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The International Team for Implantology (ITI) Research Foundation

A retrospective analysis of research grants
allocated in the years 1988 - 2006

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The International Team for Implantology (ITI) Foundation has a Research Committee that distributes financial support amongst researchers in dental implantology and related fields. Since 1988, approximately CHF 27 million has been granted making the ITI one of the leading private institutions in research funding in dentistry.

Aim

The aim of this search and analysis was to study the nature, quality and allocation dynamics of all research grant applications submitted to the ITI Foundation since 1988 and through 2006.

Results

499 grant applications were submitted to the ITI Foundation. Of these, 46.5 % of the applications were financed. Annually, 3 to 62 applications were received per year with a success rate of 29.4 % to 100 % for funding. Applications were received from 31 countries, the most originating from the USA, with a success rate of 54.5 %. Eighteen applicants submitted 4 or more applications. The applicants were citizens of 37 countries. Most applicants were either medical doctors or dentists, both with PhDs (n = 226). Twenty-nine percent of the applicants were ITI Fellows and were 58.9 % of the time successful in their applications. One hundred and forty-one different universities and institutions with 75 different departments submitted applications. The ITI have 4 different grant programs, where the Single Grant Application (SGA) was selected by the applicants 44.5 % of the time with a success rate of 43.2 %. Most of the proposed studies were clinical studies (36.9 %). The majority of the projects dealt with dental implant surface research, bone augmentation, predictability of implants and implant prosthodontics. A total of CHF 27.6 million was allocated to the successful applicants ranging from CHF 8'000 to CHF 1.5 million per project with an average amount per project of CHF

119'128. Of the 232 financed projects, 94 produced at least one verifiable publication in a peer-reviewed journal, totalling 206 publications. These publications appeared in journals with impact factors ranging from 0 to 7.666 (average = 1.562) and were cited between 0 to 450 times (average = 25.9).

Conclusion

The ITI Foundation is a leading research granting agency in dentistry at large and especially in implant dentistry. In the last two decades, the ITI Foundation has substantially set the trends and contributed paradigm shifts in implant dentistry.

Introduction

Introduction

Through the efforts of two researchers, P.-I. Brånemark at the University of Gothenburg, Sweden and A. Schroeder at the University of Berne, Switzerland implant dentistry was to become a predictable treatment option in the rehabilitation of edentulous and partially edentulous patients through the procedure of “osseointegration” or “functional ankylosis” (Berglundh et al. 2002, Brånemark et al. 1969, Brånemark et al. 1977, Schroeder et al. 1976).

In subsequent years this treatment concept was scrutinized by a number of clinical and laboratory studies. In an effort to promote further research and development in the field Prof. Dr. André Schroeder and Dr.h.c. Fritz Straumann, amongst others, founded the International Team for Implantology, in short the ITI. For many years the ITI was predominantly a forum for exchange of thoughts and clinical experience in implant dentistry. The development of a novel implant system (today the Straumann Dental Implant System®) in 1984-1986 was the result of industry with very loose consulting arrangements with some members of the ITI. The network grew fast and more academics became interested in promoting the field of implant dentistry. As a consequence, basic questions arose and had to be answered through hypothesis testing and well-designed

research. Also, the need for staging clinical studies on the longevity of the implant system and its complication rate made it necessary to prioritize the funds available for research and development outside the Institute Straumann AG, Waldenburg BL, Switzerland.

Hence, as a non-profit academic organisation of clinicians and academics active in research, development and education of implant dentistry the ITI Foundation for the Promotion of Implantology was established in 1988. Ever since, the Team of the Research Committee of the ITI allocated the available funds to researchers after a peer-review process and the degree of relevance of the proposals, the scientific content and methodology and the reputation of the research groups applying for grants. The ITI was founded by Dr.h.c. Fritz Straumann and Prof. Dr. André Schröder. Initial funding was provided by the Institute Straumann AG, Waldenburg BL, Switzerland. Subsequently, the financing of the ITI Foundation is guaranteed by a compensation from Straumann AG, Basel BS, Switzerland. However, the allocated finances of the ITI are administered and further allocated in independence of the industrial partner.

Generally, 51 % of the compensation are distributed by the Research Committee to the various grant applicants, while the remainder is used for educational projects and to run the ITI Center in Basel BS, Switzerland.

Since 1988, approximately 230 research projects have been financially supported by ITI Research Committee to the sum of about CHF 27 million. Hence, by its own estimates, ITI is the largest non-governmental organisation to assign research grants in implant dentistry and its related fields. Owing to the peer-review process the grant applications are allocated solely on the basis of scientific merit. Therefore, all researchers around the world, both ITI Fellows as well as non-ITI researchers are free to submit applications.

Aim

The aim of this search and analysis was to study the nature, quality and allocation dynamics of all research grant applications submitted to the ITI Foundation since 1988 through 2006.

Materials & Methods

Materials & Methods

THE GRANTING MECHANISM

The application for a research grant from the ITI Foundation for the Promotion of Implantology is made by the senior author/researcher on a pre-printed application form. The completed forms must be submitted to the ITI Research Committee before the 27th of February or the 31st of August of each year for review by the Research Committee of the ITI Foundation. The Research Committee is composed of eleven members who all review each application and express their judgement individually and in advance of convening with the peers. The application is either rejected, returned for revision or the grant is approved, all at the discretion of the entire Research Committee. The Committee convenes twice a year.

There are four different grant programs available. These are:

1 | Small Grant Application (SGA):

These grants are primarily intended for those research proposals submitted by young investigators who have been working within established groups, but who wish to expand their scope and level of

responsibility. This grant is also intended for newer investigators who want to establish a track record in implant dentistry. This may be by pursuing their own research interests or by building up their own research group. The grants should not exceed the sum of CHF 50'000. Annual reports, either intermediate or final, must be provided. The goal of the project is directed towards publication in an international peer-reviewed journal.

2 | Research Proposal for Clinical or Laboratory Research (RCL):

These grants will be awarded to researchers or research groups who have established a reputation of credibility and thoroughness in the field as demonstrated by a continuous publication record in peer-reviewed journals. The grant amount may exceed CHF 100'000, but should not be higher than CHF 200'000. Funding from other sources (universities, foundations or third parties) must be disclosed. Results from such granted project proposals are to be published in internationally recognised peer-reviewed journals. Annual reports, either intermediate or final, have to be provided.

3 | Research Program Projects (RPP):

These grant proposals may contain several single research projects (RCL's) or several single aspects within a major line of research, and are usually granted for several (3 - 5) years. RPP's are only awarded to well-established research teams of international repute. A single annual sum of CHF 200'000 should not be exceeded. Annual reports and a final report must be provided.

4 | Single Laboratory Support (SLS):

These grants are allocated to established laboratories with expertise in a field of interest for the ITI Foundation. The support should not exceed the salary of one laboratory technician. Annual short reports

documenting the projects served must be provided. Applications have to be submitted in a letter format that provides evidence for the existing expertise and the rationale as to why an SLS grant application should be undertaken instead of a different funding category.

These grant programs have been used since 1993. For clarity and for the present analysis the grant applications submitted before 1993 were retrospectively classified.

With the application the main applicant signed a statement obliging the applicants to three things:

- 1 | to submit a final report to the ITI Foundation at the end of the study;
- 2 | to include a footnote in all abstracts or publications stating that "this project was supported by a grant from the ITI Foundation for the Promotion of Oral Implantology, Switzerland";
- 3 | that all funded equipment be registered at the ITI Foundation and that this equipment becomes the property of the institute where the study took place and be clearly marked with a special sticker supplied by the ITI Foundation.

With these statements it was possible to track the publications to the funding source (ITI).

The decision by the ITI Research Committee is communicated after the meeting in June, respectively in December. As a matter of policy, the Research Committee does not provide any reasons for not awarding a grant to any one particular project. The Committee deems some applications interesting but the present form does not fulfil the criteria of the Committee. Such projects are returned to applicants with suggested modifications. The revised projects are then resubmitted and newly appraised. Revised projects are not automatically supported by the Foundation.

THE SEARCH STRATEGY

The analysis was based on the information available from each application's form, progress reports and the final reports stored at the ITI Center in Basle, Switzerland. Furthermore, publications were retrieved electronically from PUBMED. Also the tables of content of *Clinical Oral Implants Research* and *International Journal of Oral and Maxillofacial Implants* were hand searched for the years 1990 - 2006 for possible papers with the titles revealed by the application forms of the grant proposals.

