General discussion
General discussion

In this thesis, we focused on the improvement of the surgical treatment of burn scar contractures and on measurement tools. Firstly, clinimetric studies on 3D stereophotogrammetry for surface area and volume measurements of scars are described. In the following chapters, the current literature on the surgical treatment of burn scar contractures is reviewed and the effectiveness of the full thickness skin graft to treat burn scar contractures is evaluated. In the last part we assessed the suitability of the Doppler device for locating perforators and we performed two clinical trials that investigated the effect of the use of perforator-based interposition flaps for the treatment of burn scar contractures.

Part I Clinimetric studies on scar surface area and volume

Outcomes

In Chapters 2 and 3 we presented the clinimetric studies on 3D stereophotogrammetry for measuring scar surface area and volume. 3D stereophotogrammetry showed to have a very high reliability, expressed by a high ICC (intraclass correlation coefficient), and a very high validity, expressed by a high CCC (concordance correlation coefficient). The ICC and CCC are both relative correlation parameters. They relate the measurement error to the variability between patients, using the ratio of variances\(^1\). Relative correlation parameters tell us something about how well patients can be distinguished from each other, despite the presence of measurement errors. If the variation between patients is high (in a heterogeneous population), the reliability parameter will be larger than in a homogenous population (little variation in the characteristic to be measured)\(^2,3\). However, in clinical practice we are interested in the absolute measurement error of an individual measurement because that determines the change that can be detected beyond the measurement error. Therefore, in Chapters 2 and 3 we also used absolute parameters: the SEM (standard error of measurement), the CV (coefficient of variation) and the limits of agreement based on Bland and Altman plots. This additional analysis showed a moderate agreement between observers. This means that the high reliability was achieved because of the large variation in the area and volumes of the scars that we evaluated. So, in this study population 3D stereophotogrammetry can be used to distinguish scars despite the large measurement error.

By using Bland and Altman plots in Chapter 2 and 3, it became clearly visible that the measurement error was larger when larger objects were assessed. This is a rather uncommon phenomenon in clinimetrics, but for example also observed in measuring skin folds\(^4\). The dependency of the measurement error on the size of the scar was observed.
when measuring surfaces, and to an even greater extent when measuring volumes and can be explained by the dimensions in which surface areas and volumes are assessed. When measuring the surface area, a measurement error can be made in the length and width of the scar; the measurement error is then multiplied instead of summed up. For scar volumes, cubic units are used which means that the measurement error is cubed. As the data on scar surfaces and volumes were not normally distributed and the measurement error increased by an increasing size of the scar, we used a log transformation and cube root transformation respectively to overcome this problem. Unfortunately, transforming the data hinders an easy interpretation of the Bland and Altman plots. Therefore, after calculating the SEM (and ICC), we transformed them back to the original Bland and Altman plots to allow for a better understanding of the data. The limits of agreement now form a funnel instead of horizontal lines. As the limits of agreement correspond to the smallest detectable change this also means that with increasing scar sizes, larger changes in surface or volume are needed to be able to observe changes beyond the measurement error.

**Comparison with other studies**

Relative parameters, such as ICC and Pearson’s correlation coefficient, are widely accepted and are to date the most common parameters used in clinical research to assess the reliability and validity. In many clinical studies high correlation parameters are found on the basis of which is concluded that the measurement error is small. However, to assess measurement errors, relative correlation parameters are misleading and inappropriate. Information on the measurement error is especially important when a measurement tool is tested for its use in the clinical follow-up of scar sizes in time. We should therefore take extreme caution when assessing the value of reliability and validity studies that only use relative correlation parameters. Bland and Altman suggested, already in 1986, an alternative method to analyze the agreement between methods: the Bland and Altman plot. Therefore, it is surprising that since then so little has changed with regard to using absolute measures of agreement instead of relative correlation coefficients to assess the agreement.

**Implications**

We have shown that 3D stereophotogrammetry is a reliable and valid tool to assess scar surface area and volume for research purposes. For research purposes, measurement errors are much smaller as they are leveled out in groups because the error is divided by the square root of the number of patients included in the study. For the clinical follow-up of patients though, where we are interested in the absolute measurement error of an individual measurement, the measurement error was found to be rather large for both surface area and volume measurements. We expect that other measurement tools currently in use most certainly are not superior in terms of the measurement error. This means that still no ideal tool is available to register the surface area and volume of scars used for the clinical follow-up of patients.

