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The Efficacy and Safety of Fractional Ablative Resurfacing Using 10,600nm CO_2 Pulse Wave in the Treatment of Striae Distensae Among Filipino Women with Skin Types III-V. A Preliminary Investigation and Initial Results.

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The Efficacy and Safety of Fractional Ablative Resurfacing Using 10,600nm CO_2 Pulse Wave in the Treatment of Striae Distensae Among Filipino Women with Skin Types III-V. A Preliminary Investigation and Initial Results.

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Introduction

Striae distensae (stretch marks) is one of those common skin conditions that can be quite concerning and oftentimes distressing, especially among women in their child-bearing years as it occurs in up to 90 percent of pregnant women, affecting various areas in our body such as in the abdomen, hips, buttocks, breast[1], thighs, and groin[2]. Striae is not a specific condition of pregnancy alone. Adolescents undergoing their growth spurts and overweight individuals can also experience striae distensae as well as individuals with prolonged use of topical or oral steroids or an increase in adrenal cortical activity such as in Cushing syndrome[1,2,3].

Improving the appearance of striae has been a challenge for dermatologists. Topical retinoids have shown clinically significant improvement in the appearance of pregnancy-related striae with a decrease in length of the striae by 20% (P=.01) in an open-label multicenter prospective study of 20 women with daily application of tretinoin 0.1% cream for 3 months[7]. Combination topical treatment such as 20% glycolic acid with 0.05% tretinoin cream and 10% L-ascorbic acid, 2% zinc sulfate, and 0.5% tyrosine with 0.05% tretinoin emollient cream (Renova) showed both clinical and histological improvement of striae alba when applied daily for 12 weeks[8].

The advent of laser technology in the treatment of striae has shown promise with the use of various lasers such as 585 nm pulsed dye laser (for striae rubrae)[9], 308 nm excimer laser for striae albae[10], intense pulsed light[11], short pulsed carbon dioxide laser[12], and fractional 1550 nm erbium-doped fiber laser[13]. Ablative fractional resurfacing (AFR) thus began as the combination of the 10,600 nm CO_2 laser with the fractional photothermolysis (FP) system. This achieves controlled tissue vaporization and thermally-induced dermal coagulation extending to depths beyond those reached by traditional CO_2 lasers or by non-ablative lasers[17].

Several studies have proven that AFR has been tested on mild to moderate rhytides, photo-aging, and a variety of scars (acne scars, atrophic scars, hypopigmented scars, traumatic scars, cosmetic surgery scars, and other surgical scars) successfully[10, 17].

Ablative fractional resurfacing in the treatment of striae distensae have also been investigated. A fractional non-ablative laser (Fraxel SR 1500) was tested on 22 Asian women with striae (rubrae and albae) and comparing pre-and post- treatment photographs and skin biopsies. Results showed clinical (27%, all striae albae showed marked improvement in the striae) and histopathological improvement (epidermal and dermal thickness were greater after treatment than at baseline)[18]. Another study using fractional CO_2 laser on striae showed moderate (grade 3) clinical improvement (51.9%) and participants being very satisfied (51.9%) with the results[19].

Another study, however, showed minimal improvement with the use of AFR in the treatment of striae. A recent multicenter clinical trial utilized fractional ablative CO_2 laser (DEKA SmartXide DOT) in the treatment of striae and results showed minimal mean grade improvement scores at 1.00 (SD+/-1.41). There were inconsistent responses to treatment of striae albae with some subjects showing no improvement while others showed moderate-advanced improvement.

Parameters used in this study ranged from power of 14-15 W, spacing of 700-750 µm, dwell time of 600 µs, 1 pass, and with 3-4 number of treatments[20].

The various outcomes mentioned on the use of fractional ablative CO_2 laser on striae remains inconclusive. Further evidences as to the effectiveness of fractional CO_2 resurfacing in the treatment of striae are needed. The safety of these fractional ablative lasers in the treatment of rhytides, photo-aging, and scars, however, have been proven in several studies, where clinical improvement, less side effects, and less downtime especially among darker skin individuals are its greatest advantages compared to traditional ablative laser resurfacing[10, 17, 20].

The purpose of the study is to, therefore, determine the efficacy and safety of fractional ablative resurfacing using 10,600 nm CO_2 pulse wave in the treatment of striae distensae among Filipino women with skin types III-V.

Objectives

To determine the efficacy and safety of using Fractional CO_2 laser resurfacing system in the treatment of striae distensae among Filipino women with Skin Types III-V.