An attempt was made to objectively analyse the data with respect to rejection or approval, as well as the country of origin of the applications, the universities or research groups involved, the senior and co-applicants, the grant program applied for and the study design of the project.

With the studies supported by the Research Committee a search for a publication in peer-reviewed journals was performed. The impact factor and the number of citations of the published study were determined.

Most of the data was stored in a FileMaker Pro 7 (FileMaker, Inc., Santa Clara, California, USA) database designed for the electronic storage of the relevant information for the ITI Foundation. This database was augmented by the inclusion of further information that had not been entered in the original database.

For the information that was not in the original database, all the applications were individually analysed in numerical order and the information fed into and stored on a laptop computer (iBook, Apple Computer, Inc., USA). The completed database was used for the statistical evaluation of the entered data.

STRUCTURE OF THE ANALYSIS

The information relevant for this analysis was divided into sections. The first section, **Grant Application**, mentioned the grant application number, the title of the project, the application year and the principal and secondary country of origin of the application. The principle country was always given as that country where the senior applicant was based at the time of the application. The secondary country was given as the country where all the co-applicants were based, when it did not correspond to the principle country of the senior applicant.

As the last piece of information in the Grant Application section, the research group was noted. Here the research group of the senior applicant was given. The groups were first arranged together in the same countries and then the same regions or cities and then subdivided into all the different universities or institutions. The applicants from the same departments in the same universities or institutions were grouped together. In this way a list was compiled, where each group received a code. This code lists the country e.g. CH for Switzerland, the abbreviation for the university, e.g. UBE for the University of Berne and the number indicated a Department. The number given was arbitrarily. When one listed group collaborated with another group, this was noted.

The second section dealt with the **Senior Applicant**. Here, the name, nationality, academic title, highest qualification and age of the principle applicant were noted. Moreover, the ITI Fellowship or Membership was noted. The address and position of the senior applicant was recorded.

In the third section, the **Co-Applicant** with the name, nationality, academic title, highest qualification as well as ITI Fellowship or Membership was entered. Any other co-applicants were listed in the fourth section.

1 Implant surface and implant tissue interface research	
2 Osseointegration, wound healing, metabolism and systemic influence	
3 Surgery	a Primary Surgery: Implant insertion b Secondary Surgery: Re-entry c Surgery: GBR/Augmentation d Periodontal Regeneration (EMD)
4 Prosthetics, including occlusion and aesthetics	
5 Pathology	a Pathology: Diagnosis b Pathology: Mucostitis c Pathology: Periimplantitis
6 Treatment of Complications	a Treatment of Complications: Mucostitis b Treatment of Complications: Periimplantitis c Treatment of Complications: Prosthetics
7 Risk factors for dental implants	
8 Implant therapy treatment planning	
9 Predictability of implant restorations	
10 Implant orthodontics	

Table 1 | Classification of studies

Grant Program was the title of the fifth section where the grant category and type of project was classified. The grant categories are the four programs mentioned above, namely: Small Grant Application (SGA); Research Proposal for Clinical or Laboratory Research (RCL); Research Program Projects (RPP) or Single Laboratory Support (SLS). The project type was either classified as new, continued or revised.

In the sixth section, **Grant Sum**, the amount was expressed in Swiss Francs (CHF).

The **Study Design** was analysed in the seventh section. Here, the project was classified either as an *in vitro*, animal or clinical study. Clinical studies were subclassified into one of five subclasses, namely a Randomised Controlled Clinical Trial (RCT), a Non-Randomised Clinical Trial (Non-RCT), a Prospective Cohort Study (PCS), a Retrospective Cohort Study (RCS) or a Case Series and/or Case Report (CS). Also the size of the study (n) was evaluated. In the *in vitro* studies it was difficult to discern the size of the material from the project proposal. In most animal studies

and clinical trials it was stated how many subjects and/or implants were to be used. Therefore, under the heading “n”, two numbers were listed if applicable. The first number represents the number of subjects and the second number was the amount of implants to be placed in the proposed project. At the end of this section the prospective duration of the study was noted.

Study Topics, being the eighth section, contains the classification of the studies submitted — **TABLE 1**.

The ninth section is titled **Grant Status**. Here, it was mentioned if the grant was financed or rejected or sent back for revision. Some grants sent back for revision were resubmitted as a new grant. In this section it was mentioned if the project was terminated. The project was regarded as still running when the prospective end date was not yet reached, as of the end of 2006. At the end of this section, the dates of the prospective start and prospective end of the study were noted. These dates were used to calculate the prospective duration of the project and determine if the project was terminated or was still running.

In the following section, **Reports**, the status of the reports were presented. The date of each report filed was given. The status of the intermediate and final reports was classified numerically as follows:

- 0: no report was necessary
- 1: the report was due and
- 2: a report was filed.

Publications that acknowledged the financial support of the ITI Foundation or publications that obviously were financed by the Foundation were listed in the databank. The fact that no acknowledgement was made was also noted.

Besides publications it may be possible that financed study results were presented at an IADR or another international or national academic meeting, meaning that an abstract of the work existed. This was listed in the section *Abstract Available*. The year of the abstract publication was noted.

Finally, the section *Publication* listed papers that were published presenting the results of the financed studies. The publication was listed as follows: senior author, all co-authors, the title of the paper, the journal in which it was published as well as the year, the impact factor of the journal in the year of publication and the number of times the publication had been cited up until the end of 2006.

Occasionally, more than one publication was published from a single grant. If this was the case, it is duly mentioned. The subsequent publications were listed in the same way as the first publication. When more than five publications were available, the further publications were listed together.

With the raw data entered as described the following analyses were undertaken. From all grant applications the number of approved studies was of interest. The fate of the projects sent for revision was researched. All grant applications were also grouped according to year of submission and analysed. The data was divided by principle country. Further, the data was divided into the different research groups and analysed as to how many applications stemmed from each group and how many of these were rejected or supported. Lists of all universities and private institutions grouped by countries, as well as all departments, grouped by fields, were compiled.

The grant programs were to be evaluated by the type of projects, the study designs, the study topics according to ITI classification and that

for the present analysis, as well as how many approved projects were still running at the end of 2006 and how many had been fully or partially financed.

Another area of interest was the financial aspect of the supported grants. For each grant, the average size of the approved grant sum, the agreed amount, the total amount, the average size of the additional sum granted and the total paid in the end was evaluated.

As to the reports: the applicants had to sign an agreement where they promised to send regular progress reports and at the end a final report. It interested us if these reports were duly filed. Even if there was no reports filed we wanted to know if publications of the results of the supported studies were printed, and where, or if an Abstract is available. In which journals did the publications appear? What was the impact factor of each journal at the time of publication of the article? How many times was the publication cited? The publications that were not sent to the Foundation were searched for online from the Pubmed resource from the National Library of Medicine in the USA. The search confined itself to the applicant or co-applicants from each supported study. The abstracts that were not enclosed in the reports sent to the Foundation were searched for manually from the meetings of the International Association of Dental Research (IADR) in the Journal of Dental Research, the Academy of Osseointegration (AO) in the International Journal of Oral and Maxillofacial Implantology and the European Association of Osseointegration (EAO) in the Journal of Clinical Oral Implant Research. The impact factors for each journal for each year was searched for in the Journal Citation Reports, Thomson Scientific, Philadelphia, PA, USA. This information was online from 1997 onwards. Before 1997 the impact factors for the journals are not online and had to be searched for manually at the Medical Library of the University of Berne, USB. If a journal was not listed in the Journal Citation Reports then the journal was given an impact factor of zero. The number of citations an article had was searched for online, also using the Journal Citation Reports, Thomson Scientific, Philadelphia, PA, USA.

Results

Results

■ NUMBER OF GRANT APPLICATIONS AND FUNDING BY THE ITI FOUNDATION

Up to the closing date, 499 grant applications were submitted from 1988 until August 2006. Of these, 232 applications were funded by the ITI Foundation (Fig. 1). This, in turn, means that 46.5 % of all applications submitted were funded. Twenty-two projects (4.4 %) were returned for revision. Of these 22 applications, 13 were supported at a later date but all resubmitted as new projects. One application was sent back for revision twice and finally funded (# 158, # 164) — SEE FIGURE 1.