**Future perspectives**

Future research could focus on optimizing 3D stereophotogrammetry to quantify scar surface area and volume. Besides that, other three-dimensional imaging techniques are rapidly developing. A recent advancement is laser technology in combination with digital photography of which the Artec MHT™ 3D Scanner (The Artec Group, San Diego, USA) is an example. An advantage of this device is that it is able to measure larger surface areas. We have initiated a study to assess the clinimetric properties of this device for measuring the wound surface area of burns. Furthermore, 3D technology is becoming more and more available for consumers in the form of application on smartphones and portable devices. An example of such a tool is the structured 3D-scanner which was recently developed by Occipital and can be easily attached to Apple hardware (Occipital and Lynx laboratories, Boulder, Colorado, USA). For clinicians it is important to keep up with these developments and to be able to judge whether these devices are a valuable addition to clinical practice. Clinimetric analysis of new devices is therefore warranted. The first part of this thesis illustrated once more that relative parameters do not provide an answer to the question how precise a measurement is and to what extent it is free from measurement error. We therefore recommend for future clinimetric studies to report parameters of absolute measurement error. As was illustrated by the studies that were performed in Chapters 2 and 3, solid clinimetric research can be challenging. To aid future research initiatives that investigate the clinimetric properties of a device we have included detailed statistical descriptions in Chapters 2 and 3. These analyses can be difficult to perform by clinicians. For that reason, we strongly recommend collaborations between epidemiologic departments and clinical research departments.

**Part II Burn scar contracture treatment: the current state of the art**

**Outcomes**

For the treatment of burn scar contractures, many techniques are available and new techniques are developing rapidly. It is important to shed light on the available knowledge on the effectiveness of different treatment regimens. Therefore, we performed a systematic review that is presented in Chapter 4. By performing this review, we hoped to be able to develop an algorithm for the treatment of burn scar contractures. Although we did not expect to find many high quality studies, the result of studies concerning the effectiveness of different treatment therapies was extremely disappointing. Using an extensive search strategy, over 1600 articles were found and analyzed of which only 17 articles described a surgical treatment regimen in a sample of ≥ 15 procedures. The included studies were found to be of low overall quality. First, the low quality was caused by a poor study design (pre-postoperative design). Second, the outcomes were often poorly described, using a great variety of (not always relevant) outcome parameters. Finally, the majority
of the studies did not succeed in an adequate data presentation and statistical analysis (e.g., standard deviations were lacking or statistical analysis not performed). Therefore, we were not able to provide sufficient evidence to draw conclusions on the effectiveness of reconstructive techniques after burn scar contracture release. Moreover, developing a standardized treatment algorithm remains a challenge on which we aimed to contribute in the later chapters in this thesis (part III).

In Chapter 5 the effectiveness of full thickness skin grafts (FTSGs) is described. In clinical practice FTSGs are an important tool of the reconstructive surgeon. Although in the past decades a shift has been observed to more advanced techniques such as perforator flaps and dermal substitution, FTSGs are still frequently used for reconstruction of burn scar contractures. The reason is that they are relatively easy to perform and useful in many facets of reconstructive surgery. Especially in the treatment of burn scar contractures it is of paramount importance that the added tissue retains its original surface area. FTSGs are often preferred over split thickness skin grafts (STSGs) because they are supposed to result in less contraction\textsuperscript{15,27-29}. In Chapter 5 however, it was demonstrated that the surface area of FTSGs contracts considerably on the long term. Even though we were able to demonstrate the contraction pattern of FTSGs over time, the underlying mechanism of contraction remains unclear. We assume an important role for the underlying wound bed in this contraction process. When a contracture release is performed a considerable wound is created. The subsequent wound healing process aims at accelerated wound closure and reducing the size of the wound in order to minimize the chance of infection. This contraction process involves a wide array of processes that is not fully understood yet\textsuperscript{30}. The myofibroblast has a potential important role in this process, because of its contractile structure and its strong retractile activity\textsuperscript{31}. It is conceivable that the FTSG that is placed on top of a contracting wound bed is subject to this contraction process. This hypothesis is supported by the fact that a significant difference in contraction rate was observed between grafts harvested from the trunk, compared to grafts harvested from the extremities. Skin originating from the trunk is generally considered to contain a thicker dermis than skin from the extremities\textsuperscript{32} and it may be suggested that a graft with a thicker dermis will provide better results with reduced contraction compared to a graft with a thinner dermis. Also, a thicker dermis likely contains a more extensive collagen network, which is more capable of stretching\textsuperscript{33,34}.

