities where almost everyone wears homespuns to one with white collars, silk hats, and English walking coats and the most elegant of feminine attire. The children are refined and everyone shows the effect of contact with culture. The hotels in their appointments and design are reminders of Atlantic City. Immediately one sees that something is different here than in the primitive localities: The children here do not

*The Danube is no longer blue in the cities where the river serves for drainage, and consequently is a disappointment to travelers who see it only in cities, such as Budapest.

have the splendidly developed features, and the people here do not give evidence of the great physical reserve that was seen in the communities already reported.

Through the kindness of Doctor William Barry, a local dentist, and the Superintendent of the Public Schools, we were invited to use one of the school buildings for our studies of the children. The summer classes were dismissed with instructions that the children be retained in the rooms or kept conveniently near so that we could have them for study as rapidly as we wished. Several factors were immediately apparent. The teeth were shining and clean, giving eloquent testimony of the thoroughness of the instructions in the use of the modern dentifrices for efficient oral prophylaxis. The gums looked better and the teeth more beautiful for having the débris and deposits removed. Surely this superb climate, this magnificent setting combined with the best of modern prophylactic science should provide a 100 per cent immunity to tooth decay. But in a study of the children from 8 to 15 years of age, 29.8 per cent of the teeth out of every hundred examined had already been attacked by dental caries. Here again our studies included careful examina-

tion of the mouth; photographs of the faces and teeth; the obtaining of samples of saliva for chemical analysis; also mouth cultures, and a detailed study of the nutrition used in each case. The diet was strikingly modern and the only children found who did not have tooth decay proved to be children who were eating the natural food of whole rye bread and plenty of milk.

A detailed discussion of the chemical differences in the food constituents will be made of both the districts conducive to immunity and those conducive to susceptibility in the fifth article of this series to appear in the July, 1933, number of THE DENTAL DIGEST.

I was told by a former resident of this upper Engadin country that in one of the isolated valleys only a few decades ago the children were still carrying their luncheons to school in the form of roasted rye carried dry in their pockets, just as their ancestors had eaten their cereal for centuries preceding. There is no question but that along with good physical exercise from the process of mastication not only all of the minerals would be had but also all the factors of the embryo

grain except those which may have been injured in the roasting.

St. Moritz is a typical alpine community with a similar physical setting to those in the Cantons of Bern and Wallis (Valais). It is, however, provided with modern nutrition consisting of an abundance of white flour products, marmalades, jams, canned vegetables, confections, and fruits—all of which are transported to the district; only a limited supply of vegetables is grown locally. We studied some children here whose parents retained their primitive methods of food selection and without exception those who were immune to dental caries were eating a distinctly different food from those with high susceptibility to dental caries.

Few countries of the world have been so untiring in their efforts to study and tabulate the incidence of dental caries for various geographic localities as have the authorities in Switzerland. Through the kindness of Doctor Adolf Brodbeck I am privileged to present a map of Switzerland (Fig. 1), to be discussed later, which discloses by its shadings the incidence of dental caries for the various communities. The shaded areas indicate the incidence of dental caries according to the percentage of persons affected. It is important to observe this critically. In the most deeply shaded area, lying to the north and east near Lake Constance, there is a considerable district where 100 per cent of the people are reported to be suffering from dental caries. In the next lighter shading the incidence of dental caries is from 98 to 100 per cent thus lacking little in severity of 100 per cent. This district covers an extended agricultural and commercial area where the greater part of the population is to be found. Practically all of the balance of Switzerland supporting considerable population comes within this and the next shading which shows from 95 to 98 per cent of persons suffering from dental caries. Of the two remaining shadings one has from 90 to 95 per cent and the other from 85 to 90 per cent individual susceptibility to dental caries. The last group is located within the rugged alpine country and incidentally includes the general district in which the few relatively limited primitive groups were found in the Cantons of Bern and Wallis (Valais) previously reported. Since the district in the vicinity of Lake Constance has so high an incidence of dental caries that it is recorded as 100 per cent, it seemed especially important and desirable to make a similar critical study there and to obtain samples of saliva

and detailed information regarding the food and to make detailed physical examinations of growing child life in this community. Accordingly, through the great kindness of Doctor Hans Eggenberger, Director of Public Health for this general district, we were given exceptionally fine opportunity for studying the children and obtaining the specimens of food and saliva and for securing clinical data and records.

Arrangements had been made by Doctor Eggenberger so that typical groups of children, some in institutions, could be carefully studied. He is located at Herisau in the Canton of St. Gall. We found work splendidly organized for building up the health of these children insofar as outdoor treatment, fresh air, and sunshine were concerned. Dental caries being a major problem and probably nutritional, it was being treated by sunshine. The boys group and girls group were both being given suitable athletic sports under skillfully trained athletic directors. These groups are located in different parts of the city. Their recreation grounds were open lawns adjoining wooded knolls which gave the children splendid protection and isolation to play in their sunsuits and build vigorous appetites and thus prepare them for their institutional foods which were largely a modern menu. Critical dental examinations were made and an analysis of the data obtained revealed that twenty-five out of every hundred teeth of these growing boys and girls had already been attacked by dental caries and that only 4 per cent of these children had escaped from the ravages of tooth decay which many of them had in an aggravated form.