Only 3 grant applications were approved in 1988. In 2003 and 2006, most grant applications (n = 62) were received up to present and 26 and 29 were funded respectively. The detailed description of grants submitted for the entire period is presented in Table 2 and in Fig. 2 — SEE TABLE 1 | FIGURE 2. During this observation period of 18 years, the rejection rate ranged from 0 % to 70.6 % for any given year.

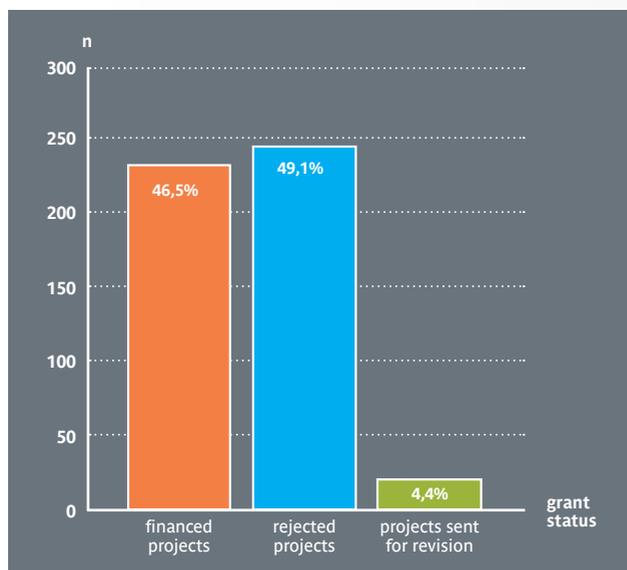


Figure 1 | Grant application success rate

Year	Financed		Rejected		Revision		Total	
	n	%	n	%	n	%	n	%
1988	3	100.0	0	0.0	0	0.0	3	0.6
1989	8	88.9	1	11.1	0	0.0	9	1.8
1990	6	54.6	5	45.5	0	0.0	11	2.2
1991	6	50.0	6	50.0	0	0.0	12	2.4
1992	6	33.3	12	66.7	0	0.0	18	3.6
1993	4	80.0	1	20.0	0	0.0	5	1.0
1994	13	65.0	7	35.0	0	0.0	20	4.0
1995	7	36.8	12	63.2	0	0.0	19	3.8
1996	5	29.4	12	70.6	0	0.0	17	3.4
1997	7	33.3	14	66.7	0	0.0	21	4.2
1998	7	36.8	12	63.2	0	0.0	19	3.8
1999	9	42.9	8	38.1	4	19.1	21	4.2
2000	21	70.0	8	26.7	1	3.3	30	6.0
2001	12	63.2	4	21.1	3	15.8	19	3.8
2002	22	44.0	25	50.0	3	6.0	50	10.0
2003	26	41.9	32	51.6	4	6.5	62	12.4
2004	19	47.5	19	47.5	2	5.0	40	8.0
2005	22	36.1	35	57.4	4	6.6	61	12.2
2006	29	46.8	32	51.6	1	1.6	62	12.4
Total	232		245		22		499	100.0

Table 2 | Grant applications during the observation period (1988-2006)

Applications were returned for revision in the years 1999 through 2006 and ranged from 3.33 % to 19.1 % of all applications received in each particular year — SEE TABLE 1 | FIGURE 2.

■ GEOGRAPHICAL DISTRIBUTION OF GRANT APPLICATIONS

In total, 31 nations submitted applications. Most grant applications (n = 99) originated from the USA. Out of these, 54 grants (54.5 %) were funded — SEE TABLE 3. Switzerland submitted the second most applications (n = 98) of which 70 (71.4 %) were funded, 27 rejected, and one was returned for revision. Switzerland was the most successful country in terms of grant allocation. Germany submitted the third most applications (n = 91) and yielded a success rate of 36.2 %.

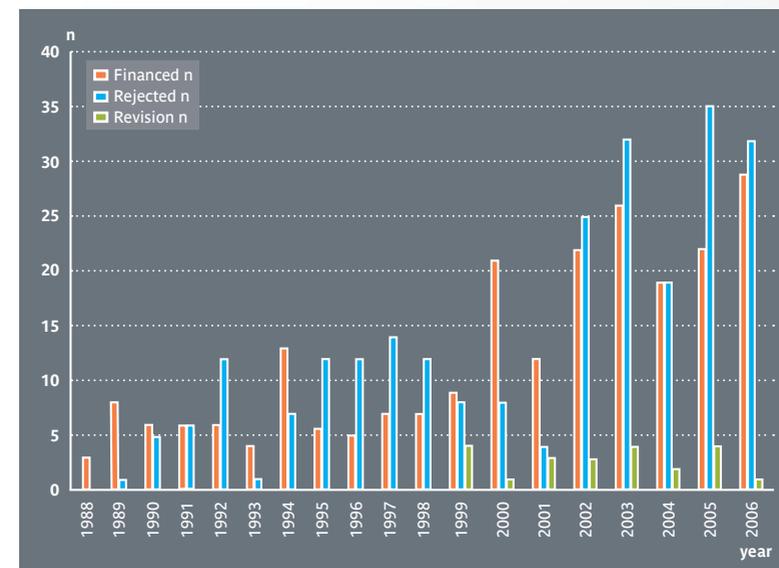


Figure 2 | Grant application success rates per year

Along with the above-mentioned countries, Denmark, Italy, Japan, the Netherlands and the United Kingdom all submitted more than ten grant applications. Australia, Austria, Belgium, Brazil, Canada, Finland, France, Israel, Lebanon, New Zealand, P. R. of China, Singapore, Spain, Sweden and Turkey all submitted between two to ten grant applications since 1988.

Principle Countries n=31	Financed		Rejected		Revision		Total	
	n	%	n	%	n	%	n	%
Switzerland	70	71.4	27	27.6	1	1.0	98	19.2
USA	54	54.5	43	43.4	2	2.0	99	19.8
Germany	33	36.2	55	60.4	3	3.3	91	18.2
Italy	10	34.5	17	58.6	2	6.9	29	5.8
UK	12	46.2	12	46.2	2	7.7	26	5.8
Denmark	16	59.3	8	29.6	3	11.1	27	5.4
Netherlands	3	23.1	9	69.2	1	7.7	13	2.6
Japan	3	23.1	7	53.8	3	23.1	13	2.6
Turkey	2	22.2	7	77.8	0	0.0	9	1.8
France	2	20.0	8	80.0	0	0.0	10	2.0
Finland	3	30.0	7	70.0	0	0.0	10	2.0
Belgium	3	50.0	1	16.7	2	33.7	6	1.2
Spain	0	0.0	4	100.0	0	0.0	4	1.0
Brazil	2	32.2	7	77.8	0	0.0	9	1.8
Sweden	3	50.0	2	33.3	1	16.7	6	1.2
Austria	5	55.6	4	44.4	0	0.0	9	1.8
Canada	3	50.0	3	50.0	0	0.0	6	1.2
New Zealand	4	44.4	5	55.6	0	0.0	9	1.8
Australia	2	50.0	2	50.0	0	0.0	4	1.0
Singapore	0	0.0	3	100.0	0	0.0	3	0.6
Lebanon	0	0.0	2	100.0	0	0.0	2	0.4
P. R. China	1	20.0	3	60.0	1	20.0	5	1.0
Israel	0	0.0	2	66.7	1	33.3	3	0.6
Portugal	0	0.0	1	100.0	0	0.0	1	0.2
Romania	1	100.0	0	0.0	0	0.0	1	0.2
Egypt	0	0.0	1	100.0	0	0.0	1	0.2
Jordan	0	0.0	1	100.0	0	0.0	1	0.2
Serbia-Montenegro	0	0.0	1	100.0	0	0.0	1	0.2
Colombia	0	0.0	1	100.0	0	0.0	1	0.2
India	0	0.0	1	100.0	0	0.0	1	0.2
Greece	0	0.0	1	100.0	0	0.0	1	0.2
Total	232		245		22		499	100.0

Table 3 | Geographic distributions of grant applications (1988-2006)

Eight further nations (Colombia, Egypt, Greece, India, Jordan, Portugal, Romania, Serbia-Montenegro) sent only one application; all except the application from Romania were rejected.