Comparison with other studies

As holds true for the surgical techniques that were described in the included studies in the systematic review, the effectiveness of FTSGs to release scar contractures has been studied insufficiently. The general thought is that FTSGs do not contract, a belief that is probably held intact because of the fact that FTSGs are mostly compared to STSGs, which tend to contract to a greater extent\textsuperscript{25,27,35-37}. Also, in most studies the contraction rate is expressed in the recurrence rate (i.e. recurrence of contracture), which is to our opinion a suboptimal outcome parameter, as it is influenced by many other factors\textsuperscript{15,37}. Only one study used surface area reduction, measured by digital photography, to express the contraction rate in FTSGs and demonstrated a considerable contraction (to 62%) of the original surface area\textsuperscript{28}. In Chapter 5 we observed a reduction of surface area to 85.9% of the original surface area after a comparable follow-up period of 13 weeks.

Implications

As disappointing as the evidence from the abovementioned review may be, it uncovers the flaws in the current available scientific literature and thereby provides important lessons for future studies investigating the effectiveness of burn scar contracture release surgery. First, a sufficient sample size should be chosen. A realistic power calculation is needed to determine the number of patients that should be acquired in a trial, depending on the effect of an intervention in a specific patient population. Second, the study should be designed in such a way that a comparison is made with another intervention. Only then can the effect of the treatment be distinguished from the clinical course and from the treatment with other surgical techniques. Third, we would like to stress the importance of the outcome assessment; it should be carefully linked to a relevant clinically expected outcome. Reliable and valid measurement techniques should be used to assess the outcome, which allows for comparison between study results\textsuperscript{1}. The introduction of new measurement tools, without validating them, is not recommended\textsuperscript{1}. Finally, an adequate data presentation and statistical analysis are a necessity. Although randomized controlled trials are promoted as the holy grail for establishing how well an intervention works, they have some shortcomings in terms of recruitment, ethics, patient preferences, and treatment comparisons\textsuperscript{35}. Due to these shortcomings, the duration of RCTs is often long, which may hinder an adequate response to new developments. The ability to scientifically anticipate to new developments is essential for a more evidence-based medicine in reconstructive surgery. When performing the randomized controlled trial that is described in Part III, we experienced a lengthy research process of five years from concept to results. The long duration was mainly caused by extensive ethical procedures, patient preferences and rigidity of the inclusion criteria that were according to the predefined protocol. Recently, a new design to overcome these shortcomings has been introduced: the cohort multiple randomized controlled trial (cmRCT)\textsuperscript{39,40}. The basis of the cmRCT is a large observational cohort of patients that is recruited for multiple trials in which a random selection of some participants is used for comparison between (new developed) interventions. This study design could allow for multiple, comparisons simultaneously and a lower drop off due to patients’ preferences. We believe this could be a valuable study design in the field of reconstructive surgery where new techniques or adaptations to yet existing techniques are rapidly developing.
In line with previous findings, it was demonstrated in Chapter 5 that FTSGs contract. Although the study does not satisfy to all the above-mentioned requirements: it was an observational cohort study and no power analysis was performed, it provides a unique insight in the contraction process of FTSGs over time. This increased knowledge on the contraction pattern allows to take into account the expected contraction and to use another reconstruction technique in cases where a re-contraction is least desired, as is the case in scar contracture release. Furthermore, it should be recommended to harvest a FTSG with a larger surface area than expected to be needed on the recipient location, taking future contraction into consideration. Furthermore, regarding our finding that grafts excised from the trunk endure significantly less contraction on the long term than grafts excised from the extremities, we advise to, whenever possible, use the trunk as the donor site location of preference.

Future perspectives
Inspired by the revolutionary developments that characterized the reconstructive surgery during the First and Second World Wars, it is now time to make steps forward to a more evidence-based medicine approach in reconstructive surgery. Implementation of the lessons that were addressed above should be pursued in future studies. We suggest repeating a systematic review of literature with respect to this subject within a five-year period to detect a shift towards better studies that enable a more evidence-based clinical practice within the burn field.