As bad as these conditions were we were advised that what we had seen was better than the average for the community. The ravages of dental caries had been strikingly in evidence as we came in contact with the local and traveling public. As we studied these children we occasionally found one with much better teeth than the general average just as we had at St. Moritz. Of course, we were eager to know why these children had a different dental condition than the others. We usually do not need to inquire long before we find the answer. For example, in one of the St. Moritz groups in a class of sixteen boys there were 158 cavities or an average of 9.8 per cent present or past cavities per person (fillings are counted as cavities). In three other children in the same group there were only three cavi-

ties past or present and one without dental caries. Two of these three had been eating dark bread or entire grain bread and one was eating dark bread and oatmeal porridge. All three drank milk liberally.

When looking here for the source of dairy products one is immediately impressed with the absence of cows on pasture in all the plains in Switzerland in which areas a large percentage of the entire population resides. True, one frequently sees large dairies or creameries but the cows are not in sight. When I asked a government official the explanation for this he stated that it had been found that a larger quantity of milk could be obtained from the cows if they were kept in the stables during the period of high production. Indeed this was a necessity in most of those communities since there were so few fences, and during the time of the growth of the crops, including the stock feed for the winter's use, it was necessary that the cows be kept shut up. About the only time that cows were allowed out on pasture was in the fall after the crops had been harvested and while the stubbles were being plowed.

In studying the diets of the children in St. Moritz and Herisau in every case those with the lower number of cavities per person were using milk more or less liberally. Of the total number of children examined in both places only 11 per cent were using milk in their diets, whereas 100 per cent of the children in the other districts that provided immunity were using milk. Nearly every child in St. Moritz was eating white bread. In Herisau all but one of the children examined were eating white bread in whole or in principal part.

Since there are so many cattle being stall-fed in the thickly populated part of Switzerland and since so low a proportion of the children seem to be using milk even sparingly, I was concerned to know the use that was being made of the milk. I was interested to find, as was suggested by the numerous signs, which might sometimes be mistaken for the names of the towns or the stations, announcing the brand of sweetened milk chocolate made in that district. This is one of the important products for export and constitutes as a beverage a considerable item in the nutrition of large numbers living in this and in other countries. It is recognized as a high source of energy primarily because of the sugar and chocolate which when combined with the milk greatly reduces

the ratio of the minerals to the energy factors as expressed in calories.

It was formerly thought that the dental caries which was so rampant in the greater portion of Switzerland was due in part to low iodine content in the feed and food because of this deficiency in the soil. Large numbers of the former generations suffered from clinical goiter and various forms of thyroid disturbances. That this is not the cause seems clearly demonstrated by the fact that dental caries is apparently as rampant today as ever before, if not more so. The iodine problem has been splendidly met by the medical service of the community through a reinforcement of the diet of growing children and others in stress periods with iodine in suitable form. Indeed the early work done in Cleveland by Crile, Marine, and Kimball was referred to by the medical authorities there as being the forerunner of the control of the thyroid disorder in these communities.

It was of interest to be advised that many in former generations in that general district of Switzerland had had abnormally small teeth, which was thought to be associated with iodine deficiency, and that one of the principal manufacturers of artificial teeth had made a special mold for adaptation to the needs of the people of that district. The present generation, however, does not have abnormally small teeth.

The officials of this community were so deeply concerned regarding the rampant dental caries that they were carrying forward institutional and community programs with the hope of checking this affliction. If dental caries was primarily the result of an inadequate amount of vitamin D, then sunning the patients should provide for an adequate reinforcement. This is one of the principal purposes of getting the growing boys and girls of the community into sun suits for tanning their bodies, as illustrated in Fig. 4.

Another procedure to which my attention was called consisted of adding to the bread a product high in lime which was being obtained in the foot hills of the district. This and other types of bread were studied by chemical analyses and will be discussed in a later communication.

It is of interest that I have established a clinic in a neighboring town for the purpose of demonstrating with a group of children that dental caries can be controlled by a simple nutritional program. An important incident has developed in connection with the selection of the children in this experimental group. When parents were asked to permit their children to have one meal a day reinforced, which I have demonstrated to be adequate by my two clinical groups in Cleveland, the objection was made that there was no use trying to save the teeth particularly for the girls since they should have all their teeth extracted and artificial teeth provided before they were married because they would lose them then. One of the purposes of this clinic is to ascertain whether it may be feasible completely to control the dental caries almost entirely with products that are available within that country.

If reference is made to the map of Switzerland in Fig. 1 the location of the different districts which have been included in these studies will be seen. They have been made in three major drainage areas. Number 1 indicates the location of the Loetschental valley; 2, Grachen; 3, Visperterminen; 4, Ayer—all in the Rhone drainage basin. Number 5 indicates the location of St. Moritz in the upper Engadin on the headwaters of the Danube; 6, Herisau in the drainage basin of the Rhine. It is of interest that the southern part of Switzerland including the high alpine country is largely granite. The hills in the northern part of Switzerland are largely limestone in origin. A great number of the people live in the plain between these two geologic formations which is largely alluvial having been washed down from both formations. It is extraordinarily fertile soil and has supported a thrifty and healthy population in the past.