Besides the principle country of origin other countries may have been involved in the projects. Almost one third (27.7 %) of all applications had a second country involved. Mostly only one other country collaborated in a single project. Eighteen projects had more than one secondary country collaborating in a particular project. Of all the projects originating outside of Switzerland (n = 401), forty-six (11.5 %) collaborated with an institution within Switzerland. This, in turn, means that Switzerland was the country most often collaborating.

ACCEPTANCE AND REJECTION RATES FOR VARIOUS RESEARCH TEAMS

The analysis of the success or failure rates of the various research teams revealed large differences. In total, 223 research teams submitted applications. Only one application was submitted by 127 (57 %) of these teams.

Out of all research teams, 125 teams (56 %) never received any funding leaving 98 teams with occasional or consistent approvals of their proposed projects. Of those research teams having submitted multiple applications, 7 teams were always successful. These included:

- Federal Institute of Technology | Laboratory of Ultrarapid Spectroscopy (LSU), Lausanne, Switzerland (n = 3);
- Medical University of Vienna | Central Research Laboratory, Vienna, Austria (n = 2);
- Technical University of Dresden | Department of Orthodontics, Dresden, Germany (n = 2);

- _ University of Berne | Department of Periodontology & Fixed Prosthodontics, Berne, Switzerland (n = 10);
- _ University of Gothenburg, Department of Periodontology, Gothenburg, Sweden (n = 3);
- _ University of Lausanne, Department of Experimental Physics, Lausanne, Switzerland (n = 2);
- _ University of North Carolina, Department of Periodontics, Chapel Hill, NC USA (n = 2).

Of those research teams having submitted a single application, 34 teams were supported for this single project.

This, in turn, means that 41 research teams out of 98 (42 %) with funding were 100 % successful.

The most applications were received from the research team at the University of Berne, Department for Oral Surgery, Berne, Switzerland with 16 applications or 3.2 % of all applications submitted. Thirteen (81.3 %) of these were supported by the ITI Foundation.

The second most applications were received from the University of Copenhagen, Department of Oral and Maxillofacial Surgery (n = 14) with a success rate of 64.3 %.

The third largest amount of grant applications were received out of Germany and Switzerland (n = 12) from the University of Erlangen-Nuremberg Department of Prosthodontics, Erlangen with a success rate of 50 % and from the University of Berne, ITI Research Institute for Dental and Skeletal Biology, Berne with a success rate of 66.7 %, respectively.

The fourth most applications were received from the University of Texas Health Sciences Centre at San Antonio, Department of Periodontics, TX, USA (n = 11) with 90.9 % success rate.

Between 10 and 8 applications were received from the Harvard School of Dental Medicine, Department of Restorative Dentistry, USA (n = 8); the University of Berne, Department of Periodontology and Fixed Prost-

odontics, Berne Switzerland (n = 10); University College of London, Department of Periodontology, London, UK (n = 9); University of Erlangen-Nuremberg, Department of Oral and Maxillofacial Surgery, Erlangen, Germany (n = 8); University of Freiburg, Department of Oral and Maxillofacial Surgery, Freiburg, Germany (n = 8) and the University of Geneva, Department of Fixed Prosthodontics, Geneva, Switzerland (n = 9). The success rates for these institutions were 62.5 %, 100 %, 77.8 %, 37.5 %, 50 % and 88.9 %, respectively.

ACCEPTANCE AND REJECTION RATES FOR VARIOUS RESEARCHERS

Four or more applications for a grant were submitted to the ITI Foundation by 18 applicants — **SEE FIGURE 4**. From the University of Erlangen-Nuremberg, Department of Prosthodontics, Erlangen, Germany (S. M. Heckmann) sent the most applications to the Foundation. From 11 projects, five were supported. From the University of Copenhagen, Department of Oral and Maxillofacial Surgery, Copenhagen, Denmark (S. Schou) 8 applications were received, and 4 were supported. From the University of Berne, Department of Oral Surgery and Stomatology, Berne, Switzerland (D. Buser) 7 applications were received and all were supported. From the University of Berne, Department of Periodontology and Fixed Prosthodontics as well the ITI Research Institute for Dental and Skeletal Biology, Berne, Switzerland 6 applications from both institutes were received. Four of the 18 applicants submitted 5 applications and 9 applicants sent 4 applications to the ITI Foundation. Their success rates are indicated in Table 4 — **SEE TABLE 4**.

Name	Financed n	Rejected n	Revision n	Total n
Bernard, Jean-Pierre	3	2	0	5
Boyan, Barbara D.	4	1	0	5
Buser, Daniel	7	0	0	7
Cochran, David L.	4	0	0	4
Descouts, Pierre A.R.	4	1	0	5
Heckmann, Siegfried M.	5	6	0	11
Hunziker, Ernst Bruno	5	1	0	6
Jensen, Simon	2	1	1	4
Karring, Thorkild	3	1	0	4
Kelly, John R.	2	2	0	4
Lang, Niklaus P.	6	0	0	6
Liu, Yuelian	2	2	0	4
Matarasso, Sergio	2	2	0	4
Schou, Soren	4	4	0	8
Simpson, James P.	1	2	1	4
Textor, Marcus	3	1	0	4
Vogel, Giorgio	1	2	1	4
Weber, Hans-Peter	3	2	0	5
Total	58	28	3	89

Table 4 | Applicants with 4 or more submissions including granting success. The nationalities of the various researchers were analysed in Table 5. There are 37 different nationalities listed. Most applicants were Germans (n = 104). Seventy-three US citizens submitted applications, and 62 applicants were Swiss. Nineteen applicants were dual citizens. These dual citizens are also included in the single national list.

QUALIFICATIONS OF THE APPLICANTS

In Table 6 the highest qualifications the researchers is analyzed — **SEE TABLE 6**. A slim majority of the applicants (n = 226) have degrees in medicine or dentistry as well as a PhD, and 210 out of a total of 499 researchers have either a medical or a dental qualification. The first applicants were also the most successful in receiving grants (50.4 %) for their proposed projects. The latter group was less successful (42.4 %) than the first group in receiving grants. Only one applicant had a Master of Science (MS) degree without a medical or dental degree as her highest education. Four applicants had other qualifications than one of the 3 mentioned: one was an engineer and the remaining 3 are dental laboratory technicians.

Principle Countries n=31	Financed n	Rejected n	Revision n	Total n
Germany	40	61	3	104
USA	36	36	1	73
Switzerland	49	13	0	62
Italy	17	17	2	36
UK	11	14	1	26
Denmark	15	8	2	25
France	12	12	0	24
Japan	7	9	3	19
Netherlands	4	11	1	16
Greece	6	5	3	14
Finland	4	10	0	14
Canada	7	4	1	12
Turkey	2	9	0	11
Belgium	4	2	2	8
Sweden	4	3	1	8
P.R. China	3	4	1	8
Brazil	2	6	0	8
New Zealand	4	3	0	7
Austria	5	1	0	6
Australia	2	3	0	5
Spain	1	3	0	4
Columbia	1	1	0	2
Ireland	1	1	0	2
Israel	0	1	1	2
Egypt	0	2	0	2
Lebanon	0	2	0	2
Indonesia	1	0	0	1
Mexiko	1	0	0	1
Pakistan	1	0	0	1
Croatia	0	1	0	1
Iceland	0	1	0	1
India	0	1	0	1
Jordan	0	1	0	1
Portugal	0	1	0	1
Serbia	0	1	0	1
Singapore	0	1	0	1
Zimbabwe	0	1	0	1
Dual Citizens	12	17	0	19

Table 5 | Researchers' nationalities and granting success (ranked)

The average age of the applicants was 44 years old. The youngest applicant from the University of Sao Paulo was 23 years of age at the time of submission of his project. The oldest researcher was from the University of Berne and was 74 years old at the time of submission.

ITI MEMBERSHIP OF THE APPLICANTS

Among the applicants that submitted grant applications about a third are ITI Fellows (n = 146) — SEE TABLE 7. More than double the applicants were not members of ITI (n = 353). The non-members had more research projects financed than the Fellows. However, the ITI Fellows were more successful and received in 58.9 % of their submitted applications an approval for funding from the ITI Foundation compared to 41.4% of all grant applications being funded for the non-members.