Part III Progress in burn scar contracture reconstruction by perforator-based interposition flaps
Outcomes of perforator-based interposition flaps
Since the survival of patients with extensive burns has improved significantly, burn scar reconstruction becomes increasingly important. As is highlighted in Chapters 4 and 5 of this thesis, many surgical techniques are available. In our opinion the best technique should be simple and easy to perform, create as little as possible donor site morbidity and be safe and effective. We therefore advocate the use of local tissue. Local flaps have been used for a long time, are safe and are technically simple to perform. The disadvantage of local flaps is that they are subject to a restricted length-to-width ratio and exceeding this ratio increases the risk of vascular problems. Incorporating a perforator bundle in the flap overcomes this restriction. This way a safe and versatile interposition flap can be used, without a restriction of the length-to-width ratio. The flaps that were described in Chapters 6 and 7 had a mean length-to-width ratio of 3.0:1 and 2.9:1 (data not published) respectively. Flaps can be created much larger without compromising on the vascularization. The maximum length-to-width ratio’s in the studies in Chapters 6 and 7 were 4.5:1 in and 5.9:1 (data not shown), respectively, and showed successful results. Moreover, no correlation between length-to-width ratio and incidence or percentage of necrosis was demonstrated. By creating longer flaps (higher length-to-width ratio) we probably could have demonstrated more challenging possibilities of perforator-based interposition flaps. However, it was not our purpose to create as long as possible length-to-width ratios but to provide a safe and effective treatment that is tailored to individual needs.

Because the current literature could not provide an algorithm for the treatment of burn scar contractures (Chapter 4), we developed an algorithm based on clinical experience. The treatment algorithm was presented and tested in Chapter 6 and provides a stepwise approach for surgical treatment of scar contractures. In short, the algorithm implies the following. A non-islanded flap should be preferred in case of small angles of rotation because an intact flap base provides extra venous outflow and prevents the necessity for additional scar tissue. However, when the perfusion of the flap is at risk because of a too large angle of rotation, the flap can be islanded quite easily. The flap can be converted to a FTSG as an escape in cases where the flap remains vascular compromised. This provides surgeons with a versatile tool to adequately take on burn scar contractures. The algorithm was found to be effective and safe.

With regard to the effectiveness, favorable results were found in of both our studies. In the pilot study (Chapter 6) an increase in surface area of the flaps was observed to 116% measured after a mean follow-up of 7.8 months. In the randomized controlled trial (Chapter 7) we were able to demonstrate an even larger increase in surface area after 3 and 12 months follow-up. The flaps showed an increase of the original surface area to 123% after 3 months and to 142% after one year, which was in contrast to the substantial decrease in surface area of FTSGs after 3 months and after one year. From our point of view, this could be completely attributed to the properties of adjacent healthy tissue (and in some cases subtle scar tissue) that is inserted into the defect created by the contracture release. First of all, interposition flaps contain, in contrast to FTSGs, the subdermal fat tissue. An important property of the subdermal fat tissue is to provide a functional sliding layer. In Part II of this thesis, we already assumed an important role of the underlying wound bed in the contraction process after contracture release. The additional subcutaneous sliding layer of a flap prevents the skin from being attached to the underlying wound bed. The skin of the flap has the possibility to stretch in time. Second, in perforator-based interposition flaps the subdermal plexus is preserved. This rich network of cutaneous arteries and veins, which is spread out between the subcutis and dermis, provides blood supply to the skin and its adnexes. By preserving the perforator and the subdermal plexus, the blood supply to the skin is secured from the moment the tissue is transferred. For the transplantation of FTSGs, the graft is thinned to the dermis and ingrowth of the grafts initially succeeds by diffusion of nutrients. Skin grafts can tolerate...
an ischemic period without being subject to necrosis, however this is not favorable for graft take and subsequently for the quality of the grafted skin. Based on our findings and the interpretations of our findings we conclude that local flaps possess a better tissue quality and thereby are more capable of stretching which is probably caused by the fact that they remain in their original surrounding tissue and are provided with an uninterrupted blood supply.

With regard to the safety of the perforator-based interposition flaps we found a relatively low percentage of necrosis compared to FTSGs (6% versus 17%). In all cases we were able to detect a suitable perforator adjacent to the contracture. The calibers of the perforators were measured incidentally and ranged between 0.3 mm and 0.8 mm (unpublished data). This advocates that flaps can be based on smaller perforators (<0.5 mm). We could however not prove that the perforator that was located preoperatively is responsible for an adequate perfusion of the flaps, since we did not standard dissect the perforator bundle.