Materials and Methodology

SmartXide DOT, a 10,600 nm CO_2 Fractional Laser Resurfacing System by DEKA, from Florence Italy, was used throughout the study. The machine works with a scanner in DOT mode. The machine emits a CO_2 laser with 30 W maximum power capable of releasing energies in pulsed mode.

Participants' Selection Criteria

All patients enrolled to this preliminary trial were given clear and complete instructions about the goal and study design; the test materials and mechanisms of action; expected outcomes from the treatment and what this means; possible side effects; how these side effects will be reported, immediately addressed, and followed up by the investigators; and the appropriate post-study care to be given.

They were initially assessed using an eligibility criteria checklist prior to enrollment into the study. Upon meeting the inclusion/exclusion criteria, participants were asked to sign an informed consent form and were interviewed for their medical history. Digital photographs of the areas with striae were taken using a Nikon D80 camera.

Inclusion

- Healthy females from the general community
- Filipino
- Ages: 25-40
- Skin Phototypes III-V
- Presence of striae distensae on the following areas: abdomen, arms, thighs, breast, thighs, buttocks
- All types of striae distensae (striae albae, striae rubrae)
- At least 2 months post-partum (if stretch marks due to pregnancy)
- Free of any systemic or dermatologic disorder which, in the opinion of the investigative personnel, will interfere with the study results

Exclusion

- Use of other topical products such as retinoids or topical steroids on the test site, or of systemic medications known to alter skin responses in the past 1 month
- History of keloid scar formation
- Compromised wound healing or presence of systemic diseases such as diabetes, hypertension, heart disease, circulatory problems
- Pregnant women
- Allergic to Antiviral medications, Paracetamol, or to Lidocaine (topical or injected)
- Debilitated or immunocompromised patients
- Unable to follow-up once a month (4-6 weeks interval) for 3 months
- Participating in any other clinical study during the study period required to complete the study

The participants enrolled in this preliminary trial weresubjected to one or more treatments with the Fractional Laser System.

The interval between treatments is 4-6 weeks depending on the assessment of the investigators.

Laser Treatment

Prior to the laser procedure, the area with striae was cleansed with mild soap and water. Topical anesthesia (13% Lidocaine cream) was applied to the area to be treated and then wrapped with a transparent wrapper and left on for at least 30 minutes before the procedure. Concomitantly, participants were also asked to take a mild analgesic (Paracematol 500mg) 30 minutes prior to procedure to minimize pain.

After 30 minutes, the topical anesthetic was then removed using clean gauze soaked in normal saline solution, the area was dried, and the laser procedure then commenced. The size and shape of the laser was adjusted to the size and shape of the striae such that the area involved included 2 mm of normal adjacent skin. The parameters used were Power of 15 W, Spacing of 800-1,000 µm, Dwell time of 200-800 µs and Stacking of 2-4. During the procedure intermittent application of cooling gel on the treated area were done to soothe pain. After the laser procedure, a cold compress over the treated area for 10 minutes and then an antibiotic (Mupirocin ointment) were applied thereafter. Before leaving the center, the participants were asked to rate the pain from the procedure using a 10-point Universal Pain Scale. Participants were advised regarding post-laser skin care and were given post-laser instructions.

The participants were asked to follow-up monthly in the next 3 months for re-assessment of their striae using the quartile grading scale rated by both the participants and the investigators. Digital photographs were taken prior to giving the next laser treatment. The Universal Pain Scale was answered by the participants after every laser procedure.

At the end of the study, the photographs taken were used for the visual assessment rated by 2 independent dermatologists using the same quartile grading scale.

Results

The Fractional CO_2 Laser System was used in this preliminary investigation to verify its effectiveness in the treatment of striae distensae.

The results tabulated are just initial results of this preliminary investigation which are examined visually using pre and post treatment photographs with follow ups varying from 4 weeks to 6 weeks from the last treatment. Additional trial is underway to examine more carefully the effect of this treatment on a higher number of subjects and longer study period.

The first case is of M.S., a 38 y/o female who had striae distensae in her abdomen. She had three cesarean sections and her last delivery was may 2011. She had her first session with Fractional Laser Treatment last july 22, 2011. Already after her first session there was a reduction in the widened spaces of the striae and a decrease in the associated pigmentation.



Figure 1. Abdominal striae. Pre and post 1 session with SMARTXIDE DOT at 15 W, a distance of 1,000 µm between spots, 200 µs dwell time and stacking of 4.