INSTITUTIONS APPLYING FOR FUNDING

One hundred and thirty-nine universities from 30 countries submitted grant applications to the ITI Foundation in the period of 1988-2006 — SEE TABLE 8. Among the universities, 79 different departments were represented — SEE TABLE 9.

Forty-two departments in schools of dental medicine constituted the largest contingent of all applicants. Medical school departments both clinical and basic research also submitted applications from 23 different departments. Eleven institutions in basic sciences or technical sciences were represented. Only two private institutions were named. Furthermore, 7 private practices submitted 8 applications. Four of these were supported (Data not shown).

COAPPLICANTS

Only 51 grant applications (10.2 %) were submitted by single authors. The remainder had between 1 and 11 co-authors. The average age of the Co-applicants from the remaining 448 (89.8 %) applications was 48 years. Thirteen individuals were co-applicants in four or more applications

— SEE TABLE 10. Some of these individuals are also among the persons that submitted four or more applications as principle investigators.

In 16 projects, Buser and Lang were co-applicants, and the ITI Foundation supported 10 and 12 of these, respectively. Belser, Cochran, Hjørting-Hansen and Weber were co-applicants in 7, 11, 12 and 7 submitted projects, respectively. Of the 448 co-applicants 144 (32.1 %) were ITI Fellows and 296 (66.1 %) were non-members. Of these former submitted projects, 89 (61.8 %) were supported. Among non-member projects, only 118 (39.9 %) were supported by the ITI Foundation and 169 were rejected (57.1 %). Three percent of the applications were sent for revision.

Qualification	Financed n	Rejected n	Revision n	Total n
MD/DDS & PhD	114	96	16	226
PhD	28	29	1	58
MD/DDS	89	116	5	210
MS	0	1	0	1
BSc	0	0	0	0
Other	1	3	0	4
Total	232	245	22	499

Table 6 | Highest qualifications of the researchers

ITI Membership	Financed n %*	Rejected n %*	Revision n %*	Total n %**
Fellow	86 58.9	50 34.2	10 6.9	146 29.3
Non-member	146 41.4	195 55.2	12 3.4	353 70.7
Total	232	245	22	499 100.0

* percentage of total | ** Percentage of all grant applications (n = 499)

Table 7 | Grant success rates for ITI Fellows and Non-members

<p>Switzerland University of Basel University of Berne Cantonal Hospital ETH Lausanne ETH Zurich University of Geneva Institute Straumann AG University of Lausanne University of Zurich USA University of Boston University of California, Los Angeles (UCLA) Columbia University University of Connecticut Health Centre Cleveland Clinic Foundation University of Florida Georgia Institute of Technology Harvard Hospital Centre at Orange University of Indiana University of Iowa Loma Linda University University of Miami New York University University of North Carolina at Chapel Hill Ohio State University Oregon Health & Science University University of Pennsylvania University of Rochester University of Southern California University of Tennessee Texas A&M University System HSC University of Texas at Houston University of Texas at San Antonio University of Texas South-western Medical Centre Virginia Commonwealth University (VCU) University of Washington Germany University of Bonn University of Düsseldorf University of Erlangen-Nuremberg University of Frankfurt University of Freiburg University of Giessen University of Göttingen Hannover Medical School University of Heidelberg Humboldt University Berlin Katharinen Hospital University of Kiel Knappschafts Hospital Bochum Langendreer University of Mainz University of Marburg University of Munich University of Münster University of Regensburg RWTH Aachen</p>	<p>Technical University of Dresden University of Tübingen University of Ulm University of Wiesbaden University of Witten/Herdecke Italy Ariminum Research & Dental Education Centre (ARDEC) University of Chieti Children's Hospital Vittore Buzzi, Milan G. Eastman Hospital, Rome Hospital Castelfranco University of Milan University of Naples National Health Institute University of Padova Polytechnic University of the Marshes Second University of Naples Vergata University UK University of Aberdeen Barts & The London, Queen Mary's School of Medicine and Dentistry University of Bristol Edinburgh Postgraduate Dental Institute University College London University of Glasgow Image Diagnostic Technology Ltd. University of Manchester University of Newcastle University of Wales Denmark University of Aalborg University of Aarhus University of Copenhagen Netherlands ACTA Free University de Weezenlanden Hospital University Medical Centre Groningen University of Nijmegen St. Elisabeth Hospital Japan Centre of Implant Dentistry Japan University of Kagoshima Kumamoto Implant Centre University of Kyoto University of Tsurumi Turkey University of Ankara University University of Hacettepe University of Istanbul University of Marmara France Louis Pasteur University University of Nantes University of Paris 7 REP, Toulouse Finland University of Helsinki University of Kuopio University of Oulu</p>	<p>University of Turku Belgium University of Brussels Catholic University Leuven University Hospital P8, Gent University of Liège Spain University of Cantabria University Complutense University of Santiago de Compostela Brazil Federal University of Rio de Janeiro Federal University of Santa Catarina University of São Paulo Sweden University of Gothenburg Austria General Hospital of Vienna Medical University Of Innsbruck Medical University of Vienna Canada University of British Columbia McGill University New Zealand University of Otago Australia University of Adelaide University of Queensland University of Western Australia Singapore Singapore General Hospital National Dental Centre, Singapore Lebanon American University Lebanese University China Quindu Stomatological College University of Zhejiang Israel Geriatric Dental Clinic, Jerusalem University of Tel-Aviv Portugal University of Lisbon Egypt University of Mansoura Jordan Jordan University of Science & Technology Serbia-Montenegro Military Medical Academy, Belgrade Columbia Instituto de Ciencias de la Salud CES India Royal Dental College, Kerala Greece University of Athens Private Practice Private Practice</p> <p>n = 139</p>
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Table 8 | Geographic distribution of applicant universities and institutions

<p>Dental Schools Adult Dental Care Centre for Rural and Remote Oral Health Central Research Laboratory Colgate Australian Clinical Dental Research Centre Dept. of Craniofacial Sciences & Therapeutics Dept. of Dental Diagnostic Science Dept. of Dental Hygiene Dept. of Dental Materials Dental Research Institute Dept. of Fixed Prosthodontics and Periodontology Geriatric Dental Clinic, Jerusalem Dept. Of Implant Dentistry Institute for Oral Transplantation and Implantation New Jersey Institute of Implant Dentistry Dept. of Odontostomatology Dept. Of Operative Dentistry and Periodontology Dept. of Oral Biochemistry Dept. of Oral Biological & Medical Sciences Dept. of Oral Biology Dept. of Oral Cell Biology Dept. of Oral & Dental Science Dept. of Oral Diagnosis Dept. of Oral Function Oral Implant Centre Oral Implant Clinic Dept. of Oral & Maxillofacial Surgery Dept. of Oral Medicine & Pathology Dept. of Oral Rehabilitation Dept. of Oral Sciences Dept. of Oral Surgery Dept. of Orthodontics Dept. of Paedodontics Dept. of Periodontology Dept. of Prosthodontics REP, Toulouse Dept. of removable Prosthodontics Dept. of Research & Graduate Studies Dept. of Restorative Dentistry SCTD, Strasbourg Soejima Dental Clinic Unit of Oral & Max. Implantology The Weintraub Centre for Reconstruc- tive Biotechnology Medical Schools Dept. of Anatomy Dept. of Bio-Medical Physics & Bio-Engineering Dept. of Biomaterials Dept. Biomedical Engineering Dept. of Biomedical Engineering and Imaging Dept. of Clinical Research Division of Biomedical Swine Research Dept. of Endocrine Pharmacology</p>	<p>Group of Mechanics of Biological Materials Institute for Surgical Research Dept. of Internal Medicine ITI Research Institute for Dental and Skeletal Biology Lab. for Research of Calcified Tissues and Biomaterials M.E. Müller Institute for Biomechanics Matrix Biology & Tissue Repair Research Unit Dept. of Microbiology Dept. of Morphology, Stomatology & Physiology Dept. of Neonatology Dept. of Orthopaedics Osteoarticular Research Group/Institute of Pathology Dept. of Pathology Dept. of Plastic Surgery Research Centre of Materials with Biological Interest Science Departments Automatic Control Laboratory Bio Interface Group, Laboratory for Surface Science and Technology Dept. of Biochemistry Dept. of Chemistry GAP-Biomedical Dept. of Experimental Physics Institute of Theoretical Physics Laboratoire de Spectroscopie Ultrarapide (LSU), Institut de Science et Ingenierie Chimiques (ISIC) Dept. of Mathematics, Statistics and Computation Dept. of Physics Dept. of Theoretical Physics Private Institutions Image Diagnostic Technology Ltd. Institute Straumann AG Private Practice</p> <p>n = 79</p>
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Table 9 | List of applicant departments and institutions