Comparison with other studies on perforator-based interposition flaps
Studies on the use of perforator-based interposition flaps mainly focus on the use in specific regions such as the thoracodorsal artery flap for the breast or axilla region and the cervical artery flap for the neck. The results from these studies are useful in cases where contractures appear in that specific region. Burn scar contractures though, will occur almost on all body sites. Moreover, healthy tissue is not always available for flap preparation. The concept of the ad hoc perforator-based flaps overcomes these problems, and was introduced and described to be safe and sustainable in small cohort studies. Nevertheless, the concept is not routinely applied for burn scar reconstructions.

Implications and future perspectives on perforator-based interposition flaps
The long-term results as demonstrated in our study described in Chapter 7 show that local flaps, based on a perforator, are a safe, effective and sustainable technique for the surgical treatment of burn scar contractures. We provided convincing evidence that these flaps lead to better long-term results compared to the current standard of skin grafting. We hypothesize that the subcutis has an important role in this difference in outcome between the two techniques. Therefore, we strongly suggest future research into the precise role of the subcutis and its possibilities in reconstructive surgery.

In clinical practice perforator-based interposition flaps should be added to the armamentarium of the reconstructive surgeon and be considered as preferred treatment of wide burn scar contractures. Besides the treatment of burn scar contractures, there is a role for perforator-based interposition flaps in other fields of reconstructive surgery. Since they are easy to perform and provide a safe and effective treatment option, they may become an important tool in the surgical treatment of other reconstructive defects, such as deep burns in functional areas or large defects as a result of decubitus. They might extend the repertoire of the reconstructive surgeon considerably. In our burn center we have already been successfully treating several acute burns with perforator-based interposition flaps (Figure 1). Future research should further clarify the role, possibilities and limitations, and outcomes of perforator-based interposition flaps in the treatment of other defects.
Outcomes on vascularization

In this thesis the clinimetric properties of the hand held Doppler for the detection of perforator locations were studied. The use of Doppler to locate the origin of perforators is not new and has been used by many reconstructive surgeons since the early nineties. In Chapter 8 we discovered that the agreement between the observers was poor. In clinical practice this means that when one plastic surgeon locates a certain perforator, another plastic surgeon is not capable of finding the same location. Furthermore, we demonstrated a very low validity of the device, which may be explained by the moderate reliability since a high validity is not attainable without reliability.

Comparison with other studies on vascularization

Before the start of the study that is described in Chapter 8, there were conflicting reports on the suitability of the Doppler device as diagnostic tool for the detection of perforator locations. Several studies had shown that the device was only moderately capable of validly detect perforators, while other studies reported a high validity of the device. At the same time the device is increasingly being used in the upcoming field of ad hoc perforator flaps. It was therefore striking that we could not find any papers that studied the reliability of the device. But how can we explain the difference in validity results between our study and other studies? First, the higher validity rates in previous studies may be explained by the difference in study design; these studies investigated the validity of Doppler for the detection of established perforators, such as the deep inferior epigastric perforator (DIEP), the superior gluteal artery perforator, and the thoracodorsal artery perforator. In contrast, we focused on the Doppler as a diagnostic tool to detect all perforators within a square of 7 by 7 cm, including smaller perforators. These perforators are located more dispersed and may differ in diameter, which most likely results in a lower positive predictive value. We propose that the Doppler device is a suitable measurement tool to confirm the exact location of a known perforator as mentioned above, but not to detect an unknown (smaller) perforator. Second, this can be attributed to the use of another gold standard; in most of these studies the validity was tested by comparing the Doppler locations with the locations that were found intraoperatively. Usually perforator locations that are detected with Doppler are marked on the skin, but the location changes per definition once the skin has been incised. With the knowledge that many perforators are present in a certain area, it could be that perforators that were detected with Doppler were mistaken for nearby located perforators. It is difficult to evaluate if the ‘match’ that is described in these studies is real or that it concerns another perforator. It was for that reason we chose Duplex as the standard of comparison. Also, the volunteers were kept in the same position so locations could not change based on changing position of the volunteer. This could have led to a lower positive predictive value than the values presented in the majority of previous validity studies.

Still, in the upcoming field of ad hoc perforator-based interposition flaps, the Doppler is a very popular tool for the detection of perforators. Studies that assessed the outcome of these type of flaps commonly use the Doppler device to preoperatively locate the perforators. Also many good results with minimal flap necrosis have been presented. This leaves us with the question, how it is possible that a diagnostic tool with very low clinimetric properties is able to perform that well in clinical practice. To solve this problem, we have to understand the anatomy of the human integument. Extensive basic research on the vascularization of the human integument has brought us the knowledge that the body contains a few hundred perforators with a diameter larger than 0.5 mm. The total number is expected to be much larger as smaller perforators (<0.5 mm) can also be detected with the hand held Doppler. The perforator detected preoperatively is almost certainly surrounded by many other (possibly smaller) perforators. It is plausible that the perforator that is detected preoperatively is not the perforator that is supplying the flap postoperatively.