The parameters used were 15 W, a distance of 1,000 µm between spots, 200 µs dwell time and stacking of 4 (Fig.1).

Figure 2 and 3 is also that of M.S. taking a closer look on the left and right sides of the abdomen. Notice the lightening of the abdominal area and the narrowing of the previously widened stretch marks.



Figure 2. MS's left side of the abdomen. Before and after 1 treatment.



Figure 3. MS's right side of the abdomen. Before and after 1 treatment.

The second case is that of E.M., a 40 y/o woman who have stretch marks in her buttocks due to weight gain and weight loss secondary to pregnancy. She had two cesarean sections and her last delivery was october 2005. E.M. received her first fractional laser treatment on august 2, 2011.

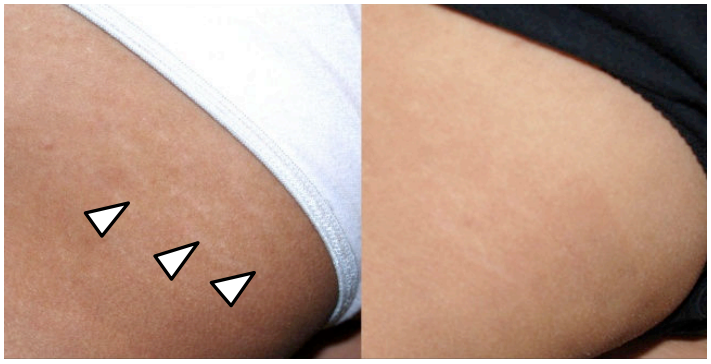


Figure 4. EM's left buttocks. Arrows showing lines of striae. Before and after 1 treatment.

Figure 4 and 5 showed pre and post treatment photographs of the left and right buttocks of EM respectively.



Figure 5. EM's right buttocks. Before and after 1 treatment.

Notice the reduction in the striae even after only the first session. The post treatment photograph showed

Laser mark as exhibited by the dark pigmented areas surrounding the striae. The skin pigmentation/ discoloration will fade through time.



Figure 6. EM's knee scar. Pre and post 1 session of fractional laser treatment at 15W, spacing of 1000 µm, dwell time 800 µs and stacking of 4.

EM was also treated with Fractional laser on her knee scar using a different parameter: 25 W, spacing of 1000 µm, dwell time of 800 µs and stacking of 4 (Fig 6).

Although the study concentrated on the striae, it is good to note that the knee scar showed marked improvement. The formerly deep scar leveled with the normal surrounding skin. The dark areas surrounding the scars mark the treatment area. The pigmentation will fade spontaneously through time or lightening can be hasten with lightening creams. It can be assumed that the marked improvement is a result of collagen stimulation and formation beneath the treated areas.

The third case is that of R.A., a 33 y/o who had 2 cesarean deliveries. Her last delivery was january 2011. Aside from the stretch marks caused by pregnancy, RA has a very lax abdomen.

Her pre treatment photograph showed a CS scar and a markedly relaxed abdomen. After only 1 session of fractional laser treatment, there is marked improvement not only on the significant reduction of stretch marks but also on the laxity of her abdominal skin. Focus on the area around the umbilicus. The post treatment photograph showed skin tightening (Fig 7).



Figure 7. RA's abdominal striae pre and post 1 session photograph showing marked improvement on both stretch mark reduction and skin tightening.

A closer look on the left side of the abdomen will also show a disappearance of the darkly pigmented areas near the flanks (Fig 8).

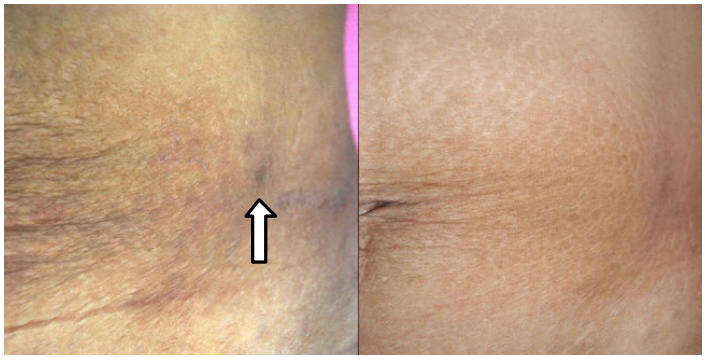


Figure 8. RA's left side of the abdomen. Before and after 1 treatment.