Name	Financed n	Rejected n	Revision n	Total n
Belser, Urs C.	6	1	0	7
Buser, Daniel A.	10	5	1	16
Berglundh, Tord O.	4	0	1	5
Cochran, David L.	10	1	0	11
Donos, Nikolaos	4	0	1	5
Hjørting-Hansen, Erik	7	5	0	12
Hunziker, Ernst B.	2	3	0	5
Karring, Thorkild	1	2	1	4
Lang, Niklaus P.	12	3	1	16
Natali, Arturo	1	2	1	4
Schenk, Robert K.	4	2	0	6
Schlegel, Karl A.	1	3	0	4
Weber, Hans-Peter	5	2	0	7
Total	61	28	6	95

Table 10 | Co-applicants with 4 or more submissions

Name	Financed		Rejected		Revision		Total	
	n	%*	n	%*	n	%*	n	%**
SGA	96	43.2	122	55.0	4	1.8	222	44.5
RCL	107	49.3	94	43.3	16	7.4	217	43.5
RPP	22	44.0	26	52.0	2	4.0	50	10.0
SLS	7	70.0	3	30.0	0	0.0	10	2.0
Total	232		245		22		499	100.0

* percentage of total | ** Percentage of all grant applications (n = 499)

Table 11 | Categorization of submitted grants according to the nature of the proposalmembers

Name	Financed		Rejected		Revision		Total	
	n	%*	n	%*	n	%*	n	%**
New	202	44.3	234	51.3	20	4.4	456	91.4
Continued	17	70.8	6	25.0	1	4.2	24	4.8
Revised	13	68.4	5	26.3	1	5.3	19	3.8
Total	232		245		22		499	100.0

* percentage of total | ** Percentage of all grant applications (n = 499)

Table 12 | New, continued and revised research proposals

RESEARCH PROJECTS AND GRANT PROGRAMS

All the applications that were submitted to the ITI Foundation were categorized into four different grant programmes, namely SGA, RCL, RPP and SLS. All the projects submitted before 1990 were retrospectively categorized for analysis. Most grant applications were of the SGA type — SEE TABLE 11.

From 222 projects of the SGA category, 96 (43.2 %) were supported, 122 (55%) were rejected and 4 (1.8 %) were sent for revision.

In the RCL category 217 projects were submitted. Of these, 107 (49.3 %) were supported, 94 (43.3 %) were rejected and 16 (7.4 %) returned for revision.

In the RPP category, 50 projects were submitted and 22 (44 %) of these were supported, while 26 (52 %) were rejected and 2 (4 %) returned for revision. The last category (single laboratory support SLS) category yielded 10 projects with 7 (70 %) being supported and 3 (30%) rejected.

The majority (n = 456) of the submitted projects were new research projects, 24 were continued and 19 were revised projects — SEE TABLE 12. Less than half (44.3 %) of the new projects were financed by the ITI Foundation (n = 202), 234 (51.3 %) were rejected and 20 (4.4 %) were sent back for revision. Seventeen (70.8 %) of the continued projects were supported, six (25 %) were rejected and one (4.2 %) was returned for revision. Among the revised projects 13 (68.4 %) were subsequently supported and five (26.3 %) were rejected, while one (5.3 %) project was returned for a second revision. Therefore, the continued projects had a fractionally the better success rate than the revised projects, which both performed better than the new projects.

There were three basic study designs, such as *in vitro*, animal studies or clinical trials. One quarter of all proposed projects (26.7 %) were *in*

Study design	Financed		Rejected		Revision		Total	
	n	%*	n	%*	n	%*	n***	%**
In vitro	64	48.1	68	51.1	1	0.8	133	26.7
Animal	88	48.9	81	45.0	11	6.1	180	36.1
Clinical****								
RCT	27	45.0	28	46.7	5	8.3	60	12.0
Non-RCT	3	14.3	16	76.2	2	9.5	21	4.2
PCS	35	47.3	37	50.0	2	2.7	74	14.8
RCS	8	53.3	7	46.7	0		15	3.0
CS	7	43.8	6	46.2	0		13	2.6
Subtotal clinical	80	43.5	95	51.6	9	4.9	184	36.9
Total	232		244		21		497	

* Percentage of total | *** Project No. 025 is not included | ** Percentage of all grant applications (n = 499) | **** Project No. 016 could not be categorised further

Table 13 | Study design categories and success rates for funding

vitro studies (n = 133), of which 64 (48.1 %) were supported, 68 (51.1 %) were turned down and one (0.8 %) was returned for revision — SEE TABLE 13. Of the 180 animal studies, 88 (48.9 %) were supported, 81 (45 %) rejected and eleven (6.1 %) had to be revised. The largest group of studies comprised of 184 proposed clinical trials. This is 36.9 % of all grant applications received by the ITI Foundation. The clinical projects were subdivided into subcategories, where the largest group was the prospective cohort study (n = 74), where almost half of them (47.3 %) were financed. The smallest subcategory was the case reports (n = 13), where the ITI Foundation also supported almost half these studies. On average, the prospective duration of all the studies was 24 months ranging from 2 months to 121 months. Among the supported studies the average prospective duration of the studies was 24.5 months with a range of 3 months to 10 years. At the end of 2006, there were 51 projects (10.2 % of all grant applications) still running.

Study classification	Financed		Rejected		Revision		Total	
	n	%*	n****	%*	n	%*	n****	%**
1 Implant surface and implant tissue interface research	50	57.5	35	40.2	2	2.3	87	17.4
2 Osseointegration, wound healing, metabolism and systemic influence	29	45.3	33	51.6	2	3.1	64	12.8
3 Surgery								
a Primary: Implant insertion	2	20.0	7	70.0	1	10.0	10	2.0
b Secondary: Re-entry							0	0.0
c GBR/ Augmentation	34	43.1	40	50.6	5	6.3	79	15.8
d Perio. regen. (EMD)	8	38.1	12	57.1	1	4.8	21	4.2
4 Prosthetics including occlusion and aesthetics	36	42.3	47	55.3	2	2.4	85	17.0
5 Pathology								
a Diagnosis	4	50.0	4	50.0	0	0.0	8	1.6
b Mucostitis	3	75.0	0	0.0	1	25.0	4	0.8
c Peri-implantitis	4	36.4		54.5	1	0.9	11	2.2
6 Treatment of Complications								
a Mucostitis	2	50.0	6	50.0	0	0.0	4	0.8
b Peri-implantitis	6	50.0	2	41.7	1	8.3	12	2.4
c Prosthetics			5				0	0.0
7 Risk factors for dental implants	12	63.2	7	36.8	0	0.0	19	3.8
8 Implant therapy treatment planning	2	16.7	10	83.3	0	0.0	12	2.4
9 Predictability of implant restorations	31	44.9	33	47.8	5	7.2	69	13.8
10 Implant orthodontics	9	69.2	3	23.1	1	7.7	13	2.6
Total	232		244		22		498	100.0

* Percentage of total | ** Percentage of all grant applications (n = 499) | **** Project No.016 not classified

Table 14 | Study design categories and success rates for funding

STUDY TOPIC CHARACTERIZATION AND FUNDING

A study topic categorization for all the submitted projects was created for the purpose of this analysis. Ten research topics, three of which (surgery, pathology and treatment of complications) are subdivided into three to four subheadings are presented in Table 1 — **SEE TABLE 1**. In Table 14, however, the results of the grant allocations according to the research topic classification are shown — **SEE TABLE 14**. Under the classification of “Implant surface and implant tissue interface research” the most grant applications were found (87 projects) that made up 17.4 % of the entire submitted applications. In this class, 57.5 % (n = 50) of the projects were supported by the Foundation. The second most grants were found under the classification „Prosthetics including occlusion and aesthetics“ (n = 85) with a success rate of 42.3 % (n = 36). The third most grants were found under the subclassification „GBR/Augmentation“ with a success rate of 43.1 % (n = 34). The highest success rate of 75 % for financial support was for the class “Mucostitis” from the “Pathology” category. “Implant orthodontics was the second most successful class with 69.2 %. The subclasses “Secondary: Re-entry” from the “Surgery” class and “Prosthetics” from the “Treatment of complications” class both received no grant applications. The least successful classes with a success rate of only 16.7 % (n = 2) and 20 % (n = 2) were from the class “Implant therapy treatment planning” and the subclass “Primary: Implant insertion” from the class “Surgery”, respectively.