When I asked a government official what the principal diseases of the community were he said the most serious and most universal was dental caries, and the next most important, tuberculosis, and that both were largely modern diseases in their country.

When I visited the famous advocate of heliotherapy, Doctor Rollier,

in his clinic in Leysin, Switzerland, I wondered at the remarkable results he was obtaining with heliotherapy in nonpulmonary tuberculosis. I asked him how many patients he had under his general supervision and he said about 3,500. I then asked him how many of them come from the isolated high alpine valleys and he said not one; they are practically all from the Swiss plains but some from other countries.

I inquired of several clinicians in Switzerland what their observations were with regard to the association of dental caries and tuberculosis among the people of Switzerland. I noted that the reports indicated that they were generally associated. We will find an interesting correlary of this in my studies in the Outer Hebrides.

These studies in Switzerland, as so briefly presented here, seem to demonstrate that the isolated groups dependent on locally produced natural foods have nearly complete natural immunity to dental caries and that the substitution of modern dietaries for these primitive natural foods destroys this immunity whether in ideally located elevated districts like St. Moritz or in the beautiful and fertile plains of lower Switzerland. The question seems to answer itself in a general way, without much laboratory data, from a critical examination of the foods. The laboratory analyses, however, identify the particular factors in the foods which are primarily responsible by their presence in establishing immunity and by their absence in inducing susceptibility to dental caries. These studies have pertained to communities dependent on rye and dairy products in large part for their primitive nutrition. In later studies diets that do not contain either of these fundamental primitive foods will be considered.

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COMING

IV. Field Studies in Primitive and Modern Outer Hebrides, Scotland.

V. Practical Procedures for the Nutritional Control of Dental Caries.



Fig. 2—This magnificent gateway to the Jungfrau range shows the typical verdure and shelter of the high Alpine valleys.

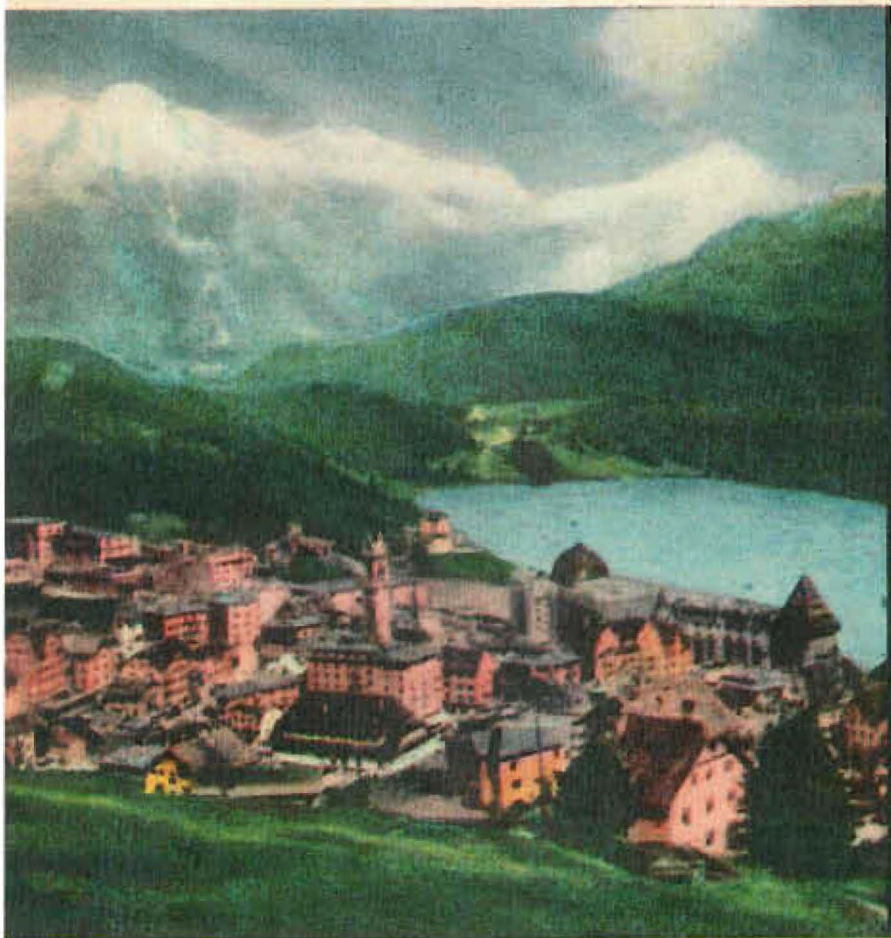


Fig. 3—The famous summer and winter health resort of St. Moritz.



Fig. 4—Sun tanning is a health service in Herisau. This is a typical boy