Fig. 9 RA's right flanks pre and post 1 treatment.

Figure 9 is a photograph of RA's right flank taken at a different angle. Notice the narrowing of the previously widened areas of the stretch marks making the skin tighter and smoother.

The fourth case is of A.L., a 34 y/o who had 3 cesarean deliveries. Throughout her pregnancies she acquired stretch marks on different parts of her body like the abdomen, flanks, thighs, and breast.

She had her first fractional laser treatment on august 13, 2011. The first session resulted only to minimal improvement. She also exhibited prolonged skin discoloration, one of the laser's noted side effect (Fig 9).



Figure 9. AL's abdomen. Pre and post 1 session at 15 W, spacing 1000 µm, dwell time 800 µs and stacking 4.

Discussion

The evolution of striae starts from being erythematous to purplish, raised wavy lesions (striae rubrae) eventually fading to become white atrophic and wrinkly lesions (striae albae)[4]. The exact pathogenesis of striae has yet to be elucidated. The pathology, on the other hand, shows early stages of development with elastolysis, mast cell degranulation, and macrophage engulfment of elastic tissue[5]. Histological features substantiating striae as being forms of scars are the densely packed eosinophilic thin collagen bundles parallel to the epidermis, effacement of rete ridges, and the lack of adnexal structures[6].

Old school has taught that there are no cure for stretch marks. One you have it you will have it for life, not until the advent of laser technology.

Laser skin resurfacing has evolved since the 1980's from ablative, non-ablative, and fractional ablative technologies. Ablative technologies (Er:YAG, CO_2 lasers) cause uniform patches of epidermal and dermal injury. Though having the advantage of predictability in the depth of tissue ablation and thermal damage, ablative lasers have shown longer downtime, higher incidences of side effects such as prolonged erythema, dyspigmentation and scarring, especially among darker skin types apart from needing effective anesthesia, intensive post-operative care, and prolonged avoidance of sun exposure[14].

Non-ablative technologies were then created as an alternative to ablative lasers. Non-ablative lasers induce dermal neocollagenesis without epidermal disruption, thereby limiting adverse effects and virtually eliminating downtime. Results from these non-ablative lasers, however, were less dramatic compared to their predecessors[15]. Fractional ablative lasers, on the other hand, uses the concept of fractional photothermolysis (FP) where light is emitted in a pixilated fashion into the skin producing micro-thermal zones (MTZ), thus causing small microscopic columns of thermal injury[16]. These leave adjacent columns of intact skin, which stimulate re-epithelialization and repair, which heals quickly thus reducing downtime. Dermal repair is hastened due to the presence of healthy fibroblasts, which cause an increase in collagen production that migrate into the treated dermis, thus causing collagen remodeling[17]. Other advantages of fractional laser include a decrease in postoperative edema, erythema, and a decrease in the risk of dyschromia. These lasers are said to be more suitable for darker skin types[14].

Over the recent years, the market has therefore been oriented towards less invasive and less problematic systems and methods. This has led to the wide-scale production of a myriad of non-ablative devices for skin resurfacing to skin rejuvenation.

Despite the fact that all these machines are based on the same principles, they present significant differences with regard to the parameters used to achieve a satisfactory result. The Fractional CO_2 laser system uses FLSR treatment in scanner DOT mode

causing less epithelial damage. There are normal tissue spaces in between treated areas that hasten healing process faster than the traditional laser skin resurfacing resulting to reduced or minimal downtime.

Conclusion

The Fractional CO_2 laser system is a very promising machine. It has proved to be an extremely versatile instrument in aesthetics. Excellent results were obtained in this preliminary investigation and in 90% of cases patient satisfaction was achieved.

The parameters used in each patient are tailored depending on the skin type, pain tolerance and reaction to previous treatments. The occurrence of the typical side effects like dark pigmentation which we addressed accordingly is considered negligible, provided the patients followed the post treatment instructions given to them.

We established that in this preliminary investigation the parameters of 15 W power, dwell time of 200-800 µs, spacing of 800-1000 µm and stacking of 2-4 will result to a very favorable response even after the first session.

We surmised that the treatment of striae using the fractional CO_2 laser system in DOT mode is achievable without any significant complications.

Limitation and Recommendations

The final result of this preliminary investigation is on going awaiting the final 2 photographs from each subject.

We observed that a high level of dwell time (600 – 800 µs) can more often cause hyperpigmentation, especially with darker skin types, while 200 µs is very conservative. At this moment 400 µs is the most used setting.