Applications for grants that were supported by the ITI Foundation either received the full amount that was asked for by the applicants or were only partially financed. As stated above, 46.5 % (n = 232) of the 499 submitted applications were financed by the Committee; 82.3 % (n = 191) of these grants were fully financed. The remainder of 17.7 % (n = 41) were partially financed. There were accepted projects where the

size of the grant was agreed upon, but that needed further financing as the project was executed. A number of these grants were subsequently given more money. Among the fully financed projects, 7.9% (n = 15) were further financed. Among the partially financed projects, 7.3 % (n = 3) needed more funds.

Since 1988 and until December 2006, the total sum of grants allocated by the ITI Foundation was CHF 26'547'393. When the 18 projects that received subsequent financing are taken into account, the Foundation, to date, has distributed CHF 27'637'797 — **SEE TABLE 15**. The smallest grant allocated was CHF 2'693 (S. M. Heckmann, University of Erlangen-Nuremberg). The largest grant awarded (W. Wager, University of Mainz) amounted to CHF 1'513'740. Interestingly, this was a project that was only partially financed. Among the total amounts paid for the fully financed projects the average was CHF 110'108. The average per project for the partially financed projects was CHF 161'15.

REPORTING AND PUBLISHING

All the authors of the grant applications signed a statement agreeing to send to the ITI Foundation an annual interim report during and/or a final report at the end of the proposed project. Of the 232 supported projects, only 30.6 % (n = 71) projects had filed interim reports and 23.7 % (n = 55) of the projects had final reports filed as of the 31st December 2006. It has to be kept in mind, however, that a large number (n = 51) the projects were still running. Nevertheless, 177 final reports were due.

Forty-six (out of 232) supported studies produced at least one abstract that was published in a Journal resulting in 19.8 % of all supported projects complying with the Foundations conditions for funding.

Amount*	Agreed amount	Total amount**	Difference	Total paid
Fully financed projects:				
Average	104'840.84	110'107.87	5'267.03	
Range: Min.	2'693.00	2'693.00	0.00	
Max.	1'000'000.00	1'000'000.00	0.00	
Total	20'024'600.90	21'030'603.90	1'006'003.00	21'030'603.90
Partially financed projects:				
Average	159'092.49	161'151.05	2'058.56	
Range: Min.	8'000.00	8'000.00	0.00	
Max.	1'513'740.00	1'513'740.00	0.00	
Total	6'522'792.00	6'607'193.00	84'401.00	6'607'193.00
Total of all projects	26'547'392.90	27'637'796.90		27'637'796.90

* In CHF
 ** The amount that was additionally paid to 18 projects above the agreed amount

Table 15 | Finances of supported grants

	n	%
Publications available*		
No	139	59.9
Yes	94	40.1
Number of publications per project**		
1	43	46.2
2 to 5	42	44.1
> 5	9	9.7

* Percentage of all accepted projects (n = 232)
 ** Percentage of projects with publications available (n = 94)

Table 16 | Publications availability and number of publications per project

Many of supported projects produced publications. The publication statistics are summarised in Tables 16 and 17 — SEE TABLE 16/17. In Table 16, the availability and amount of publications per project are listed. Among the supported studies, 94 projects produced at least one publication corresponding to a rate of 40.1 %. Forty-six percent (n = 43) of the studies among these 94 projects produced only one publication. Forty-four percent (n= 42) of the projects produced between two to five publications, and 9.7 % (n = 9) of the projects produced more than five publications (range 6 to 12).

Year	n	Impact factor				Number of citations			
		Range		Sum	Average	Range		Sum	Average
		Min	Max			Min	Max		
1988	0								
1989	0								
1990	11	0.000	2.232	5.952	0.541	9	176	564	51.27
1991	6	0.000	1.865	4.408	0.735	2	450	1130	188.33
1992	7	0.000	3.019	6.591	0.942	4	86	259	37.00
1993	4	0.000	1.897	4.180	1.045	8	53	93	23.25
1994	7	0.000	3.773	8.286	1.184	11	126	293	41.86
1995	3	0.000	1.405	2.172	0.724	10	37	74	24.67
1996	8	0.000	2.242	16.235	2.029	11	73	252	32.00
1997	9	0.791	2.096	14.000	1.556	6	270	869	96.56
1998	10	0.000	4.060	21.263	2.126	6	108	368	36.80
1999	10	0.000	7.666	19.563	1.956	0	90	283	28.30
2000	9	0.000	5.877	19.220	2.136	1	43	202	22.44
2001	25	0.000	3.350	40.673	1.627	1	30	415	16.60
2002	14	0.000	3.248	23.512	1.680	0	33	161	11.50
2003	19	0.000	2.903	32.486	1.710	0	32	187	9.84
2004	24	0.000	3.652	55.349	2.306	0	21	54	2.25
2005	22	0.000	4.698	44.668	2.030	0	18	77	3.50
2006	16					0	2	6	0.38
2007	2								
Entire range		0.000	7.666			0	450		
Total	206			318.558	1.562			5287	25.92

Table 17 | Publications per year including impact factors and citations

In Table 17 all publications per year, as well as the impact factor and number of citations until the end of 2006 are listed. If the journal was not listed in the ISI Citation Index in that year, the impact factor of that journal was zero. Book chapters and dissertations or these were not included in the analysis. A total of 206 publications were identified. These publications were cited 5287 times resulting in an average of 26 citations per publication.

The range of citations for the publications was between no citations up to 450 citations for a single article. The publications appeared to a large extent in journals with impact factors. The cumulative impact factor for all the journals in which the studies appeared was 318.558, giving a mean of 1.562 per article. The range for the impact factors varied from 0 to 7.666.

In the years 1988 and 1989 no publications appeared yet — **SEE TABLE 17**. By the year 1990, 11 articles had been published supported by the ITI Foundation. These early articles were cited collectively 564 times up until the end of 2006. The average Impact factor for the journals in which these articles appeared was 0.541. The following year, only 6 articles supported by the ITI Foundation were published. The impact factor had risen to an average of 0.735 per article and these were cited collectively 1130 times, resulting in the largest average citation of 188 times per study. In that year, one article was cited 450 times. The most publications supported by the ITI Foundation appeared in 2001 with 25 articles. 2004 produced the highest cumulative and mean impact factor of 55.350 and 2.306, respectively.

Discussion

Discussion

This analysis has shown that the ITI Foundation for Implantology and related fields, an independent granting agency since 1988, has allocated over 27 Million Swiss Francs to clinical and laboratory research within the course of 19 years. Although the funds were generated through a contract of the ITI Foundation with its industrial partner, Straumann AG, Basel, Switzerland, it has to be realized that the distribution and allocation of funding is entirely at the discretion of an academic body, the Research Committee of the ITI Foundation.

Hence, priorities are set on the basis of scientific originality, feasibility and methodology as well as reputation of the group behind a grant application. This truly professional and academic system provides 100 % independence from the industrial partner. As a consequence, the ITI Foundation acts as the biggest private and independent granting agency in the field of implant dentistry and most likely, the entire discipline of dental medicine or odontology.

From the total sum allocated throughout the years, the *in vitro* studies (n = 64) were supported with a sum of approximately CHF 7.9 million with an average per grant sum of CHF 124'095. Eighty-eight projects involved animals and were allocated totally CHF 8.5 million resulting

in an average of CHF 97'119 per project. Finally, the clinical studies (n = 80) received a total of CHF11.1 million with a mean per project of CHF 139'366. This documents the significance of clinical studies and the assumed need for those in the field of implant dentistry as judged by the peer review and the applicants' perception. Although not substantially behind the category of clinical studies, *in vitro* and animal studies ranked in a lower priority.