Implications on vascularization

The popularity of the Doppler in clinical practice has most certainly to do with its ease in use, the possibility to use it intraoperatively and the relatively low costs of the device. Until the development of more advanced and yet feasible techniques we therefore propose a unique application of the Doppler: complementary to Duplex (which was described in Chapter 8). The perforator is located and assessed for suitability (e.g., not situated intramuscular or axial) with Duplex. Subsequently, Doppler is used preoperatively to confirm the location and to monitor the viability of the perforator during the operation procedure. In this way the Doppler is used as a monitoring tool instead of a single diagnostic tool, thereby optimally utilizing the valuable properties of both techniques. Future research could investigate the validity for the Doppler used as a monitoring tool.

Future perspectives on vascularization

The success of perforator-based flaps is established on an improvement of local flaps by incorporating a perforator. Besides the perforator, also the subdermal plexus supposedly plays an important role, which was highlighted above. Further research into techniques that visualize the vascularization is needed to enhance our knowledge on the vascularization of the skin. In the past decades many advanced visualization techniques have become available. These techniques will play a key role in improving the outcome of burn and reconstructive surgery. Noninvasive optical techniques that measure vascularisation (and/or perfusion) such as optical coherence tomography (OCT), photoacoustic imaging and thermography are still under development but have great potential for improving noninvasive imaging of the vascularization of the human integument, even at a microscopic level. Others are already in use in clinical practice but are not explored yet to their full potential in terms of application for different purposes, such as Laser Doppler imaging.
(LDI), Duplex and thermography. In our opinion future research regarding vascularization should focus on the visualization of the subdermal plexus and perforators. Clinical studies have already been initiated to further explore the value of OCT, thermography, LDI and Duplex. Advanced vascularization techniques could be of value for different purposes in clinical practice. First, they could aid in a better preoperative localization of perforators and provide additional information on the flap perfusion peri and postoperatively. This may improve flap survival and thereby result in an enhanced safety of perforator flaps and a better outcome of burn scar reconstruction. In line with this improvement it would be interesting to investigate the diameters of perforators and their course through the subcutis. A better knowledge on the course of perforators would probably lead to a lower risk of damaging the perforator bundle peroperative. Second, advanced techniques may provide further insight in the role of vascularization in hypertrophic scar formation. An increased vascularization is thought to play a role in the derailing process of hypertrophic scars, but its exact role remains unclear. At present a clinical trial is in progress to test whether LDI is capable of detecting an increased blood flow in hypertrophic scars.

Summarizing, in this dissertation we focused on the improvement of the treatment of burn scar contractures. We reviewed the available literature and brought to light that the current literature on the effectiveness of reconstructive techniques for burn scar contracture release is below par in both quantity as in quality of the studies performed. Due to the lack of evidence we were not able to provide definitive conclusions on the effectiveness of different techniques or make specific recommendations. In order to attain improvement, trials should be performed that make use of sensible outcome parameters, using reliable, valid and feasible measurement tools. Because such tools were not available to assess the scar characteristics surface area and volume, we assessed the clinimetric properties of 3D stereophotogrammetry. It was revealed that for research purposes, 3D stereophotogrammetry was a reliable and valid technique. For use in clinical practice however, the measurement error appeared to be too large. Until now, burn scar contractures are often treated by use of FTSGs. We found that FTSGs contract considerably over time, with the extremities as donosite being a predisposing factor for increased contraction. Instead of skin grafting we therefore advocate the use of local flaps and developed an algorithm accordingly. The clinical studies in this thesis showed that the algorithm using local flaps based on a perforator provides a versatile, effective and safe treatment option for burn scar contractures. Moreover, the RCT showed that these local flaps perform considerably better than FTSGs in the treatment of burn scar contractures on the long term. Detection of the location perforators is often done by use of a Doppler device. Research into the clinimetric properties of the Doppler however showed that as a single diagnostic tool it is not suitable for the detection of perforators. This leaves an opportunity for more advanced techniques to become standardized in daily clinical practice.
References