The study did not include objective parameters and did not involve any invasive procedures such as a skin biopsy. The focus of the study was on the clinical changes (if any) of the striae after fractional CO_2 laser treatment. It is recommended that in future studies, a skin biopsy be done to determine any histological changes supporting the clinical improvement. Other objective parameters that can help determine clinical improvement would be a Mexameter to detect changes in erythema and pigmentation are also recommended.

The study was limited to 3 months of follow-up. It is also recommended to increase the duration of the study to 6 months to help determine if more treatment is necessary for more significant improvement.

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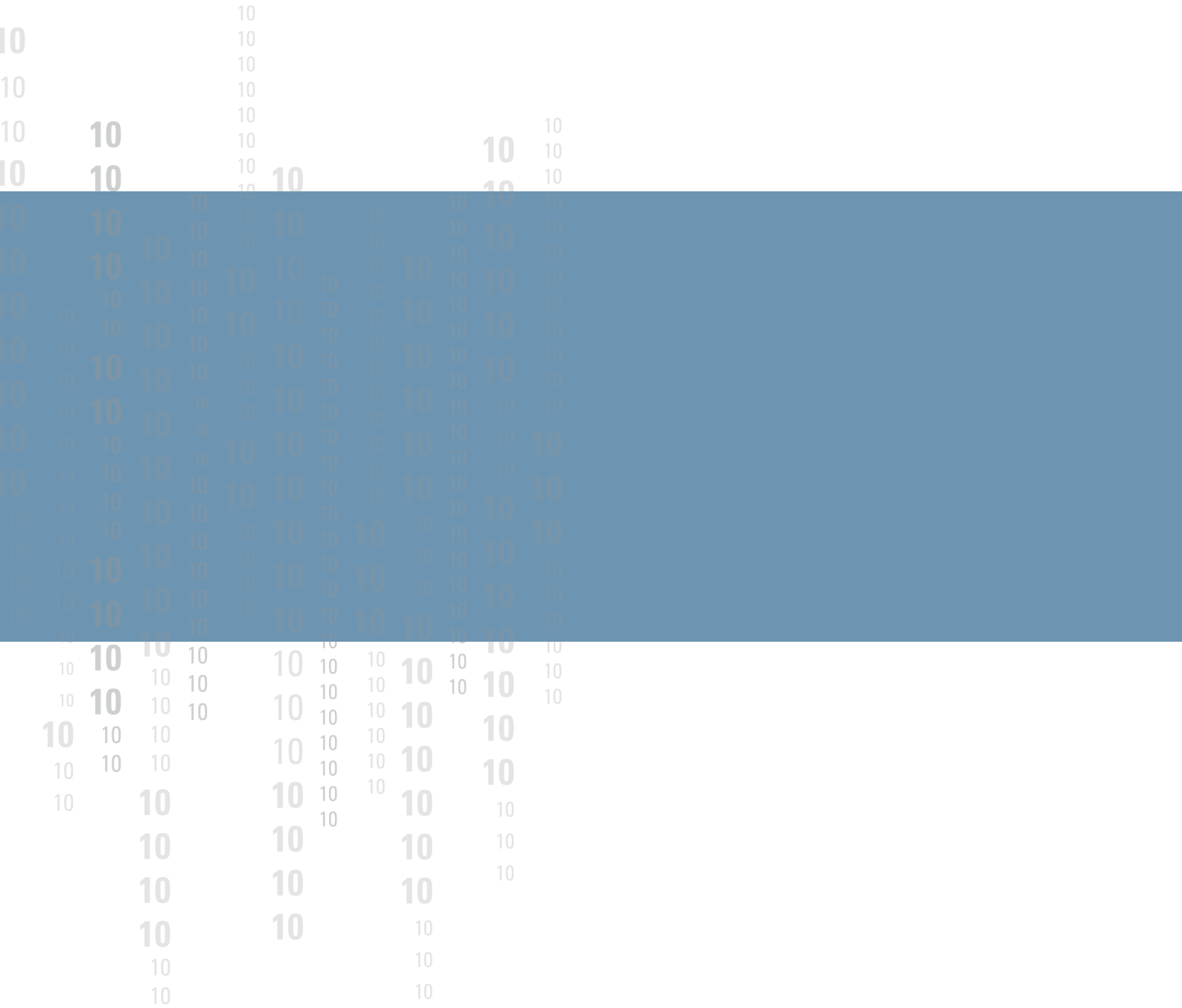
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