This is in contrast to a number of governmental and national granting agencies preferring the funding of more basic over clinical research (Swiss National Research Fund, 2005) It can be speculated that funding of good clinical studies is facilitated by the efforts of the ITI Foundation, hereby providing an essential contribution for implant dentistry. The fact that funding for clinical research occurred without the influence of industry points to the necessity of independence from marketing trends leading to objective assessments of products.

In this respect it is noteworthy that the Research Committee attributed CHF 5 million to the highest level of evidence studies, the Randomized Controlled Clinical Trials (RCTs), while Non-RCTs were only funded for CHF 0.9 million. On the other hand, the lower level of evidence, the Prospective Cohort Studies (PCS), also received a substantial amount of funding with CHF 4.6 million. Remarkably, the even lowest levels of evidence, the Retrospective Cohort Studies (RCS) and Case Series (CS) received only a total of CHF 0.8 million within the entire period of granting. This clearly indicates that the ITI Foundation prefers the funding of well-designed clinical studies.

The most supported research topic involved the *implant surface and implant tissue interface*. In this category, CHF 7.8 million was invested. At the *in vitro* level, the research revealed that roughened titanium surfaces interacted better with fluids and proteins than did machined or turned titanium surfaces (Portuondo-Campa et al. 2006; Rupp et al.

2006; Taborelli et al. 1997; Tosatti et al. 2002; Zhao et al. 2005). This, in turn, means that the roughened surfaces were more osteophylic due to their adhesive properties (Raz et al. 2004; Zenhäusern et al. 1993; Zinger et al. 2005). Also, osteoblasts were shown to prefer roughened titanium surfaces to adhere to than machined surfaces (Boyan et al. 1999, Boyan et al. 2002; Boyan et al. 2003; Brett et al. 2004; Harle et al. 2004; Lohmann et al. 2000; Lohmann 2002; Lossdörfer et al. 2004; Masaki et al. 2005; Schneider et al. 2004; Schwartz et al. 1999; Schwartz et al. 2001; Sisk et al. 2001; Zhao et al. 2006; Zinger et al. 2005).

In the *animal studies* implants with roughened surfaces required more torque force to be removed than did smooth surface implants, and roughened surfaces yielded more bone to implant contact histologically (Abrahamsson et al. 2004; Berglundh et al. 2005; Bernard et al. 2003; Buser et al. 1991; Buser et al. 1998; Buser et al. 1999; Li et al. 2002). This supported research has led to a paradigm shift favouring rough titanium implant surfaces as apposed to the "original" propagated smooth machined implant surfaces.

The third most supported research was in the area of *surgical augmentation of alveolar bone* for implant insertion. In this research field, the ITI Foundation invested CHF 2.9 million. Here, the different studies had analysed ways to augment the edentulous alveolar ridge vertically and horizontally using autogenous bone grafts, xenografts and different factors such as bone morphogenic proteins (BMP's) and/or enamel matrix proteins (EMP's), with or without the use of barrier membranes. Through the supported research in this field more predictable augmentation methods have been found, and promising new materials as well as new indications of existing materials will help develop more predictable and easier methods for increasing the alveolar bone volume prior to or during dental implantation (Blom et al. 2001, Botticelli et al. 2004, Botticelli et al. 2005, Brunel et al. 1998, Donos et al. 2005, Haas et al. 2002, Jensen et

al. 2005, Jensen et al. 2006, Lynch et al. 1991, Moradian-Oldak et al. 2006, Schlegel et al. 2006, Schou et al. 2003 a, Schou et al. 2003 b, Schou et al. 2003 c, Thorwarth et al. 2005, von Arx et al. 2001, von Arx et al. 2002).

Another field of research supported by the ITI Research Committee with a large sum of money was in the predictability of dental implants. Close to CHF 6.0 million have been allocated to various groups of researchers to execute large multi-centre studies or RCTs on the predictability of dental implants (Buser et al. 1997, Buser et al. 1991, Payne et al. 2003, Timmermann et al. 2004). Consequently, the clinical long-term success of the Straumann® Implant System has been documented in a number of longitudinal studies (Buser et al. 1990, Buser et al. 1994, Heckmann et al. 2004, Schrott et al. 2004, Weber et al. 2000).

The field of implant dentistry is one of the fastest growing disciplines in dentistry today. A multi-billion dollar industry has evolved around dental implants over the last 30 years with a still ongoing large annual growth (Straumann 2006).

In the *diagnosis and treatment of complications* associated with implants few research proposals have been submitted. This reflects, on one side, the not yet recognised need for diagnosis of complications such as periimplantitis and the treatment thereof. On the other side, there seems to be a willingness to allocate more resources to these fields of research. In these categories, a modest CHF 1.2 million had been invested so far. With the enormous growth in implant dentistry the increase in late complications may grow. Through the funding of the ITI Foundation some essential animal studies could be performed providing the basis for clinical examination of periimplant tissues (Etter et al. 2002, Lang et al. 1994).

Thirty percent of the applicants and 32% of the co-applicants were ITI Fellows. The majority of grants however, went to non-members. This fact

provides further evidence that nepotism was avoided and projects must predominately show scientific merit rather than the applicant being affiliated with the ITI.

All applicants had to sign a statement obliging them to provide interim and final reports to the ITI Foundation. A total of 232 projects were supported. Twenty-two percent (n = 51) of these studies are still running. Hence, approximately 181 final reports should have been filed. To the end of 2006, only 24 % of the reports (n = 55) have been received. This clearly demonstrates that researchers tend not to volunteer required documents unless continuously motivated to do so. This fact resulted in a new policy by the ITI Foundation to withhold 10 % of the grant sum until receipt of a final report.

The final report may be in the form of a publication. More than double the amount of projects that submitted a final report has at least one publication available indicating that final reports are usually substituted by the first publication submitted to a scientific journal.

Among the approximately 200 publications identified, not all were verifiable by an acknowledgement to the ITI Foundation, although required by the signed statement at the time of granting the funds. Therefore, we may have missed a number of publications. This makes tracking of ITI Foundation supported projects in the literature difficult and even unpredictable.

By manually searching the journals *Clinical Oral Implants Research*, *International Journal of Oral and Maxillofacial Implants* and the *Journal of Dental Research*, 46 abstracts were identified. Unfortunately, the electronic search did not reveal abstracts. This, in turn, means that probably a hidden number of abstracts may have been overlooked.

From 94 projects, 206 publications resulted up to the end of 2006. These 94 grants only account for half of the funds distributed (CHF 11.1 mil-

lion). Calculating the mean cost per publication on the basis of these results in an average cost of approximately CHF 54'273. The other half of the CHF 27 million distributed during the 18-year period is not accounted for in terms of publications. However, it has to be considered that approximately 22 % of the projects are still running representing a grant value of CHF 8.4 million with a mean cost of CHF 164'451 per project. About CHF 7.5 million of grants have not yet produced peer-reviewed publications.

The high percentage of supported studies reflects the high standards of proposed research for relatively modest amounts of money. That the budget of the ITI Research Committee could be divided among 46.5 % of the applications supports this statement. However, the number of applications being submitted per year has increased over the last 19 years. Consequently, a smaller fraction of the proposed projects may be funded in the future increasing the competition, and therefore, the quality of the research. A method to quantify the quality of the research may be chosen by analyzing the impact factor of the publications. The average impact factor per publication found has increased ten fold over the 19 years documenting the greater impact of the research funded as well as the increased quality of the single studies. Another method to quantify the quality of research is by searching the number of times a publication was cited. However, the number of cites decreased per year because the newer articles haven't been around long enough to be cited as often as the older articles. Hence, this evaluation method may not be suitable for longitudinal comparison.

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Conclusion

It is surprising to realize that, within the course of two decades, the ITI Foundation invested an astounding amount of money for predominantly clinical research. The supported research has contributed to the acceptance of dental implants as a treatment and to the confidence in predictable implant dentistry. This, in turn, has led to the establishment of a global industry with one of the fastest annual growths. It is difficult, however, to quantify the results of the research performed in objective terms. The investment of the ITI Foundation as a self-governing, peer-reviewed, independent research institution has provided essential funding for research projects independently of market-driven forces usually governing industry.

Consequently, the ITI Foundation represents one of the most important granting agencies for the promotion of evidence-based implant dentistry.

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